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FROM THE EDITORIAL COMMITTEE

We are giving you the next 33rd 3(2026) issue of the scientific journal of the Faculty of Management at the Rzeszów University of Technology entitled „Humanities and Social Sciences".

Our aim is to raise the merits and the international position of the journal published by the Faculty of Management, that is why we are still developing the cooperation with foreign team of reviewers, as well as an international Scientific Board. The Editors have also attempted to apply for international databases; currently the HSS journal is indexed in **The Central European Journal of Social Sciences and Humanities (CEJSH), ERIH PLUS, DOAJ and EBSCO**.

The journal „Humanities and Social Sciences" participated in the „Support for scientific journals" program in 2019-2020, and in the „Development of scientific journals" program in 2023-2024, organized by the Ministry of Science and Higher Education.

The articles published in this publication are devoted to the broader issues of the humanities and social sciences. They are the result both of theoretical and empirical research. The subjects covered vary considerably and reflect the interdisciplinary nature of the journal. We do hope that the papers published will meet your kind interest and will be an inspiration to further research and discussions.

On behalf of the Editorial Board of „Humanities and Social Sciences" we would like to thank the Authors for sending the outcomes of their research. We would like to express particular gratitude to the Reviewers for their valuable feedback that greatly contributed to increasing values of the scientific publications.

With compliments

Editorial Committee

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Mariola GRZEBYK[1]
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ASSESSMENT OF THE ECONOMIC POTENTIAL OF EU COUNTRIES IN 2015 AND 2024

The aim of the article is to assess the economic potential of EU countries in 2015 and 2024. The empirical research used a set of 13 variables obtained from the Eurostat database. The synthetic measure was determined using a non-pattern method, with normalization based on zero unitarization. The results of the study showed that in the period 2015-2024, the economic potential of EU countries changed relatively little. The leaders in terms of economic potential in the EU are Luxembourg, Ireland, the Netherlands, Denmark, Sweden, and Belgium. The largest number of EU countries exhibited a medium-low economic potential. A low economic potential was recorded for Romania, Bulgaria, and Greece. Factors inhibiting the economic potential of EU countries in the period under study were the COVID-19 pandemic and the war in Ukraine.

Keywords: economic potential, European Union countries, zero unitarization method.

INTRODUCTION

The countries of the European Union are characterized by different levels of economic potential. Large disparities between European countries have an adverse effect on the functioning of the European economic system. Therefore, a priority of European integration is to strive for the equalization of social and economic inequalities and the gradual reduction of development disparities between them. The EU assistance measures used for this purpose are directed to countries or regions that deviate significantly from the average socio-economic development indicators of EU countries (Stec, 2008). This means that the European Union has numerous possibilities to influence the form and course of processes and phenomena occurring in Europe, as well as globally (Milczarek, 2005).

Increasing the economic potential of the Community countries is in the interest of all entities operating in the European Single Market (ESM), and a stronger EU economy is a more desirable partner on the international stage. A necessary condition for increasing

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the level of economic potential of individual EU countries is the ability of their economies to meet the dynamically changing requirements of competition both in the European Single Market and in the global market. Intensified research on the economic potential of individual European Union countries as a whole is inextricably linked with the ongoing integration and globalization processes, which necessitate the identification and measurement of factors determining this potential (Pawlak, 2013).

The aim of the article is to assess the economic potential of EU countries in 2015 and 2024 using a selected method of multivariate comparative analysis – the non-pattern method with normalization based on zero unitarization. The empirical research used a set of 13 variables defining the economic potential of EU countries, obtained from the Eurostat database.

The article's research period covers 2015-2024. A ten-year research horizon enabled us to capture not only short-term changes in the level of economic potential but also its longer-term evolution. This allowed us to identify sustainable development trends and changes in the position of individual EU countries relative to one another. The analysis began during a period of relative stabilization and continued economic growth following the financial crisis, while the subsequent years were marked by significant economic disruptions, including the COVID-19 pandemic and its consequences, as well as increased inflationary pressures and economic uncertainty related to the war in Ukraine. Consequently, the period 2015–2024 allows us to assess the extent to which individual EU economies were able to maintain or improve their economic potential amid a changing macroeconomic environment. Setting 2024 as the final year of the study allowed us to utilize the latest Eurostat statistical data available for the entire set of countries analyzed.

The article attempts to answer the following questions:

- Which EU countries are the leaders and which occupy the last places in terms of economic potential?
- What is the economic potential of EU countries in 2015 and 2024?
- Did EU countries record significant progress in economic potential in 2024 compared to 2015?

Achieving the main objective of the study and seeking answers to the research questions required an appropriate structure of the article, including a literature review, a discussion of the assumptions of the research method and research results, as well as a discussion and conclusions.

2. LITERATURE REVIEW

In the literature on the subject, there is no single definition of a country's economic potential that is accepted by all authors. This concept is most often defined in a descriptive and intuitive way, taking into account various functions or areas of its operation.

A country's economic potential is defined by estimating various economic, social, ecological, scientific-technical, political, and other criteria, which are usually interconnected and correlated. Each of these criteria includes a heterogeneous set of economic, financial, social, political, legal, educational, scientific-innovative, ecological, cultural, and other factors, each of which may consist of independent or indirectly correlated sub-factors, referred to as indices or indicators (Guseynov et al., 2017).

In turn, Pierścieniak (2015) notes that economic potential is a complex category, associated with the identification of the entity and the specification of the subject, direction, or area in which the potential is described. Its essence is related to determining the

resources, experience, and values possessed by the entity, as well as identifying its capabilities or attitudes in the context of the defined subject.

Mastalerz-Kodzis (2018) emphasizes that the economic potential of a given country is a multidimensional concept because it depends on numerous, often interrelated factors. Potential not only assesses the capabilities of an entity based on its abilities, competencies, or efficiency, but also measures the ability to utilize these resources. The capabilities of a territorial unit (region, voivodeship, state) result both from the internal condition of the unit itself and from its location in the analyzed space.

Grzebyk (2017) adds that economic potential is a specific configuration of a country's capabilities and abilities to carry out the tasks imposed on it, embedded in the resources possessed by that country and their skillful use in order to achieve the highest possible efficiency.

In this context, Szyja (2017) emphasizes that resources are a key factor determining the potential of a given country, thereby enabling socio-economic development. From an economic perspective, resources are factors of production, which are primary and secondary in nature. The use of primary resources is influenced by natural conditions, while secondary resources are created by humans as a result of their activity.

Grzebyk (2017) adds that potential can be estimated using various scales; for example, real potential allows it to be understood in the real world. An important dimension of potential is also determining its strength or, in other words, the level of potential under specific conditions. In this way, it can be estimated as high or low.

Other authors emphasize that when analyzing the economic potential of a given country, the level of its economic, social, and legal development should be taken into account (Krugman, Obstfeld, 2007).

The importance of economic potential was also noted when defining sustainable development. The three pillars of sustainable development – environmental, social, and economic – are interconnected aspects that define the approach to the sustainable functioning of societies and economies worldwide. Each of these pillars plays a unique role in building a stable and sustainable future (Stec, Grzebyk, 2024). The aforementioned concept assumes constant and lasting economic and social progress, which must be harmonized with the natural environment. Sustainable development is becoming not only an idea we strive for in our lives, but also a specific set of principles and guidelines that administrative units must meet (Brzoska, Lewandowska, 2013).

In summary, it can be stated that the economic potential of a given country is characterized by many parameters that depend on and are shaped by various economic, environmental, and social factors. Managing this potential requires conscious decisions based on the assessment and analysis of these factors. In the case of limited capabilities, choosing development priorities for this potential requires an integrated assessment of its key parameters.

3. SELECTION OF DIAGNOSTIC VARIABLES AND ASSUMPTIONS OF THE RESEARCH METHOD

As the authors indicate (Guseynov, et.al., 2017) there exist many methods for estimation of country's economic potential, for example, method of sum of places, method of numerical scores, method of multidimensional mean, method “Pattern”, method of multidimensional comparative analysis, different by the level of complexity methods of

deterministic and stochastic factor analysis, big amount of methods of expert evaluation, etc.

In the article, the assessment of the economic potential of EU countries in 2015 and 2024 used a method of multivariate comparative analysis, in which the selection of diagnostic variables was an important stage.

The proposed variables should exhibit an appropriate level of variability and correlation. The classical coefficient of variation, calculated as the ratio of the standard deviation of a variable to its arithmetic mean, is often used to assess variability. Variables for which the calculated value of the coefficient of variation is at or below the critical value, most often 0.10, i.e. 10%, are eliminated.

The variables used in the assessment of the economic potential of EU countries should also not be strongly correlated with each other. An interesting proposal for examining the correlation of variables is the inverse correlation matrix method by A. Malina and A. Zeliaś (1998). The first stage of this method involves determining the Pearson linear correlation coefficient matrix between variables. Then, the inverse correlation matrix is calculated. Variables for which the absolute values of the diagonal elements of this matrix exceed 10 are eliminated. After eliminating variables with a low level of variability and highly correlated variables, the so-called diagnostic variables remain in the set of variables.

Diagnostic variables are the basis for determining the value of the synthetic measure. The literature presents many ways to construct a synthetic measure. Both pattern methods (e.g., Hellwig's method, TOPSIS) and non-pattern methods of linear ordering of objects are used. This study applies the non-pattern method with normalization based on zero unitarization. It includes the following stages: (Kukuła, 2000)

1. Presentation of the values of variables X_j (j = 1, 2, ..., m) for each object O_i (i = 1, 2, ..., n) in the form of an observation matrix:

$$\boldsymbol{X} = \begin{bmatrix} x_{11} & x_{12} & \cdots & x_{1m} \\ x_{21} & x_{22} & \cdots & x_{2m} \\ \vdots & \vdots & \vdots & \vdots \\ x_{n1} & x_{n2} & \cdots & x_{nm} \end{bmatrix} \tag{1}$$

2. Determining the nature of variables, which may be stimulants or destimulants. Stimulants are attributes where high values are considered desirable from a certain perspective, while low values are undesirable. Destimulants, on the other hand, are attributes where low values are considered desirable from the perspective of the phenomenon under study, and high values are undesirable (Hellwig, 1968).
3. Performing normalization of the variable values using the formulas:
   For stimulants

$$z_{ij} = \frac{x_{ij} - \min\limits_{i}\{x_{ij}\}}{R_j} \tag{2}$$

   For destimulants

$$z_{ij} = \frac{\max\limits_{i}\{x_{ij}\} - x_{ij}}{R_j} \tag{3}$$

The minimum, maximum and range values will be calculated for both years under study.

4. Determining the value of the synthetic measure

After normalizing the variables according to formulas 2 and 3, the values of the synthetic measure are calculated using the formula:

$$MS_i = \frac{1}{m}\sum_{j=1}^{m} z_{ij} \tag{4}$$

where:

MS_i – synthetic measure for the *i*-th object,

z_{ij} – normalized values of the variables.

m – number of variables.

The synthetic measure takes values from the [0,1] range. The higher the value of the synthetic measure, the higher the economic potential of EU countries.

5. Classification of EU countries into groups with similar economic potential according to the scheme (Nowak, 1990):

$$\begin{aligned}
&\text{Group I: } MS_i \geq \overline{MS}_i + S_i && \text{high level}\\
&\text{Group II: } \overline{MS}_i + S_i > MS_i \geq \overline{MS}_i && \\
&\text{medium-high level} && \\
&\text{Group III: } \overline{MS}_i > MS_i \geq \overline{MS}_i - S_i && \\
&\text{medium-low level} && \\
&\text{Group IV: } MS_i < \overline{MS}_i - S_i && \text{low level}
\end{aligned} \tag{5}$$

4. ANALYSIS OF RESEARCH RESULTS

The following variables were taken into account in the assessment of the economic potential of EU countries:

X1 – Real GDP *per capita* in Euro [sdg_08_10],

X2 – Investment share of GDP [sdg_08_11],

X3 – Gross domestic expenditure on R&D [sdg_09_10],

X4 – R&D personnel [sdg_09_30],

X5 – Patent applications to the European Patent Office by applicants' per 100,000 inhabitants [sdg_09_40],

X6 – Exports of advanced technology products in % of total [tin00140],

X7 – Exports of goods and services in % of GDP [tet00003],

X8 – High-speed Internet coverage (% of households) [sdg_17_60],

X9 – Share of enterprises' turnover on e-commerce (% of the total) [tin00110],

X10 – Employment rate [sdg_08_30],

X11 – Persons aged 25-34 with tertiary educational attainment level [sdg_04_20],

X12 – Long-term unemployment rate as a percentage of the economically active population aged 15 to 74 [sdg_08_40],

X13 – At-risk-of-poverty rate [sdg_01_41].

The values of the individual variables were obtained from the Eurostat website: https://ec.europa.eu/eurostat/data/database. Next to the variables (in brackets) their codes in the Eurostat database are provided. Variables X1-X11 are stimulants, whereas X12-X13 are destimulants.

The variables determining the economic potential of EU countries were assessed in terms of variability and correlation. The values of the calculated coefficient of variation provided grounds for eliminating only one variable: X10 – Employment rate as a % of persons aged 20-64, for which the coefficient of variation was 5.6%.

The variables also did not show significant correlation with each other. Only variable X3 – Gross domestic expenditure on R&D as a % of GDP showed excessively high correlation with the remaining variables. Ultimately, all variables except X3 and X10 were selected as diagnostic variables for 2024. The same set of variables was adopted for 2015.

Using the values of the diagnostic variables, the proposed method was applied to calculate the values of the synthetic measure for individual EU countries in 2015 and 2024. Based on this measure, rankings of EU countries in terms of economic potential were constructed, and the countries were divided into groups with a similar level of potential (Table 1).

Table 1. Ranking of EU Countries by Synthetic Measure Values in 2015 and 2024

	Country	***MSi* 2015**	**Group**	**Country**	***MSi* 2024**	**Group**
1	Luxembourg	0,7142	I	Ireland	0,7454	I
2	Ireland	0,6256		Denmark	0,6827	
3	Netherlands	0,5887		Luxembourg	0,6709	
4	Denmark	0,5798		Belgium	0,6624	
5	Sweden	0,5590		Netherlands	0,6587	
6	Belgium	0,5360	II	Sweden	0,6556	
7	Finland	0,5242		Finland	0,6018	II
8	Malta	0,5187		Austria	0,5571	
9	Czechia	0,4731		Malta	0,5481	
10	France	0,4591		Germany	0,5435	
11	Austria	0,4493		Czechia	0,5293	
12	Germany	0,4245		France	0,5240	
13	Estonia	0,4100	III	Slovenia	0,5038	III
14	Slovenia	0,4051		Cyprus	0,4748	
15	Hungary	0,3806		Hungary	0,4742	
16	Lithuania	0,3723		Lithuania	0,4687	
17	Slovakia	0,3698		Estonia	0,4626	
18	Latvia	0,3406		Portugal	0,4513	
19	Poland	0,3399		Spain	0,4449	
20	Spain	0,3059		Croatia	0,4323	
21	Portugal	0,3053		Poland	0,4150	
22	Bulgaria	0,3014		Slovakia	0,4098	
23	Croatia	0,2722	IV	Latvia	0,4046	
24	Cyprus	0,2603		Italy	0,4033	
25	Romania	0,2551		Romania	0,3534	IV
26	Italy	0,2427		Bulgaria	0,3400	
27	Greece	0,1123		Greece	0,3141	

Source: own calculations based on Eurostat data.

In 2015, the EU countries with high economic potential were: Luxembourg, Ireland, the Netherlands, Denmark and Sweden. In 2024, this group was additionally joined by Belgium.

Medium-high economic potential was demonstrated by 7 EU countries in 2015, i.e. Belgium, Finland, Malta, Czechia, France, Austria and Germany. However, in 2024 Belgium left this group, moving up to the group with the highest level of the studied phenomenon.

In both years studied, the most numerous were the groups of countries with medium-low economic potential. In 2015 this group included 10 countries, and in 2024, 12 countries.

In contrast, low economic potential was shown by 5 EU countries in 2015, i.e.: Croatia, Cyprus, Romania, Italy and Greece. In 2024, only 3 countries remained in this group: Romania, Bulgaria and Greece.

When assessing the economic potential of EU countries in 2015 and 2024, it is also worth analyzing the positions of individual countries within the European structure and their changes over the studied period (Table 2).

Table 2. Positions of EU countries in terms of the synthetic measure value determining their economic potential in 2015 and 2024

Country	2015	2024	Change 2015–2024
Austria	11	8	3
Belgium	6	4	2
Bulgaria	22	26	-4
Croatia	23	20	3
Cyprus	24	14	10
Czechia	9	11	-2
Denmark	4	2	2
Estonia	13	17	-4
Finland	7	7	0
France	10	12	-2
Germany	12	10	2
Greece	27	27	0
Hungary	15	15	0
Ireland	2	1	1
Italy	26	24	2
Latvia	18	23	-5
Lithuania	16	16	0
Luxembourg	1	3	-2
Malta	8	9	-1
Netherlands	3	5	-2
Poland	19	21	-2
Portugal	21	18	3
Romania	25	25	0
Slovakia	17	22	-5
Slovenia	14	13	1
Spain	20	19	1
Sweden	5	6	-1

Source: own calculations.

The greatest positive changes in economic potential can be observed for Cyprus, which moved up from 24th position in 2015 to 14th place in 2024, an improvement of 10 positions.

An improvement of 1-3 positions was achieved by 10 EU countries: Austria, Belgium, Croatia, Denmark, Germany, Ireland, Italy, Portugal, Slovenia, and Spain.

Five countries maintained their ranking position: Finland, Greece, Hungary, Lithuania, and Romania.

A slight decline in the ranking by 1-2 positions occurred for 6 EU countries. In contrast, a decline of 4-5 positions was recorded for 4 EU countries: Bulgaria, Estonia, Latvia, and Slovakia.

5. CONCLUSIONS

The analysis conducted in this article confirmed the findings of other researchers who examined economic and social processes in the EU-27 from various perspectives. These researchers found, among other things, that EU Member States have very diverse economic development indicators, as well as historically different trends in the formation of economic potential and its utilization (Bilan, et al., 2020; Pawlak, 2013).

It can therefore be stated that the more economically developed countries, in particular the founding states of the EU, have derived the greatest benefits from the utilization of economic potential, which is reflected in the research.

The results of the conducted research led to the following conclusions:

1. In 2015-2024, the economic potential of EU countries changed relatively little; the synthetic measure value ranged from 0.1123 to 0.7142 in 2015, whereas from 0.3141 to 0.7454 in 2024.
2. The leaders in terms of economic potential in the EU are: Luxembourg, Ireland, the Netherlands, Denmark, and Sweden. In 2024, this group was also joined by Belgium.
3. In both years studied, the largest number of countries exhibited medium-low economic potential: 10 countries in 2015 and 12 in 2024.
4. In 2024, compared to 2015, the number of countries with low economic potential decreased from 5 to 3: Romania, Bulgaria, and Greece.
5. The reason for the small changes in economic potential, especially in Western European countries, is that they have already achieved a high level of infrastructure, technology, and capital, so their further development is more qualitative in nature (innovation, services, digitalization) rather than quantitative. This limits the possibility of rapidly increasing economic potential.
6. An important factor inhibiting the economic potential of EU countries in the studied period was also strong external crises, such as the COVID-19 pandemic and the war in Ukraine. They caused supply chain disruptions, energy price increases, inflation, and economic uncertainty, which limited investment and growth rates. In addition, population ageing, low productivity dynamics, and the high costs of energy and climate transition mean that EU economies are developing more slowly than, for example, the USA or China.
7. In contrast, Central and Eastern European countries, in order to gradually catch up with the so-called “Old Union” countries, must move to a higher level of development based on innovation, knowledge, and high productivity. Stable law, predictable regulations, and efficient administration create conditions for growth in

investment and entrepreneurship. Further development of infrastructure, ensuring cheap and stable energy, and appropriate demographic policy are also necessary.

The conclusions presented in this article provide essential information for researchers and policymakers, assisting them in assessing the economic potential of the territorial units studied. The sets of variables proposed in the article and the resulting rankings can be used when constructing similar compilations in the future. They may serve as guidance on which countries and in which areas assistance should be directed, in order to most effectively support and develop the economic potential of individual EU countries. Such specification and targeting of resources can contribute to their more efficient use, as well as to more effective counteraction of numerous economic problems.

All authors have read and agreed to the published version of the manuscript.

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TYPOLOGY OF CONSUMERS IN THE DENTAL SERVICES MARKET ACCORDING TO PSYCHOGRAPHIC CRITERIA

The dental market is specific. The products and services offered directly impact individual health, encompassing both public and private healthcare providers. Such significant complexity of the dental services market allows for the research question to be asked: what types of consumers can be distinguished on the dental services market. The aim of the work is to determine the types of consumers of dental services.
The quantitative study was conducted in July 2024 by the Ariadna Research Panel on a sample of 1095 individuals, using quota selection of participants. 16 questions modeled on R. Cattell's 16PF questionnaire regarding human personality were used to prepare the typology. The typology was developed using the IBM SPSS Statistics 28 computer program, using the Ward cluster analysis and the k-means methods. Three clusters were obtained. The types of consumers were defined as: Sensitive Analyst, Pragmatic Conformist, Proactive Observer.

Keywords: typology, dental services, consumer behavior, health care, cluster analysis.

1. INTRODUCTION

Healthcare in Poland is generally based on an insurance-based health care system, although it contains elements of a budget model (Zgliczyński, 2018; Ślęzak et al., 2017), and even a residual (free market) model, where the risk of health problems is an individual responsibility (Kamiński, 2012; Wielicka, 2014; Borkowska, 2018). Despite the constitutional assurances regarding access to health care for Polish citizens (Grabowska, Urbaniak, 2014), insufficient resources of the public system have led to the need to introduce subjective, objective or quantitative restrictions in the case of access to health care services financed from public funds. These restrictions are particularly visible in the case of dental treatment services (Suchecki, 2024). Due to these restrictions, most consumers in this market decide to use the commercial offer of companies in the dental services market (Wicka, 2021; PIU, 2018; Kozera, J., Kozera, M., 2022).

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The dental services market is relatively rarely studied by scientists in Poland and around the world. It is usually simply included in the healthcare market, of which it is a part. However, it is such a specific part that even dentists are a separate professional group that must complete a different field of study than doctors of all specializations. In addition, the Polish health care system is largely based on services financed from public funds, which is difficult to say about dentistry, the commercial part of which constitutes almost 80% of the value of all services in this market (Piotrowska et al., 2020). This is undoubtedly the branch of health care in which consumers see the value of co-payment for medical services, although it differs in individual age groups of patients (Wyszkowska, 2020). It can also be said that the production of health care services, including dentistry, has certain features of a public-private partnership, and the State only partially recognizes health as a public good (Kamiński, 2012; Suchecka, 2016). The commercial nature of dentistry means that scientific publications on this market refer in particular to the marketing of medical services (Bukowska-Piestrzyńska, 2011; Syrkiewicz-Świtała et al., 2014; Jończyk, Warenda, 2016). These works usually have at least a partial practical dimension and are intended to be useful for medical entities.

A dental patient is rarely examined from an economic perspective. He or she should then be called a consumer on the dental services market, although sometimes researchers focus on the value for this consumer (Bukowska-Piestrzyńska, 2017; Cieślik, Przybylska, 2018), which can be found within the individual elements of the product structure – dental services (Suchecki, 2023).

The demand for health services, including dental services, is unlimited (Szewieczek, Świeboda, 2022; Świeboda, 2023) and it is impossible to fully satisfy equally unlimited human needs (Bębnowski, 2022). Due to the diversity of these needs in the population, we can also talk about the diversity of attitudes, preferences and behaviors of consumers in the markets (Smoluk-Sikorska et al., 2024). A research question can be asked whether it is possible to identify types of consumers in the dental services market who differ in their attitudes and behaviors in this market. The aim of the work is to determine the types of consumers of dental services.

2. LITERATURE REVIEW

Theories of consumer behavior lie at the foundation of economics. Many microeconomic theories assume that the consumer is rational and, as such, guided by economic considerations (Mazurek-Łopacińska, Sobocińska, 2014). Modern economics is increasingly moving away from the view that economic factors – specifically income and the price levels of goods and services – are the primary determinants of consumption (Zalega, 2012). Socio-economic changes, particularly the development of information technology and artificial intelligence, necessitate examining this issue from various perspectives. Some authors even argue that consumer choice can hold existential significance insofar as it fosters the shaping or realization of an individual vision of the "good life" (Anker, 2024), while others lean toward the Theory of Planned Behavior (TPB) (Rozenkowska, 2023). Undoubtedly, however, consumers do not constitute a uniform group; their diversity requires segmentation into smaller groups that are internally more homogeneous and exhibit similar behaviors. Such studies most frequently focus on specific markets (e.g., Huseynov, Özkan Yıldırım, 2019; Seo, Buchanan-Oliver, 2017).

The diversity of consumer behaviors, resulting from the multitude and hierarchy of human needs, has led many researchers to create various divisions of consumers into

relatively homogeneous groups. There are several closely related concepts in the literature, which are not synonymous, however. The most important are "segmentation" and "typology".

Segmentation, according to A. Kusińska (2009), is a term taken from marketing and means "dividing the market into homogeneous sets of market entities (so-called market segments), which determine the area of activity of an economic entity and constitute a point of reference in formulating its marketing program". The market in this definition is understood "narrowly" as a set of potential customers, and not as a set of buyers and sellers who conclude purchase and sale transactions of goods and services. M. McDonald and I. Dunbar (2003) presented segmentation as consisting in "dividing customers or potential customers within a given market into groups, i.e. segments in which all customers have the same or similar requirements, satisfied by a specific marketing mix". Thus, segmentation is the division of the market (i.e. customers and potential customers) into similar groups for the use of a specific organization (especially an enterprise) in order to better prepare a marketing strategy, as well as to select individual groups (segments) as target markets.

A. Kusińska (2009) also emphasizes that the division must be made in a logical manner. She also provides a definition of typology as: "a method of scientific cognition that allows for the isolation and description of conventional types of the studied community (consumers or buyers), as well as a certain group of types, isolated and described using the same method".

Thus, it should be assumed that consumer typology is a primary activity and has scientific features. As researchers point out, typology is a multidimensional type of classification into individual groups, which are given names consistent with their features (Greig, 2003). The separation of these types is conventional and results from the assumptions made by the researcher, e.g. criterion (Witek, 2014). It is also the result of the adopted research techniques and conducted analyses (Kieżel, 2000). Incorporating consumer typology into the company's marketing information system should help the organization determine market segmentation (Kieżel, 1997). Sometimes it is assumed that, due to the relatively high degree of generalization, consumer typology is close to the concept of macro-segmentation, while market segmentation is defined from the point of view of individual companies (i.e. the micro sphere). Typology is a passive recording of existing groups, while segmentation may also consider the possibilities of shaping them due to direct reference to the marketing strategy (Kusińska, 2009).

In consumer research, one can distinguish a practically infinite number of detailed criteria against which a typology can be conducted. In principle, there are no universal criteria, especially since the criteria adopted in the typology should refer to a specific market and market situation. These criteria may be general criteria or those referring to specific products, specific market or purchase situation. They may also be objective measures (such as demographic factors or purchase frequency) as well as subjective measures (such as personality traits or preferences) (Kusińska, 2009), which may often be more important from the point of view of real consumer behavior, e.g. related to the aspiration to belong to specific groups (Jakubowska-Łazęcka, Klimczyk-Bryk, 1997).

3. MATERIALS AND METHODS

The presented study was based on survey research conducted using an online survey technique. This is a technique generally recognized by the scientific community, especially since the restrictions on direct contact during the COVID-19 pandemic (PTBRiO, 2020).

The technique used allows for obtaining data at relatively limited research costs. It is associated with fundamental limitations related to the relatively small possibilities of control over respondents by the researcher. It is worth noting, however, that the sense of anonymity on the part of the researched increases (Kaczmarczyk, 2018; Kucharska et al., 2024).

The data presented in the work were obtained thanks to an original research questionnaire prepared based on studies of the subject literature. The research tool consisted of 17 substantive questions and 7 metric questions. The substantive questions concerned consumer behavior in the dental services market. The metric questions were intended to determine the social, economic and demographic characteristics of the respondents.

The reliability of the scales used (i.e. the internal consistency of the tool) was calculated using Cronbach's α coefficient, which is based on the internal consistency method. The coefficient value obtained for all scales used in the questionnaire clearly exceeded the level of 0.7. This is the level accepted in the scientific community as describing scales with a high level of reliability (Aron, Aron, Coups, 2013). Another coefficient for estimating reliability is McDonald's ω coefficient. Similarly, it is based on the internal consistency method. Its advantages over Cronbach's α are indicated (Ciżkowicz, 2018; Kalkbrenner 2024), as well as the fact that it can be considered a better indicator of internal consistency (Graham, 2006; Revelle, Zinbarg, 2009). It seems reasonable to use both α and ω in examining the reliability of the scales adopted in the research tool. It is assumed that both indicators should reach values between 0.70 and 0.95 (Moumni et al., 2016). The scales used in the study were within the designated range. They ranged from 0.849 to 0.923 (Cronbach's α value) and from 0.849 to 0.923 (McDonald's ω value).

The measurement of the studied social phenomena was decided to be carried out through one of the online research communities. These were registered participants of the Ariadna National Research Panel. According to the information provided by the research company, the socio-demographic profile of people registered in the panel coincides with the profile of Poles using the Internet (Ariadna, 2024). However, researchers point to doubts related to the activity of some members of the research panels and "quiet resignation" from participation in the community despite not formally deleting their personal account (Siuda, 2016). A research sample was randomly selected from among approximately 300,000 panel members (Rószkiewicz, Mazurek-Łopacińska, Sagan, 2021). The sample size was determined in such a way that the maximum measurement error at a confidence level of 95% and a fraction size of 0.5 was no more than 3% – the level of error acceptable in social research.

The study was conducted on July 10-15, 2024. A link with an invitation to participate in the study was sent to 15,368 adult and registered members of the Panel. 3,595 (23.39% of invited) respondents responded to the invitation, and 1,095 (7.13% of invited) respondents completed the study. Due to the shortcomings of the research technique used and the limited possibilities of the respondent's control over completing the questionnaire, attention was also paid to the length of time spent by the respondent on completing the questionnaire. When testing the tool, it was found that it was not possible to read the entire questionnaire and complete it reliably in less than 5.5 minutes. The shortest time of the study was 6 minutes; hence the decision was not to remove any of the obtained results from the database. The analyses of the obtained data were carried out using the IBM SPSS Statistics 28 statistical package.

The study was conducted in accordance with ethical standards, considering the International Code of Ethics of ICC/ESOMAR (ESOMAR, 2016). The study also received a positive opinion from the Human Subject Research Ethics Committee at the University of Economics in Katowice (No. 6/05/2024). The study was anonymous, and the collected data did not contain any features that would allow for the personal identification of respondents.

The selection of respondents was based on quotas based on gender and generational group affiliation. The characteristics of the research sample are presented in Table 1 and Table 2.

Table 1. Characteristics of the research sample by age and gender (in %, N=1095)

Specification	**Age groups**				
	18-28	**29-43**	**44-59**	**60 and more**	**SUM**
Females	12,4	12,5	12,3	12,3	**49,6**
Males	11,7	13,8	12,5	12,4	**50,4**
SUM	**24,1**	**26,3**	**24,8**	**24,7**	**100,0**

Source: own study based on primary research.

Table 2. Characteristics of the research sample by place of residence and level of education of respondents (in %, N=1095)

Specification		**%**
Place of residence	Village	19,1
	Small town (up to 20k)	11,1
	Medium town (20-99k)	24,5
	Big city (100-500k)	24,7
	Huge city (over 500k)	20,6
Education	Basic	1,6
	Vocational	6,1
	Secondary	40,2
	Higher	52,1
Subjective assessment of the financial situation	Very bad	1,5
	Bad	5,9
	Average	58,3
	Good	28,5
	Very good	5,8
Household Size	1 person	14,9
	2 people	38,2
	3 people	21,9
	4 people	17,0
	5 people or more	8,0

Source: own study based on primary research.

To conduct a typology of consumers according to the psychographic criterion, it was decided to adapt R. Cattell's 16PF questionnaire (Cattell, R. B., Cattell, H. E. P., 1995) concerning human personality. The questionnaire itself was not shortened; however, the categories proposed by the researcher were translated into Polish and adapted to the study and the respondents to ensure they were understandable to the sample group. The Polish phrases used in the article have been back-translated into English literally; consequently, they differ from the exact wording of the 16PF questionnaire. This resulted in the creation of 16 pairs of traits, from which the respondents had to choose one that describes them better. These traits are presented in Table 3.

Table 3. Pairs of psychographic features based on R. Cattell's 16PF questionnaire used in the research tool

No.	Specification	
1.	Reserved	Warm-hearted
2.	Concrete in reasoning	Abstract in reasoning
3.	Oversensitive	Emotionally balanced
4.	Submissive	Dominant
5.	Serious	Full of energy
6.	Conscious of norms	Pragmatic
7.	Shy	Bold
8.	Focused on utility	Sensitive
9.	Trustful	Alert
10.	Concrete in action	Abstract in action
11.	Open	Secret
12.	Self-confident	Apprehensive
13.	Traditional	Open to changes
14.	Group-oriented in thought and action	Independent in thought and action
15.	Tolerant of disorder	Perfectionistic
16.	Usually relaxed	Usually stressed

Source: own study based on (Cattell, R. B., Cattell, H. E. P., 1995).

The typology was developed using the IBM SPSS Statistics 28 computer program. The first element of the conducted analyses was the decision to use one of the hierarchical agglomeration methods – Ward's method with the square of the Euclidean distance. The application of this method was carried out in several stages. Diagnostic variables were selected (16 identified psychographic features), and a distance matrix was calculated using the computer program. A dendrogram was created on its basis. The obtained binary tree shows subsequent cluster connections from 1095, i.e. when each observation is in a separate cluster, to 1, when all observations are in one cluster. The hierarchy obtained in this way allows for determining the mutual position of the clusters. The adopted cut-off axis (at the level of 6.5) allowed for the assumption of the existence of three clusters, which enabled further analyses.

After determining the probable number of clusters, a k-means cluster analysis was used. Here, too, 16 previously identified variables were used, and the ordinal number was used to describe the observations, i.e. exactly the same data as in the case of Ward's hierarchical

method. Initial cluster centers were calculated, an ANOVA table was created (Table 4), and finally three clusters were obtained, the number of which was 34.8%, 23%, and 42.2% of the sample. The description of the distinguished clusters in this way was preceded by an analysis of the structure of each of these clusters. This provided information on which diagnostic variables were dominantly decisive for the creation of individual clusters and consequently allowed the types of consumers obtained in this way on the dental services market to be named according to the psychographic criterion.

Table 4. ANOVA table for clusters made by pairs of psychographic features

Pairs of psychographic features	Cluster		Error			
	Average Square	df	Average Square	df	F	Signifi-cance
Reserved or Warm-hearted	19,231	2	0,211	1092	91,328	<,001
Concrete in reasoning or Abstract in reasoning	2,484	2	0,168	1092	14,777	<,001
Oversensitive or Emotionally balanced	24,355	2	0,184	1092	132,172	<,001
Submissive or Dominant	34,366	2	0,188	1092	183,079	<,001
Serious or Full of energy	35,666	2	0,185	1092	193,166	<,001
Conscious of norms or Pragmatic	6,540	2	0,215	1092	30,424	<,001
Shy or Bold	65,569	2	0,128	1092	514,115	<,001
Focused on utility or Sensitive	13,830	2	0,222	1092	62,395	<,001
Trustful or Alert	4,909	2	0,209	1092	23,442	<,001
Concrete in action or Abstract in action	3,274	2	0,145	1092	22,603	<,001
Open or Secret	43,441	2	0,162	1092	267,878	<,001
Self-confident or Apprehensive	56,873	2	0,121	1092	468,674	<,001
Traditional or Open to changes	41,209	2	0,174	1092	237,240	<,001
Group-oriented in thought and action or Independent in thought and action	3,079	2	0,180	1092	17,132	<,001
Tolerant of disorder or Perfectionistic	1,934	2	0,231	1092	8,379	<,001
Usually relaxed or Usually stressed	51,745	2	0,152	1092	339,691	<,001

Source: own study based on primary research.

4. RESULTS

The first distinguished group, constituting 34.8% of the examined, included people with reserved behavior, abstract in reasoning and action, oversensitive, submissive, serious, shy, sensitive, alert, secretive, apprehensive, but tolerant of uncertainty, and stressed. This type was defined as “Sensitive Analyst”.

The second distinct group includes every fourth respondent (23%). It consists of people who are specific, aware of norms, focused on the group and utility, specific in action, self-

confident, traditional, relaxed and tolerant of uncertainty. This type of consumer was defined as the "Pragmatic Conformist".

The third cluster is the most numerous. Observations belonging to it constitute 42.2% of the total. These are people who are warm, specific, emotionally balanced, dominant, full of energy, pragmatic, bold, open to otherness and change, self-confident, independent in thinking, perfectionist and relaxed. This type of consumer in the dental services market has been defined as a "Proactive Observer".

The characteristics of the distinguished types of consumers are presented in Table 5.

Male consumers in the dental services market are more often pragmatic conformists and proactive observers, while women are usually representatives of sensitive analysts. This type also includes more representatives of younger generations. All types usually use commercial dental treatment, which is the result of the system functioning in Poland, but pragmatic conformists try to use options that do not directly involve their money and relatively most often decide on services under the National Health Fund or as part of medical subscriptions, usually paid for or co-financed by the employer. All types usually use the services of their trusted dentist, but only the sensitive analyst practically does not consider other options. Consumers in this market subjectively believe that they largely follow medical recommendations, although the proactive observer often stops the treatment process after getting rid of the original problem (e.g. after pain relief). This is also the type of consumer in the dental services market that has the most limited trust in innovations (including digital ones) in dentistry.

Table 5. Characteristics of types of dental service consumers specified in terms of psychographic criteria

Types	Description	Behaviors	Determinants of behavior (sum % of rather important to decidedly important)
Sensitive Analyst	More often women (59,1%), younger generations (Z – 33,1%, Y – 32,5%), city dwellers (79,5%), higher education (53,3%)	They usually choose commercial treatment (75,3%); They choose small dental practices, and most have a trusted dentist (57,5%); They partially or fully follow medical recommendations (85%); They do not fully implement the treatment process (69,3%); They choose afternoon and evening hours of visits (30,4%): Sources of information are: Own previous experiences (52,8%), word of mouth (56,7%); They trust Internet sources relatively little (social media – 8,4%, browsers – 20,7%, internet forums – 6,8%, intermediary platforms like ZnanyLekarz.pl – 15%)	Patient service level (88,5%) Price (86,9%) Trust in the dentist or the dental office (89,3%) Possibility to complete the entire treatment process in one place (87,4%)

Pragmatic Conformist	More often men (57,9%), older generation – 53,6% (least often generation Z – 19%), residents of towns of various sizes (79,4%), higher (51,6%) or secondary education (41,7%)	They usually choose commercial treatment (77,4%), but most often also treatment within medical subscriptions (13,1%), as well as within the National Health Fund (43,7%); they choose small practices (57,1%) or multi-specialist clinics (19,8%); most have a trusted dentist (65,1%), but they do not rule out choosing another service provider (19,4%); They fully (48,4%) or to a large extent follow medical recommendations (38,5%) They usually fully implement the treatment process (36,1%); they usually choose afternoon hours (27,8%), but they are more willing than others to decide on morning hours (24,2%); sources of information include: own experience (54%), word of mouth 51,4%); Weak influence of the Internet (social media – 9,1%, browsers – 12,3%, internet forums – 8,3%, intermediary platforms like ZnanyLekarz.pl – 11,9%)	Trust in the dentist or the dental office (89,7%) Level of patient service (92%) Possibility of implementing the full treatment process in one place (90,4%) Modern equipment (88,1%)
Proactive Observer	More often men (54,1%) from older generations (BB – 31,6% and X – 28,4%), residents of larger cities (45,5%), higher education (51,3%)	They usually seek commercial treatment (74%), choose small practices (57,6%) or specialist clinics (20,6%); Most have a trusted dentist (64,9%), but do not rule out choosing another service provider (17,7%), fully (58,2%) or significantly (30,5%) follow medical recommendations (42,2%), although they usually give up further treatment after the initial problem has been eliminated (37,2%); They have limited trust in innovations in dentistry; They choose afternoon hours (28,1%), but also relatively willingly morning hours (23,8%); They use their own experience (60,8%) or the experience of family and friends (53,2%); information from the Internet is not so important source of information (social media – 8,2%, browsers – 12,1%, internet forums – 8,7%, intermediary platforms like ZnanyLekarz.pl – 11,3%)	Possibility of implementing the entire treatment process in one place (93,3%) Level of patient service (93,9%) Quick appointments (93,1%) Modern equipment (92,6%)

Source: own study based on primary research.

All types of consumers are happy to choose afternoon hours for their dentist visits, but the sensitive analyst is also happy to choose evening hours, and the pragmatic conformist and proactive observer are happy to choose morning hours. All of them trust their own experiences the most, as well as the opinions of family and friends. The relatively low trust in online information may be surprising. Interestingly, despite limited trust in innovation, the proactive observer is the most likely of the distinguished types to use information found online.

Among the determinants of behavior on the dental services market, sensitive analysts most often indicated the level of patient service and price. Interestingly, although the price of services was important for representatives of all types, only sensitive analysts considered it to be one of the four most important determinants. A pragmatic conformist focuses on trust in the dentist and pays attention to the level of patient service, while a proactive observer considers the possibility of implementing a comprehensive treatment process in one place and also the level of patient service. Quick appointments and modern dental equipment are also important to him.

5. DISCUSSION

Due to the diversity and multitude of determinants of consumer behavior (Korneta, Lotko, 2021), we can speak of a multitude of criteria that can be used to prepare a typology of consumers in the markets studied. The situation is no different in the dental market, or more broadly, in the healthcare market, where these factors may be similar (Ostrowska, Rosa, 2015), although their strength may differ in relation to other service or product markets. Undoubtedly, however, health needs are strongly diversified, as is the scale of their awareness by consumers (Kautsch, 2010). Thus, the proposed typology does not have to be the most differentiating one. Perhaps an attempt to create a typology consisting of a larger number of clusters would allow for greater internal homogeneity of the specified clusters, but from the point of view of the possibilities of practical application of the proposal, the types should be sufficiently numerous (Walesiak, 2000).

The types identified through factor analysis align quite well with the Theory of Planned Behavior (Rozenkowska, 2023). The Proactive Observer displays a positive and pragmatic attitude toward convenience – seeking comprehensive solutions and a willingness to pay for quality and speed – yet remains wary of digital innovations. The Sensitive Analyst exhibits visible apprehension, which results in a less-than-positive attitude and, in many instances, leads to the failure to complete planned treatment. The Pragmatic Conformist is most susceptible to social norms and traditional behavioral patterns, basing their choices on recommendations from their immediate social circle.

An analysis of the ANOVA results reveals that the most differentiating psychographic traits include: shyness versus boldness, self-confidence versus anxiety, relaxation versus stress, and openness versus reserve. It is precisely these emotional factors – rather than solely cognitive or demographic ones – that most significantly segment consumers in the dental services market. Emotions can be particularly important regarding attitudes toward innovative solutions (Guzetti, Crespi, Belvedere, 2024; Klaczek-Suchecki et al., 2026).

The relatively low trust of most types of consumers in online sources of information may be surprising, although researchers indicate that information on the Internet is an important element in building trust in organizations (Paliszkiewicz, 2015). Using the Internet, also searching for information on the health care market, is common, but the problem is the need to verify the veracity of this data (Szewczyk et al., 2024; Rogala, 2017).

In the dental market, direct relationships and recommendation loops – driven by word-of-mouth and personal experience – remain crucial. Digital marketing for dental practices may have limited capacity to build initial trust unless backed by genuine quality of patient care and personal recommendations.

Some limited trust in innovations in dentistry may result from experiences with telemedicine during the COVID-19 pandemic (Teleon, Włoszczak-Szubzda, 2020), as well as from doubts about legal solutions, and often their lack, when it comes to the digitalization of health care (Kwiatkowska, 2022). This may be a particular problem for the elderly (Kwiatkowska, 2021), which include Generation BB and at least the older part of Generation X.

Dentistry is treated as a market-based service, with consumers largely accepting co-payment (Wyszkowska, 2020). The findings demonstrate that price is not the primary barrier to choice for most groups, provided the facility delivers appropriate relational value (trust, service quality) and organizational value (time, comprehensiveness).

Among the factors determining the choice of a service provider in the dental market, the issue of trust in the dentist was often mentioned. This factor seems to be key in the healthcare market in general (Lipowski, Figiel, 2023), in this context, the ability to communicate properly between the doctor and the patient is also indicated – understanding on both sides (Kubacka, 2024), as well as relational communication (Dobska, 2021), which may be particularly important in the case of creating patient/consumer loyalty to the healthcare facility.

6. CONCLUSIONS

The typology of consumers in the dental services market proposed in this paper according to the psychographic criterion shows that consumers in this market do not constitute a homogeneous group and it is possible to create relatively homogeneous clusters. The typology that has been created can be useful for entities operating in the studied market and used to prepare segmentation and, to some extent, to define the target segment of activity.

In the case of the presented typology, attention is drawn to the significant differentiation of types in terms of the determinants of purchasing behaviour and the indication that price may not usually be the main factor influencing the choice of a specific service recipient.

The psychographic criterion selected for this study is not the only one, but only one of many that could be used. If other criteria were used, the effect of the work could be diametrically different, and the usefulness of such a typology could be greater, especially if it were possible to increase the number of clusters while maintaining their significant numbers (even at a level above 10%).

It would be worthwhile to propose a typology in subsequent studies on this market that would take into account, for example, demographic features, lifestyle-related features, or economic factors. An interesting supplement to the presented studies could be qualitative studies in which respondents would try to assign themselves to the proposed types, as well as try to determine whether they agree with their description.

The author has read and agreed to the published version of the manuscript.

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SENIORS AND SILVERS IN ADVERTISING. REPORT ON RESEARCH OF 1,440 AUDIO-VIDEO ADVERTISEMENTS

The ageing of societies and the growing importance of the 'silver economy' are two key challenges facing the advertising and brand communication market. Nevertheless, silvers and seniors remain underrepresented in advertising campaigns as main characters. At the same time, there is a prevailing belief that in advertising they are typically portrayed through the lens of negative stereotypes. However, the author's analysis of advertising spots does not confirm such a one-sided image of silvers and seniors. However, the following key conclusions can be drawn based on the analyses conducted: advertising is dominated by a positive model of ageing, with negative stereotypes of older adults being marginalised, a move away from a one-dimensional depiction of ageing within a family setting and an aspirational character of the portrayals of the oldest age groups. While advertising campaigns break some of the previously established patterns, especially the negative ones, they simultaneously create new simplifications and stereotypes by presenting the value of the individual through the lens of their activity, fitness, productivity and relationship-building ability. The aim of this article is to define the contemporary portrayals of silvers and seniors in advertising and to identify the dominant roles, traits and narratives attributed to these groups. The study is based on a content analysis of 1,440 advertising spots for 280 brands, primarily from Poland, Europe and the USA.

Keywords: silver economy, ageing in advertising; advertising, image of older people, stereotypes in advertising.

1. INTRODUCTION

One fifth of the population in the European Union is already over 65 years of age. A similar demographic trend is evident in other European countries and highly developed economies such as the USA, Canada and Australia (United Nations Population Division, 2021). According to forecasts, the number of people over 60 years old worldwide is expected to exceed 2 billion by 2050 (Kalasic, Vidovic, 2018). The phenomenon of ageing societies and increasing life expectancy is accompanied by the growing purchasing power

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of older people. The so-called 'silver economy', referring to the total economic activity of people aged 50 and over, has become one of the key trends in contemporary developed economies (Eisend, 2024). In the USA, the market for consumers aged 50+ has been the fastest-growing consumer market already since the beginning of the 21st century (Russell, Lane, 2000). Silvers are referred to as the wealthiest customer group (Fengler, 2021). This situation is also redefining advertising messages and the stereotypes presented in the media (Álvarez-Diez, Vega-Esparza, 2023).

Companies are aware of these demographic changes. However, it often seems as though advertisers fail to notice, ignore or are unable or unwilling to reach the growing group of silver and seniors with their message. Older people are the most underestimated age group in marketing communications (Prieler, 2024), and advertising campaigns are failing to keep pace with an ageing society. Although there is a lot of talk about equality in the media, this does not align with data on the advertising market, particularly when demographic factors are considered. People over the age of 50 are disproportionately underrepresented relative to the general population (Eisend, 2024), and seniors appear as main characters almost incidentally. Both female seniors (3%) and male seniors (4%) appear as main characters in advertising campaigns only marginally (Kończak, 2023; cf. Wirtualne Media, 2018). This applies particularly to women. Some even go so far as to say: 'if popular culture is taken as a point of reference, one could conclude that old women do not exist' (Łysak, 2005). A significantly higher proportion (10%) of older people appears only in pre-Christmas advertising, but then they are largely cast in stereotypical roles as grandparents (Kończak, 2025).

This situation is linked, among other things, to the strong focus of advertising on young and middle-aged people. Until recently, the so-called key commercial audience for most television channels, not only in Poland, was defined as 16-49. Only in the last few years has this commonly been extended to the 16-59 age group. Furthermore, the structure of the advertising industry, which relies on young creative professionals identifying with younger characters, does not foster an understanding of older customer groups. Added to this are frequent ageist prejudices and the widespread cult of youth in the media. These factors all contribute to the systemic and cultural marginalisation of the oldest consumer groups to whom harmful stereotypes are imposed (Kruse, Schmitt, 2006), along with socially accepted yet one-sided and predominantly negative roles (Stefaniak-Hrycko, 2012). Older people are also often cast in stereotypical roles, particularly in medical advertising, rather than in areas such as the technology sector (Kwon, Saluja, Adaval, 2015). The marginalisation of older people results in a weaker image transfer effect between the advertising character and the brand. The same applies to the 'age of the brand', which is linked to the age of the person advertising it, which, given the age discrepancy between the characters in advertising spots, results in a poorer fit between the product and the target group.

Silvers and seniors are growing in strength in economic and demographic terms. Their aspirations and expectations are growing and their life roles are evolving. Prejudice, marginalisation and presented stereotypes not only fail to reflect reality, but also fail to appeal to the audience (Rybowska, 2017; cf. De Meulenaer, 2018). Over 60% of people aged 50+ do not identify with their portrayals in advertising (MEC, 2017). They want to be portrayed as intelligent, attractive, active and healthy (Power Generation, 2019). Hence, among other factors, a growing trend of the so-called 'active ageing' (Szarota, 2012) can be observed in advertising, in which characters are depicted as dynamic, active and full of life and energy. These narratives depict people experiencing a second youth, travelling,

playing sports, fulfilling dreams that were previously unattainable due to a lack of time or money, open to the world and further education, and seeking partners in old age. Old age is slowly ceasing to have a tired, sad, sick and resigned face.

2. METHODOLOGY

The study 'The Portrayal of Silvers and Seniors in Advertising' focuses on main characters appearing in advertising spots featuring individuals from the oldest age groups. The author employed qualitative research, specifically content analysis, as a popular method for researching advertising messages (Boyland, Harrold, 2012; Applequist, Ball, 2018). When preparing the purposive sample for the study, the author first selected the advertising format, focusing exclusively on audiovisual spots and not distinguishing between television, online or cinema commercials. The campaigns analysed were selected using a purposive sampling method. Although this does not allow for generalisation of the results (Grimes, Peirce, 2013), it nevertheless provides a deeper understanding of the analysed advertising spots, their messages, the emotions they convey, the attitudes and values they promote, and the characters they portray. In this case, purposive sampling was intended to provide a deeper understanding of the subject and obtain detailed information, rather than representative statistical results. As part of the analysis of the visual and verbal layers of the advertising spots, the study examined, among other things, selected narrative structures, ways of constructing stories and the portrayals of characters representing the silver (50-60 years old) and senior group (over 60 years old).

The study was conducted in 2025-2026. The analysis covered 1,440 advertisements from 280 brands (four to six advertising spots per brand from the 21st century), primarily from Poland, Europe and the USA, operating on both domestic and international markets. The companies analysed mainly represent the food industry, retail, medical services and products, the FMCG sector, entertainment and media, clothing and fashion, beauty, finance and insurance, transport and tourism, HoReCa, automotive, technology and electronics, as well as prestigious and luxury brands.

The primary objective of the study was to create a typology of portrayals of silvers and seniors in advertising. The author sought to identify the key attributes, emotions and roles, and to determine the most appealing portrayals of women and men in these age groups for advertising. The study covered a total of ten categories. This article presents six categories selected from the overall study: the gender and age of the advertising characters, the roles they play, their needs, and the most prominently highlighted positive and negative attributes.

The author acknowledges the numerous limitations associated with the ambiguous nature of the area under study. This is particularly pertinent to identifying the age category of the characters. Information on chronological age is rarely available in advertising. Age was therefore determined based on triangulation of available visual, narrative and functional indicators. Key categories included perceived age and socio-cultural age, supported by narrative structure and functional indicators. However, it was impossible to eliminate ambiguity from the advertising message, discrepancies between social and biological age, misleading stereotyping or the deliberate blurring of the characters' ages.

3. RESULTS

In the analysed sample, the main character was more often male (55.1%) than female (44.9%). Men were significantly more frequently represented in the youngest age group (50.3%; 399 advertisements). This is closely related to the large number of attractive male roles, a pattern also observed in other studies on advertising messages (Kończak, 2023). In the older age group, men accounted for 37.2% (295), and in the oldest group, they appeared least frequently at 12.6% (100). Among women, the youngest group appeared less frequently – 36.5% (236), the older group was depicted at 44.9% (290) and the oldest group at 18.6% (120). This may reflect the actual demographics as well as the stereotyping of old age as more feminine.

Table 1. Age groups by gender

	Silvers	**Seniors**	
	50-60	**61-75**	**75+**
Woman	236	290	120
Man	399	295	100

Source: Own research "The image of silvers and seniors in advertising", 2025-2026 (n=1440).

The 'silvers' and 'seniors' roles are overwhelmingly positive. Most often, they are carers – warm and helpful individuals (399) who are supportive and involved in family relationships, such as grandmothers (187) and grandfathers (154). These strong intergenerational bonds are most frequently depicted in Christmas or Easter advertising, as well as that marking special occasions such as Grandmother's Day or Grandfather's Day. The largest number of these characters are in the 60-75 age group (113 grandmothers and 87 grandfathers), slightly fewer are in the oldest group (53 vs. 43), and the youngest group features a significantly higher number of grandfathers (23 vs. 43).

Contrary to popular belief, which suggests that older people withdraw from life and activity, a second significant group comprises roles associated with activity and self-fulfilment. Categories such as 'free spirit' (355) and 'aesthete' (215) represent narratives centred on characters who are active, independent, and focused on fulfilling their own needs. These include campaigns such as: 'Live Mas' (Taco Bell), 'Forever Young' (Subaru), 'Break Free' (Adidas) and 'You've Got to Have Imagination' (Allianz). Less frequently, but still present, are roles associated with intimacy and partner relationships, such as 'lover' (82). This demonstrates a shift away from the stereotypical, asexual image of old age. Campaigns such "Christmas 2015" (Iflor) and "Grand Père" (McDonald's) feature characters who are in love, and campaigns by Mars, Viagra, Durex, Pepsi, Pornhub and Fiat 500 contain frank references to sex among older people.

There is also a distinct category highlighting the agency, knowledge, experience, high competence and excellent functioning of older people. The 'professional in their field' (353) and the 'home expert' (292) are knowledgeable, supportive, competent and experienced individuals who are a mainstay of family and professional life. However, even here, the campaigns largely rely on stereotypical patterns, as female characters are mainly portrayed as knowledgeable about shopping, special offers, cooking, health and raising children. In contrast, men more often excel in the role of experienced professionals, characterised by mature age, slightly grey hair, glasses, a suit, a doctor's apron or a work

uniform. They present themselves as trustworthy, as if they were from the 'old school' of business, medicine, finance or craftsmanship. This set of categories is further complemented by the 'superhero' (155), typically used as a metaphor for the exceptional and surprising traits of narrative characters. Examples include the elderly ladies in 'You Cannot Trust Every Old Lady But You Can Trust Every Golf' (VW Golf) and 'Bring Back the Energy' (VW Golf, 2022), and the woman in 'Girl's Trip' (Subaru).

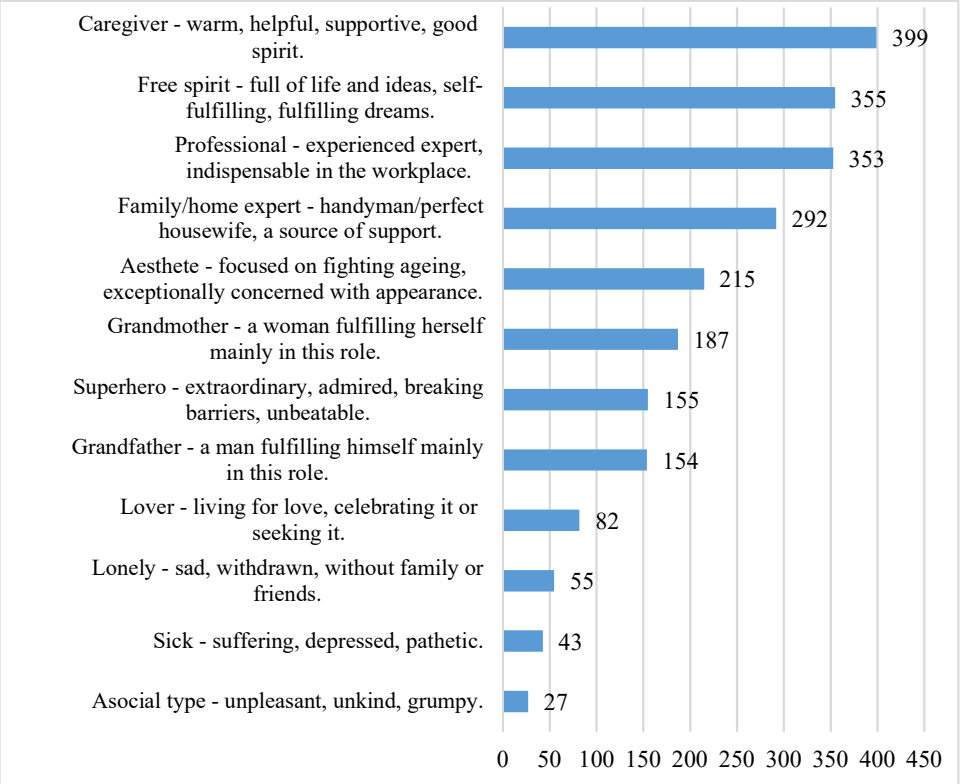


Figure 1. The roles of silvers and seniors in advertising

Source: Own research "The image of silvers and seniors in advertising", 2025-2026 (n=1440, max. 4 answers)

The vast majority of roles presented are positive. Those at the opposite end of the spectrum occur incomparably less frequently. Categories such as 'lonely' (55), 'sick, pathetic' (43) and 'asocial type' (27) are surprisingly rare, given the stereotypes associated with old age based on numerous negative connotations. This shows that, for the most part, advertising presents a better, idealised or aspirational version of the reality it reflects. Ugliness, illness, fears and negative emotions do not sell well and are therefore rarely present in messages intended to evoke a willingness to purchase, build relationships or shape brand image.

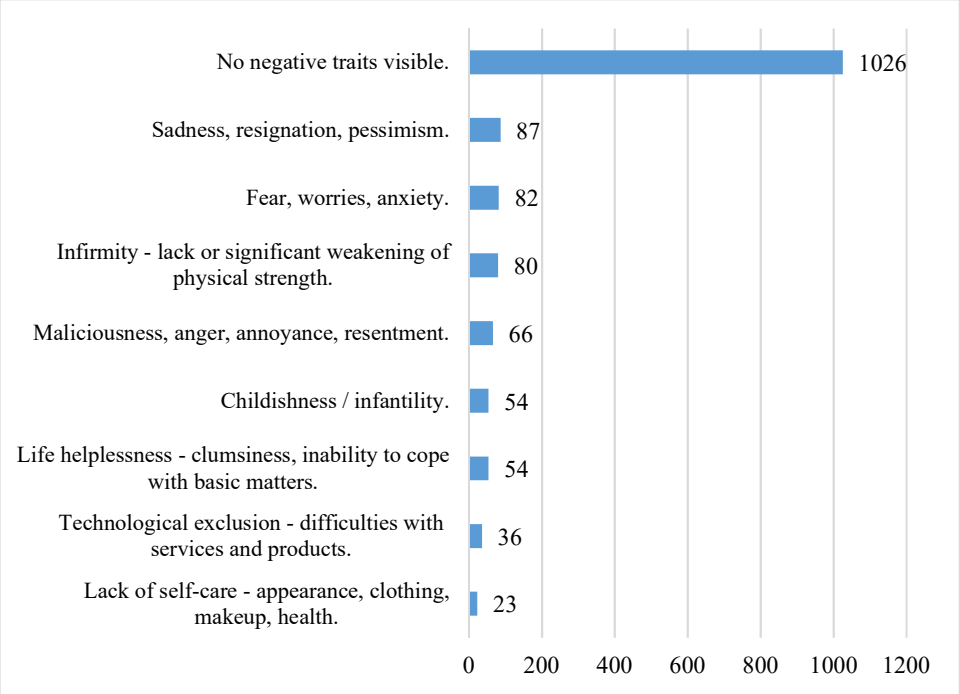


Figure 2. The most common negative traits of characters

Source: Own research "The image of silvers and seniors in advertising", 2025-2026 (n=1440, max. 5 answers)

This positive image of silvers and seniors is also confirmed by the Figure illustrating the most prominently highlighted negative attributes. In the vast majority of advertising campaigns, no such distinct traits are visible, with over 70% of advertisements featuring neutral or positive characters. The most common negative traits are associated with difficult emotional or mental states, such as sadness, fear and anger (235 advertisements in total) or helplessness in life or with technology (90 advertisements in total). However, positive narratives significantly outnumber negative ones, particularly those linked to vitality and an optimistic attitude such as a cheerful disposition (904), energy and willingness to act (676), joie de vivre and passion (519) and a sense of humour (458).

The positive traits include those related to social competences and the ability to establish and maintain relationships, including kindness and a willingness to help (390), openness to and understanding of others (255) and communicativeness (242). There is also a willingness and ability to establish interpersonal and social relationships that foster community building. Less frequently, traits related to taking care of physical fitness and sporting activity (182) or healthcare (173) come to the fore. The latter figure may appear particularly surprising, as a common perception has developed of a frail, health-conscious pensioner portrayed in medical advertising. Nevertheless, other sectors avoid such associations in their narratives, focusing instead on a cheerful lifestyle, kindness, understanding, relationships and fulfilling dreams.

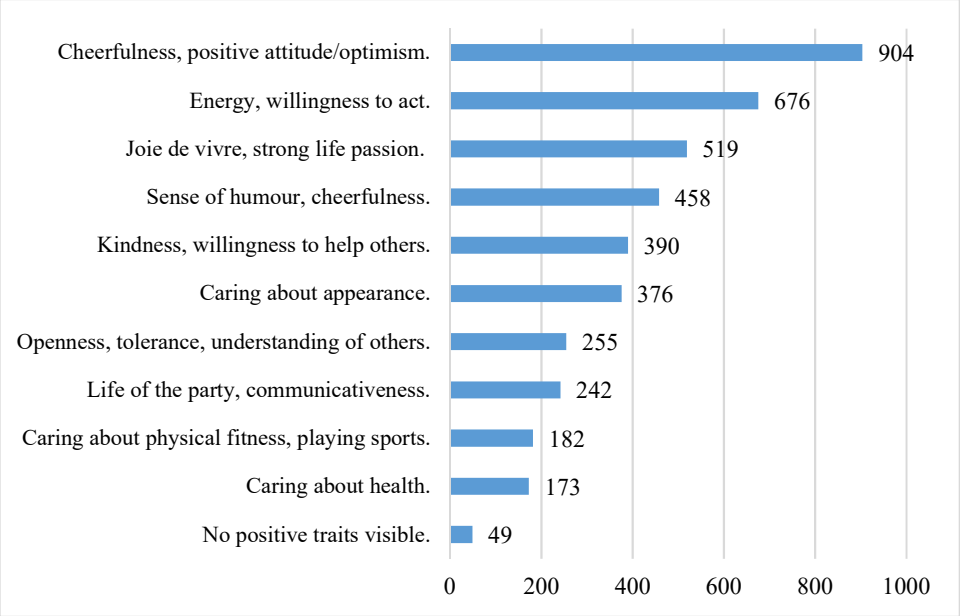


Figure 3. The most frequently highlighted positive traits

Source: Own research "The image of silvers and seniors in advertising", 2025-2026 (n=1440, max. 5 answers)

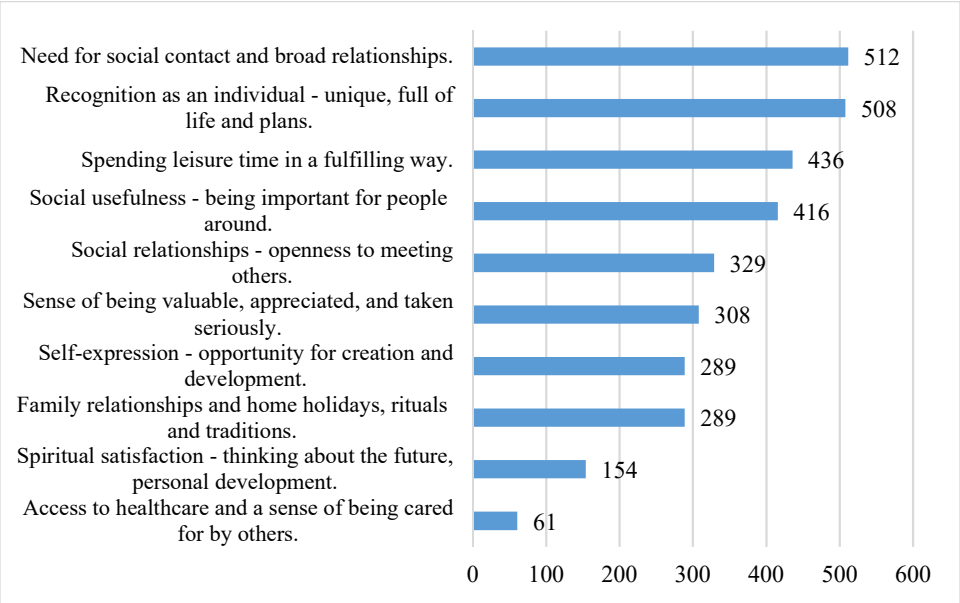


Figure 4. The most frequently highlighted needs of silvers and seniors in advertising

Source: Own research "The image of silvers and seniors in advertising", 2025-2026 (n=1440, max. 5 answers)

In the hierarchy of needs and values, social and relational needs are the most prominently emphasised: the need for social contact (512), a sense of social usefulness (416), social relationships (329) and family relationships and rituals (289). Needs related to the construction of one's identity and agency also proved important, including recognition as an active individual full of life and plans (508) and sense of being appreciated (308). Satisfying use of time (436) was also significant, as were future-oriented activities, including self-expression and personal development (289) and spiritual development (154). These categories reveal a strong emphasis on personal development, self-fulfilment and life satisfaction. Needs related to health and care were the least frequently highlighted (61). This hierarchy of needs and values reflects an inspiring, desirable and even idealised model of ageing. The narrative omits more challenging aspects of age and focuses instead on opportunities and desires, which appear almost within reach in advertising spots, aligning with the 'successful/active ageing' trend.

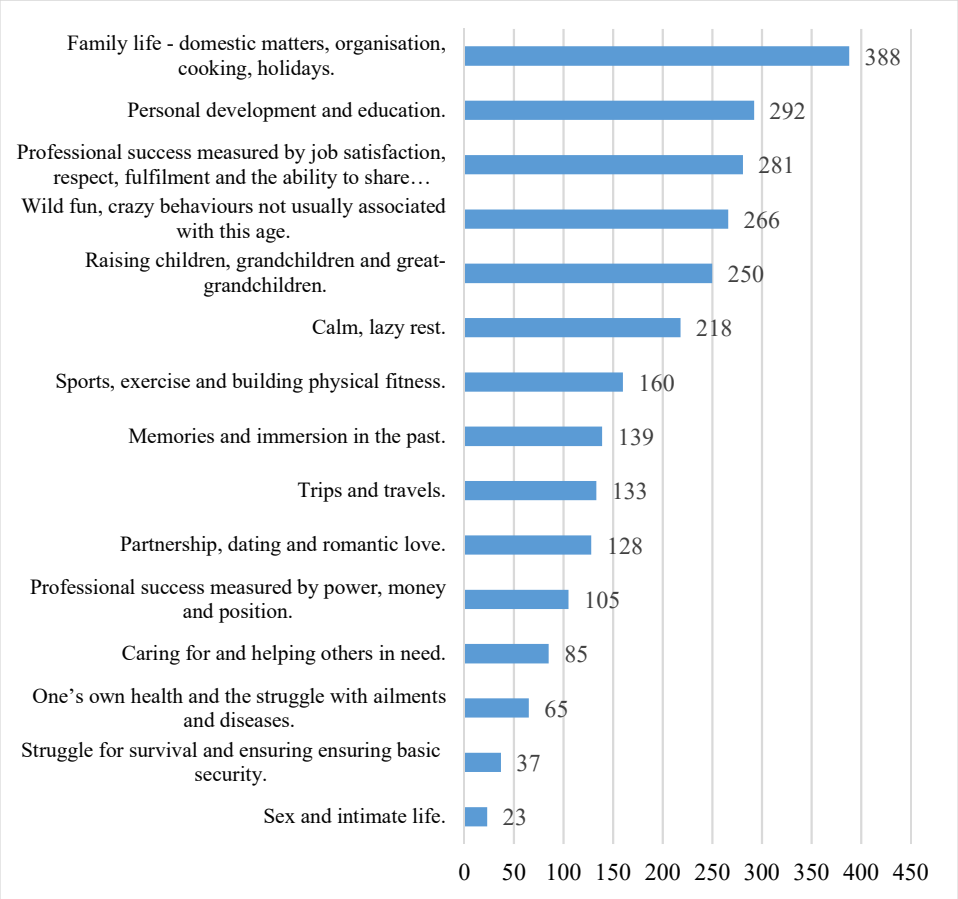


Figure 5. What is the main focus of the life of the advertising character?

Source: Own research "The image of silvers and seniors in advertising", 2025-2026 (n=1440, max. 5 answers)

The everyday lives of silver and senior characters in advertising are not one-dimensional. Family-related themes are well represented, such as family and home life (388), raising children and grandchildren (250), but there is also a strong emphasis on professional aspects, including job satisfaction understood as a source of fulfilment and a sense of purpose through work (281) as well as success at work as a means of generating income and the basis for building social status (105). Future-oriented plans also appear, particularly in the form of personal development and education (292). This theme occurs twice as often as references to immersion in the past and memories (139). A wide variety of approaches to spending leisure time can be observed. Lazy, ordinary rest (218) appears just as frequently as physical activity (160). There is also a small number of advertising spots focusing on negative aspects, such as illness (65) and existential security (37). Romantic relationships appear significantly more often (128), while references to sexual life are only sporadic (23). A surprisingly frequent motif is that of wild fun and non-stereotypical 'youthful' behaviours (266). This constitutes another example of a certain image of 'youth in old age' as a combination of traits typically associated with younger age groups, which also fits within the broader model of 'positive ageing'.

4. DISCUSSION & CONCLUSION

The representation of characters aged 50+ in advertising campaigns still does not reflect their actual population share or purchasing power in society. However, contrary to the widespread view that negative stereotypes dominate, the study 'The Portrayal of Silvers and Seniors in Advertising' points to a clear transformation in their image. The obtained data show a clear dominance of positive portrayals, and the strongly emphasised concept of positive ageing is also confirmed by other studies (Olsen, 2023). This concept is characterised primarily by activity, agency, optimism, social connectedness and self-fulfilment. The results obtained in the study contrast with previous studies in which the media image of the oldest customer groups was associated with illness, loneliness, dependency and social exclusion (Prieler, 2024).

Nevertheless, the positive image emerging from the study does not signify the elimination of stereotypes regarding these age groups, but rather a transformation of them. The sad image of old age has been replaced by an aspirational model of the so-called 'positive ageism', emphasising the most desirable traits and lifestyles. Therefore, advertising does not reflect the full spectrum of older people's experiences, but rather constructs an aspirational, or even idealised, image of them. Active, independent, full of life, healthy, productive, continuing their education and surrounded by many friends and family – this image is more a visualisation of certain desirable ageing standards than reality.

A particularly important change also appears to be the shift in the structure of roles attributed to seniors, especially the roles of grandmothers and grandfathers as a previously traditional, schematic model of representing old age. As the results indicate, this is no longer the dominant image, and the range of roles portrayed among both silvers and seniors has significantly expanded. The model in which middle and old age were defined primarily through the family sphere has been replaced by far more diverse narratives, with the traditional model being just one of many. Although family ties and domestic life remain deeply rooted in the image of the oldest generations, roles associated with professionalism, independence, self-realisation or lifestyle are also important. The analysis of needs and values also points to a strong orientation towards social connectedness, social and family recognition and personal development. Advertising constructs a coherent narrative that

combines two models: the traditional one, based on family relationships and values, and a modern one, emphasising activity, independence and competence. Silvers and seniors thus operate simultaneously and harmoniously within both of these dimensions. With the exception of medical advertising, portrayals of lonely, sick, withdrawn or asocial people are rarely present. The negative aspects of biological ageing are most often omitted. Themes such as illness, physical limitations, dependence on others and inability to function without assistance are replaced by older characters who are energetic, humorous, passionate, willing to act and full of plans for the future.

A significant limitation of the study is the methodology employed. While it enables an in-depth analysis of the narratives used in advertising and how characters are portrayed, it does not allow for the collection of representative statistical data. Furthermore, the study focuses on the structure of the advertising message itself and does not consider how it is received. This, in turn, prevents a clear determination of the social reception of new portrayals of silvers and seniors, their impact on audience attitudes and broader social perceptions of old age. However, in light of the study's findings, it is worth identifying key directions for further in-depth analysis. It would be worthwhile to consider research on the perception of advertising, further analyses of the types of portrayals in advertising and their representation by gender, as well as studies showing how the image of both social groups changes over successive decades.

However, the following key conclusions can be drawn based on the analyses conducted: advertising is dominated by a positive model of ageing, with negative stereotypes of older adults being marginalised, a move away from a one-dimensional depiction of ageing within a family setting and an aspirational character of the portrayals of the oldest age groups. While advertising campaigns break some of the previously established patterns, especially the negative ones, they simultaneously create new simplifications and stereotypes by presenting the value of the individual through the lens of their activity, fitness, productivity and relationship-building ability. It is important to remember that advertising is also a culture-shaping tool that not only reflects social changes but also shapes them. This contributes to the emancipation of silvers and seniors, while simultaneously reinforcing certain simplifications and creating new stereotypes regarding these two age groups. The study indicates that advertising is becoming one of the key areas in the redefinition of silvers and seniors in contemporary culture, changing perceptions of middle and old age. It encourages engagement in new activities by placing older people in entirely new roles. It promotes an image of old age as active, healthy and socially attractive while overlooking less comfortable aspects associated with ageing. This means that although negative stereotypes are losing their significance, they are being replaced by new normative models of 'positive ageing'. Consequently, advertising does not so much fully reflect the reality of old age as it constructs a simplified and culturally desirable image of it, which constitutes an important area for further academic research.

The author has read and agreed to the published version of the manuscript.

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BORDER INTELLIGENCE OF THE SECOND POLISH REPUBLIC – RECONNAISSANCE OF CZECHOSLOVAK UNIFORMED SERVICES BY THE POLISH BORDER GUARD IN THE YEARS 1936–1938

The purpose of this article is to present the activities of the Border Guard of the Second Polish Republic in the field of border intelligence, specifically in the context of identifying the uniformed services of Poland's southern neighbour. The article is based on an analysis of source materials from the Border Guard Archives in Szczecin, the Central Military Archives in Warsaw, and the Central State Historical Archives in Lviv. The publication consists of two parts. The first part presents information on the tasks of the Border Guard in Lesser Poland related to the protection of the state border. It outlines the objectives and assignments related to gathering intelligence on the organisational structure and personnel of the Czechoslovak border services, as well as the National Police and Gendarmerie. The second part discusses the knowledge held by the Polish Border Guard about its neighbour, based on an analysis of intelligence documents of the pre-war border formation. The timeframe of the article covers the years 1936–1938. The publication is complemented by scans of documents relevant to the topic, included as an attachment.

Keywords: state border, Czechoslovak Financial Guard, Border Guard, border zone, reconnaissance.

1. INTRODUCTION

In the years 1928–1939, the pre-war Polish–Czechoslovak state border was protected by the Border Guard. At that time, it was one of the three formations responsible for the protection of the state frontiers of the Second Polish Republic. The organisational structure of the interwar Border Guard was complex and in many respects similar to that of the Czechoslovak Financial Guard. This similarity may have stemmed from the fact that both formations had their institutional roots in the period of the Austro-Hungarian monarchy, from which they inherited comparable border protection systems.

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During this period, both formations sought to gain control over the borderland area and to achieve tactical superiority over the opposing side within this space. In order to accomplish this objective, it was necessary for the Polish Border Guard to conduct reconnaissance of the Czechoslovak services. This aim was pursued through the intelligence apparatus at the disposal of the Polish border formation.

It should be emphasised that by undertaking offensive activities within the border zone and in the immediate forefield, the Border Guard of the Second Polish Republic automatically became an object of interest for Czechoslovak counter-intelligence services conducting operational reconnaissance within their area of responsibility. Consequently, the informational service of the Lesser Poland Border Guard faced the task of determining which specific services were carrying out such activities and identifying the officers of the Czechoslovak services engaged in operational and investigative actions.

The archival research conducted by the author and the selection of source materials for the purposes of this publication constitute an attempt to answer the question concerning the level of knowledge possessed by the Lesser Poland Border Guard about Czechoslovak security bodies responsible for maintaining public security in the forefield area. This issue forms the main subject of analysis in the present article.

2. THE LESSER POLAND BORDER GUARD

When discussing the geographical boundaries of Eastern Lesser Poland[2], the southernmost area of Poland, it must be stated that its southern border is largely defined by the natural barrier of the Carpathian Mountains. For centuries, this range separated the Polish Republic from the Czech and Hungary. During the period of the Second Polish Republic, it formed the natural Polish-Czechoslovak border, which was manned by national border services. The services of both states, while performing their border protection duties, compete in the field of combating cross-border crime. Frequently engaging in hostile actions against one another, they sought to assert dominance over the borderland area. Through border intelligence, both Polish and Czechoslovak border services aimed to reconnoitre the opposing side. The Polish Border Guard's interests included the deployment, organisational structure, and equipment of the Czechoslovak border services, gendarmerie, and military operating in their respective border zones. For border intelligence, information regarding the location of Czechoslovak intelligence stations operating in the Polish direction, their personnel, forms and methods of operation, as well as the identification of the opposing side's informant (intelligence) networks on Polish territory, was also crucial. Thus, the primary area of interest for the Polish Border Guard was the Czechoslovak border zone. The objective of the operational (intelligence)

[2] Eastern Lesser Poland is a historical name referring to the lands that from 1918–1939 were part of the Second Polish Republic and included a part of the territory of the Kraków Voivodeship and the territories of the Lviv, Stanisławów, and Tarnopol Voivodeships. In publications produced after 1919, the term Lesser Poland was often used interchangeably to describe the lands of the former Austrian partition. The name Lesser Poland is derived from the historical name of a Polish province. This term was formulated in the 15th century and originates from Latin, specifically from the designation Polonia Minor, which meant Younger Poland. This name was formulated to distinguish the area of Lesser Poland from the area of Greater Poland, which at the time was referred to as Polonia Maior – which in Latin meant Greater Poland. It should be noted here that the Ukrainian side, when describing this area, used the term Eastern Galicia or Halychyna (Galicia) to emphasize the distinctiveness of these lands, their Ukrainian character. See further (Włodarkiewicz, 2020).

activities conducted at the time was the constant and systematic observation of the Polish-Czechoslovak borderland and the monitoring of all events significantly impacting the Polish protection system. The Author's analysis of operational documents generated by the Border Guard indicates that this interest covered a border strip extending 30 km from the boundary line into Czechoslovakia. In rare cases, the interest of the Polish border services extended beyond this area, allowing this to be defined as classic "shallow intelligence". All information obtained by the Border Guard was stored in object files, which subsequently served as the basis for reports, briefings, and "border zone study" documents.

The history of the Border Guard begins on April 1, 1928, when, pursuant to the Regulation of the President of the Republic of Poland of March 22, 1928, on the Border Guard, it was established in place of the disbanded Customs Guard to protect the state border. It was a police-type formation subordinate to the Minister of Finance. The establishment of the formation concluded a long, nearly 10-year process of shaping the Polish state border protection system. It is worth emphasizing here that to protect the Polish border in the east with the Soviets, Latvia, and Lithuania, a military formation, the Border Protection Corps, was established in 1924. This meant that with the establishment of the Border Guard, a permanent border protection system based on two different systems began in Poland. This process took quite a long time and resulted from political factors as well as the economic situation in which the Second Polish Republic found itself in the first years of its existence. For instance, the Czechoslovak border services, which emerged in the same period as the Polish ones, completed their formation process in 1919, creating a uniform system applicable on all state borders until the fall of the First Republic.

As previously mentioned, the Polish Border Guard, being a police-type formation, was uniformly uniformed and organized along military lines, with a hierarchical structure. At the head of the Border Guard was a Commander, supported by a staff operating at the General Headquarters located in Warsaw. In 1928, the Commander of the Border Guard oversaw the Central Border Guard School in Gora Kalwaria, the Customs Inspectorate Branch in the Free City of Gdansk, and five Regional Border Inspectorates, whose locations and names referred to the historical regions of Poland. These were:

1. Masovian District Inspectorate of the Border Guard, headquartered in Ciechanow,
2. Pomeranian District Inspectorate of the Border Guard, headquartered in Czersk,
3. Greater Poland District Inspectorate of the Border Guard, headquartered in Poznan,
4. Silesian District Inspectorate of the Border Guard, headquartered in Katowice,
5. Lesser Poland District Inspectorate of the Border Guard, headquartered in Przemysl[3].

The District Inspectorates were divided into Border Inspectorates, commissariats, and 1st-line outposts, which were situated in the immediate rear of the border line. This meant that border protection tasks were directly carried out by border guards serving in these border outposts. Additionally, in the rear of the first line of the state border protection system, there were 2nd-line outposts dealing with broadly understood border intelligence. They constituted a reinforcement of the 1st border line and were, at the time, an effective tool for combating border crime due to their form of activity. It was the Border Guard officers serving in the second line who conducted shallow intelligence on the Czechoslovak side and were the source of most of the information found in the object files kept in the Border Inspectorates. The contents of these documents, which at the time constituted

[3] Border Guard Archives in Szczecin (hereinafter ASG in Szczecin), Records of the Border Guard Headquarters, Organisational orders of the Border Guard Headquarters, ref. no. 187/30.

a compendium of knowledge about the opposing side, will be discussed in more detail later in the article.

It is worth noting here that the Lesser Poland District Inspectorate of the Border Guard was responsible for the protection of the southern border of the Second Polish Republic along the entire length of the common Polish-Czechoslovak border, as well as for the south-western section of the Polish-Romanian border. In December 1934, due to the fact that the Lesser Poland Border Guard protected the longest section of the external state border (over 1100 km), which caused difficulties in effective management and logistical challenges, the Minister of Finance, at the request of the Commander of the Border Guard, decided to divide this unit into two separate regional border units:

- Western Lesser Poland District Inspectorate of the Border Guard headquartered in Krakov,
- Eastern Lesser Poland District Inspectorate of the Border Guard headquartered in Lviv (Kozłowski, 2025).

The organisational structure of the Polish border formation adopted in 1928 meant that the border units of the Lesser Poland Border Guard were located in the foreground of the Czechoslovak border service, responsible for protecting the common Polish-Czechoslovak border, which measured 984 km[4].

When discussing the organisation of the Border Guard, one must mention the intelligence structure and the operational areas of this formation. Upon completion of the Border Guard's organisation, the organisational structure of the information (intelligence) service consisted of: the Chief of the Department II of the Border Guard (Border Guard Headquarters in Warsaw), information officers in Border Guard Districts, intelligence officers in Border Inspectorates, heads of commissariats (or II officers), 2nd-line outposts, and border guards serving as intelligence operatives. The intelligence apparatus also included confidants and informants who performed tasks on behalf of the Border Guard intelligence, the State Police, and Department II of the Border Guard of the Polish Army. In the 1930s, the information service of the Border Guard conducted operational-reconnaissance activities in three areas. The goal of the actions undertaken at the time was to obtain information in the scope of: anti-smuggling intelligence (concerning smuggling organisers, smugglers, storage locations, methods and routes of smuggling goods across the border, recipients, and the domestic distribution system of smuggled goods); political intelligence (concerning individuals and sympathisers belonging to communist and nationalist organisations, with particular emphasis on national minority organisations operating in the operational zone of Border Guard organs and directly in the foreground on the Czechoslovak side); and military intelligence (concerning the deployment of military units, police, border formations, and customs offices in the foreground of the southern

[4] During the interwar period, the length of the borders of the Republic of Poland was 5,529 km, of which maritime borders accounted for 140 km and land borders for 5,389 km. The Second Polish Republic had its longest border with Germany, measuring 1,912 km, which accounted for 34.5% of all borders, followed by the border with the USSR – 1,412 km (25.5%), Czechoslovakia – 984 km (17.8%), Lithuania – 507 km (9.2%), the Kingdom of Romania – 347 km (6.3%), the Free City of Danzig – 121 km (2.2%), and Latvia – 106 km (2.0%). Crucial from the point of view of state security was the ratio of the length of the borders (5,529 km) to the area of the country within its borders (387 thousand sq. km), which for the Second Polish Republic amounted to approx. 72 km. For comparison, this ratio for Czechoslovakia was 39 km, and for the Kingdom of Romania, it was 102.7 km (*Mały Rocznik Statystyczny*, 1938).

border, their equipment and armament, personnel composition, command staff of military units, and the morale within these units). Also of interest were the offices and employees of the government and local administration of Czechoslovakia, as well as military installations existing and under construction in the foreground (Kozłowski, 2025). Thus, it was a broadly understood border intelligence[5].

In the case of the Polish Border Guard, intelligence information was carefully analysed and grouped in object files. They formed the basis of operational work for border operations conducted by Border Guard intelligence. The Polish Border Guard shared this knowledge with military intelligence, for whom the information provided by the guards complemented the operational material gathered by branches operating on behalf of Department II of the General Staff of the Polish Army in the Czechoslovak direction. Therefore, it is worth pointing out the sources of the Polish Border Guard's information about the opposing side. According to the nomenclature of the interwar period, the sources of information included:

- official meetings between border plenipotentiaries of the Polish Border Guard and representatives of the Czechoslovak border services.
- conversations conducted by Polish border guards with officers of the Czechoslovak border services during border meetings;
- the Border Guard intelligence apparatus, consisting of: Border Guard operatives, confidants, human sources of information;
- direct observation made by border patrols from 1st-line Border Guard outposts while carrying out border protection tasks across the border line;
- information obtained from individuals detained for smuggling during procedural activities conducted by the Border Guard;
- white intelligence (OSINT) – information obtained from the Czechoslovak press or official documents produced by Czechoslovak border services.

The cited catalogue of sources of information about the opposing side indicates that, despite the internal regulations of the Czechoslovak border services protecting access to information about these services, obtaining it was not overly complicated and did not require extensive operational games on the part of the Polish border services. Another issue was the quality of the intelligence obtained about the opposing side by the Border Guard. To a large extent, the activities conducted by the information service were determined by chance. The weakest link in the protection of sensitive information, as was also the case with the Polish border service, was the human factor – i.e., widespread garrulity or non-compliance with regulations on official/state secrecy. Procedural documents drafted by

[5] Border intelligence is a polysemous concept and, in the context of the activities of the Border Guard of the Second Polish Republic, encompassed operations in two primary areas. The first area involved providing essential information regarding individuals suspected of smuggling, the locations of illicit goods concealment, methods of their transport across the border, and the cooperation between smugglers and the authorities of the neighboring state. The second area of border intelligence focused on delivering information concerning the deployment of security forces within the border zone, as well as the personnel of the border and police services of the adjacent state. These activities were conducted using the Border Guard's intelligence apparatus, which included officers and privates of the BG information service, along with a field-based agent network. Border intelligence carried out within the operational zone of the border services performed an auxiliary (service) function for military intelligence; consequently, it is currently often erroneously identified with the 'shallow intelligence' (shallow intelligence) conducted by the 2nd Department of the General Staff of the Polish Army.

these organs, which contained the personal data of Czechoslovak officers carrying out these activities, were also of considerable importance for acquiring information about the personnel composition of individual border outposts. In light of the above, the following questions should be asked:

- what was the state of knowledge of the Lesser Poland Border Guard regarding the Czechoslovak border services and gendarmerie executing public safety tasks?
- did the state of knowledge about these services correspond to the actual state of affairs (i.e., personnel composition, deployment of border units, or the equipment of these units)?

The answer to these questions will be an analysis of the preserved source materials found in the resources of: the Border Guard Archives in Szczecin, the Central Military Archives in Warsaw, and the Central State Historical Archives in Lviv, which the Author of this publication accessed.

It is worth emphasizing here that information about the Czechoslovak uniformed services responsible for public safety was obtained as part of internal tasks by the Border Guard information service and as a result of orders the Border Guard received from military intelligence. An example of this is a letter dated March 25, 1938, from Maj. Stanisław Solecki, Head of the Independent Information Section of DOK No. V in Kraków, to the intelligence officer of the Bielsko Border Inspectorate concerning the observation of the Czechoslovak foreground and a study of the border zone. An analysis of this letter reveals that military counterintelligence demanded that the leadership of the Border Guard information service intensify the observation of border traffic, using it to gather political and military information from the territory of Czechoslovakia. The letter outlined the intelligence objectives for the information service of the Lesser Poland Border Guard:

- paying attention to changes in the military situation, the calling up of reservists, and other mobilization orders;
- paying attention to the attitude of national minorities living in Czechoslovakia (especially the Polish and German minorities) towards the state, as well as repressive measures taken by Czechoslovakia against these national minorities;
- keeping a record in their own territory as well as in the foreground of all persons suitable for intelligence work in Czechoslovakia;
- paying attention to Czechoslovak citizens and their families who might have access to information within their country. In the event of obtaining information about such persons, the data was to be immediately transferred to the Branch of the Independent Information Section of DOK No. V in Bielsko;
- directing the special attention of the Border Guard information service to any elements of Soviet military and economic expansion in Czechoslovakia[6].

Crucial in this case was the fact that the border services of the Second Polish Republic received orders to treat the above information as urgent and top-priority tasks, which proves that military intelligence was interested in the crisis situation prevailing in Czechoslovakia, laying the groundwork for Polish actions in the Zaolzie region.

[6] Letter dated March 25, 1938, from Major Stanisław Solecki, Head of the Independent Information Section of DOK No. V in Kraków, to the intelligence officer of the Bielsko Border Inspectorate regarding the observation of the Czechoslovak foreground and the border zone study. Central Military Archives – Military Historical Office in Warsaw (hereinafter CAW-WBH), Records of Section II of the General Staff, ref. no. I.303.4.268.

Among the preserved documents from that period, a letter dated February 18, 1935, from the information officer, Commissioner Maksymilian Weglowski, acting head of the Eastern Lesser Poland District Inspectorate of the Border Guard, addressed to the heads of subordinate organisational units, deserves special attention. In this letter, Commissioner Maksymilian Weglowski orders that, in order to standardize the principles of drafting periodic intelligence information, the following aspects should be included when developing intelligence analyses regarding the reconnaissance of Czechoslovak border services:

1) drawing up organizational charts separately for individual Czechoslovak services;
2) marking with a pencil on the operational maps of Polish outposts and border commissariats the deployment of Czechoslovak border services, providing the original spelling of the border authorities;
3) preparing in border inspectorates and commissariats organizational-deployment charts of Czechoslovak authorities in the foreground (in ink on so-called eleates)[7].

Additionally, the letter contained an instruction that in the future, the prepared documentation must be systematically updated, taking into account any organizational and personnel changes that occurred during the reporting period within the Czechoslovak border services. The rules for documenting the results of reconnaissance adopted at that time remained in force practically with minor modifications until the outbreak of World War II. When documenting the results of the reconnaissance of the Czechoslovak border services and national gendarmerie in 1938, monthly charts were prepared, on which the current deployment of individual outposts in the foreground was marked. The charts detailed the numerical strength and nominal personnel composition of individual units. This documentation was supplemented by brief character profiles of Czechoslovak officers and gendarmes, including data concerning, inter alia: nationality, marital status, interests, and attitude towards the Polish Border Guard[8]. These reports took various forms: sheets, tables, graphs, and organizational charts.

An identical letter in terms of content and objectives for border intelligence at the time was received by the Intelligence Officer of the Western Lesser Poland District Inspectorate in Kraków from the head of SRI DOK No. V in Kraków. Consequently, as part of the intelligence cooperation between the Border Guard and SRI DOK No. V in the Czechoslovak direction, the head of the ZMIO SG, Inspector B. Rodkiewicz, issued an order in March 1938 to subordinate services to prepare, by April 10, 1938, another study regarding the deployment of Czechoslovak services in the foreground of the Western Lesser Poland Inspectorate[9]. This evidenced the coordinated action of military intelligence in the Czechoslovak direction. It also expanded the tasks of the Border Guard information service in the foreground of the Lesser Poland Border Guard to include a new objective, namely information on the possible appearance of the Soviets in Czechoslovakia.

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[7] Центральний Державний Історичний Архів у Львові (CDIA) we Lwowie, Records of the Lesser Poland District Inspectorate of the Border Guard (hereinafter MIO SG), Letter regarding guidelines, organizational charts, and deployment of Czechoslovak and Romanian authorities dated February 18, 1935, ref. no. 204/1/72.

[8] CDIA in Lviv, records of MIO SG, *Deployment of the Czech Border Guard in the foreground of the Border Guard Commissariat Ławoczne*, ref. no. 204/1/1216.

[9] Letter dated March 25, 1938, from Inspector B. Radkiewicz, head of the Western Lesser Poland District Inspectorate of the Border Guard in Kraków, to the heads of Border Inspectorates regarding the deployment of Czechoslovak units in the foreground, CAW-WBH in Warsaw, Records of Section II of the General Staff, ref. no. I.303.4.268.

The intelligence activities of the Polish border services on the Czechoslovak side were inspired by Department II of the Border Guard. According to the received order from Department II of the Border Guard, Border Guard intelligence was to report on any changes in the deployment of military units, police services, mobilization orders, and to search for individuals in Czechoslovakia who could be used for intelligence purposes. This information also indicates that for Polish intelligence, the appearance of Soviet military personnel in Czechoslovakia and the determination of possible military and economic cooperation with the USSR became a priority task for intelligence work in the southern direction (Pepłoński, 2009). This demonstrates the recognition of the threat to the security of the Second Polish Republic posed by the Soviet presence in Czechoslovakia and the actions undertaken by the intelligence services of the USSR in the Polish direction. According to the author, this order from Department II of the Border Guard for the Border Guard was a preparation by special services to initiate diversionary actions in the Czechoslovak direction.

An example of the documentation compiled from the reconnaissance of Czechoslovak border services and gendarmerie is a report drafted by intelligence operatives from the 2nd-line Rajcza outpost. Based on an analysis of the deployment plan of Czechoslovak gendarmerie and FG outposts situated in the foreground of the Rajcza commissariat, subordinate to the Border Inspectorate in the Western Lesser Poland District Inspectorate of the Border Guard, it emerged that tasks related to maintaining law and order were carried out by 31 police-gendarmes from 6 stations. Gendarmerie outposts were located in the following towns: Skaliste, Oscadnica, Nová Bystrica, Erdutki, Novot, and Mutne[10].

The presented study informed that camouflaged cells of the Czechoslovak offensive intelligence were located at the gendarmerie stations. However, despite intensive reconnaissance conducted by the Border Guard, they failed to "establish the personnel composition of officers and enlisted men assigned to intelligence tasks, the agency and confidential networks, and the points of potential border crossings"[11].

Furthermore, the report contained information that in larger border towns in Czechoslovakia, there were municipal police stations maintained from local government budgets. However, this list lacked information on the deployment and numerical strength of the municipal police. The Polish Border Guard's lack of interest in the Czechoslovak municipal police resulted from the fact that it did not conduct intelligence activities. Another attachment to the information was Sheet No. 2, in which the information service from the Rajcza outpost presented the deployment and manning of Czechoslovak FG outposts operating in the foreground of the Rajcza border commissariat. The information contained in the report indicated that border protection tasks on the Czechoslovak side in the foreground of the Rajcza commissariat were executed by 68 FG officers serving in 7 border outposts. These outposts were located in the towns: Skaliste, Oscadnica, Nová Bystrica, Vychylovka, Erdutki, Novot, and Mutne[12].

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[10] ASG in Szczecin, records of the Western Lesser Poland District Inspectorate of the Border Guard (hereinafter ZMIO SG), Annex to the report of the head of the Rajcza Commissariat dated June 27, 1938, Sheet re point 2b. Possessed information on the deployment and personnel of gendarmerie stations. In Information from the foreground sent to the Bielsko Border Inspectorate from commissariats, ref. no. 193/63.

[11] *Ibidem*, Sheet re point 1 Possessed to date information on Czech intelligence.

[12] *Ibidem*, Sheet re point 2c Possessed information on the deployment and personnel of Border Guard outposts.

One of the many intelligence documents prepared by the information service of the WMIO SG in Lviv regarding the reconnaissance of Czechoslovak border services is a surviving report on the deployment of the Czechoslovak District (Zemský) Inspectorate of the Financial Guard in Uzhhorod. This document contains a characterization of the Czechoslovak Border Inspectorates: Volovec[13], Iska, and Torun, carrying out tasks in Carpathian Ruthenia.

An area of interest for Border Guard intelligence was the armament and equipment of the Financial Guard. In the mid-1930s, the Polish Border Guard intelligence noted that a replacement of the basic armament of enlisted personnel had taken place in the Czechoslovak border services[14]. The Czechoslovak guards were rearmed with modern small arms for the time. The first reports that flowed into the district headquarters in Lviv

[13] From the characterization prepared by the Border Guard, it emerged that in July 1938 the staff of the Czechoslovak Border Inspectorate Volovec operating in the foreground of the Ławoczne commissariat consisted of 18 officers. The head of the Inspectorate was Józef Wimazal ("of Czech nationality, married, avoiding meetings with the Polish Border Guard"). Furthermore, the surviving document also shows that at that time the Border Inspectorate Volovec had subordinate field outposts located in the towns of Lazy, Volovec, and Skotarsko. The Lazy outpost was headed by Senior Respicient Zahora ("of Czech nationality, married"). Serving in the outpost were Respicient Szulz, who served as deputy outpost commander ("of German nationality, married") and guards: Alojzy Wasiczek ("of Czech nationality, bachelor, sportsman, alcoholic"), Gazda ("of Ruthenian nationality, bachelor"). The Volovec outpost was headed by Senior Respicient Strużyński ("of Czech nationality, married, taciturn, likes to play cards, and if the opportunity arises, likes to have a drink"). Serving in the outpost were: Respicient Antoni Mełka ("of Czech nationality, married, holding communist views, propagating the communist system at every opportunity"), who served as deputy outpost commander, and guards: Stefko ("of Czech nationality, married, four children, taciturn, level-headed"), Galiczek Jozef ("of Czech nationality"), Cześniak ("of Czech nationality, married, nationalist, conceited"), Bażant ("of Czech nationality"), and Pilipi ("of Czech nationality, married, sportsman, observant, interested in politics, conducts intelligence"). The Skotarsko outpost was headed by Senior Respicient Schiher ("of Czech nationality, married, alcoholic, constantly complaining about the CSR government, pursuing bad policy towards Poland, underwent military training in Uzhhorod in 1938"). Additionally, serving in the FG outpost were: Respicient Jan Mali ("of Czech nationality, married, communist views, specially trained to gather information from Polish territory"), who acted as deputy outpost commander, and guards: Michał Tekza ("of Ruthenian nationality, married, garrulous, likes to drink alcohol"), Michał Kasper ("of Czech nationality, married, nationalist, interested in intelligence on Polish territory"), and Franciszek Wolman ("of Slovak nationality, bachelor, Russophile"). CDIA in Lviv, Records of MIO SG, Deployment of the Czech Border Guard in the foreground of the Border Guard Commissariat Ławoczne, ref. no. 204/1/1216.

[14] In a dispatch dated May 21, 1935, the head of the Ludwikówka commissariat, Sub-Commissioner Stefan Gawroński, describes the new carbine received by the Czechoslovak FG as part of their equipment, which Guard Borowczyk had the opportunity to carefully examine during a border meeting. The description of the weapon reveals that it was a Mauser system carbine, model 33, from the year 1935. The handle at the bolt body was curved towards the stock; the layout of the weapon was similar to the carbine of the German cavalry. In the middle of the carbine's butt plate, there was an opening to the stock. Inserted in this opening was a cleaning rod for the carbine, consisting of three parts connected by a thread; the length of each part of the rod was 25 cm. Attached to the rod was a stamp that served as the base for a bayonet. CDIA in Lviv, records of MIO SG, Information dated May 21, 1935, from Sub-Commissioner S. Gawroński, head of the Ławoczne commissariat, to the head of the Stryj Border Inspectorate regarding the Czechoslovak FG. In News from the foreground of the Stryj Border Inspectorate – 1935, ref. no. 204/1/728.

contained a range of information regarding the technical data of the weapons, acquired by officers of the Lesser Poland Border Guard[15].

District Inspectorate of the Financial Guard in Uzhhorod Organizational Chart

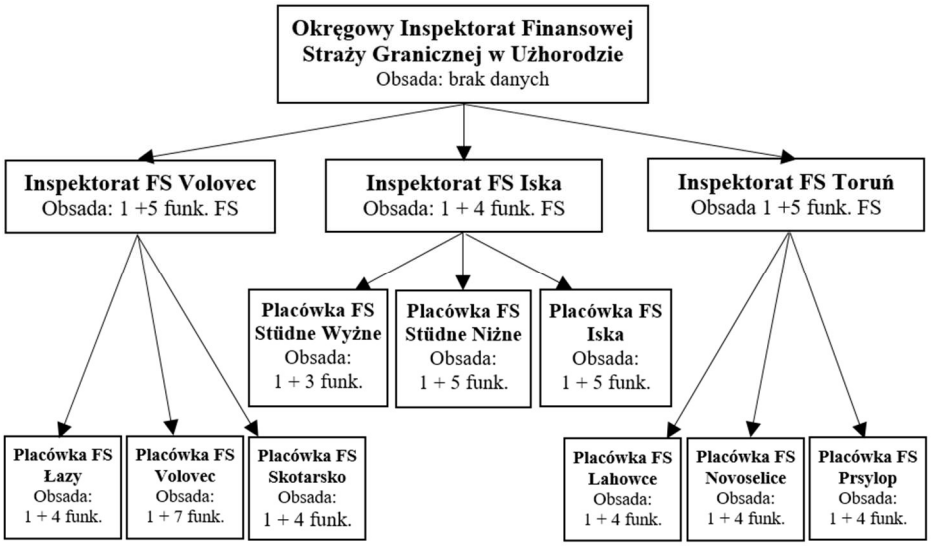


Figure 1. Organizational structure of the District Inspectorate of the Financial Border Guard in Użhorodzie.

Source: Author's own compilation based on CDIA, ref. no. 204/1/1216, *Deployment of the Czech Border Guard in the foreground of the Border Guard Commissariat Ławoczne*. Oddeleni FS – border outpost of the Czechoslovak FG.

While gathering military information in June 1936, during a meeting with a Czechoslovak border guard named Aleksander Dudziński, a Border Guard intelligence operative learned that in the forest near Uzhhorod, the Czechoslovak side had completed the construction of ammunition bunkers and chemical equipment facilities, where combat gases and masks were stored. The information indicated that the bunkers were so well integrated into the terrain that they were not visible to unauthorized persons. Consequently, to verify the credibility of this information, a discreet observation of the area was initiated. Soon after, the provided information was confirmed by a Czech gamekeeper, Karol Dacer, who was reached by a Border Guard informant. During a conversation with the informant, Dacer detailed the layout of the magazines, where he had personally stayed during reserve exercises[16]. Similar information regarding the construction of combat bunkers came from

[15] The fact that the armament of the FG was replaced in the 1930s is confirmed by Czech historian Ota Holub. From the information cited by the aforementioned, it appears that in February 1935, the Ministry of National Defence began transferring to the Czechoslovak border guard the first batch of 900 units of 7.92 mm Mauser 33 rifles out of a total order of 5,300 units. The costs of replacing the armament, amounting to over 5,400 thousand kc, were covered by the budget of the Ministry of Finance (Holub, 1987).

[16] CDIA in Lviv, records of MIO SG, Letter dated June 9, 1936, from Sub-Commissioner P. Łazarewicz, head of the Sołotwina Commissariat, to the head of the Stryj Border Inspectorate

the foreground of the Border Inspectorate in Jasło, indicating that in the forest 20 km from the town of Prešov, concrete bunkers and positions for artillery and machine guns were being built, and the entire area was fenced with barbed wire to restrict unauthorized access to the construction site[17].

While conducting reconnaissance of the foreground on the Czechoslovak side, the Border Guard information service acquired training plans that took place in July 1936 in Svaliava (in the territory of Carpathian Ruthenia), organized by chemical troops. The plans acquired by the Border Guard showed that the purpose of the exercises was to test the preparation of the military and civilian population for anti-chemical defense using gas masks during a simulated air attack involving chemical weapons.

In June 1936, the Border Guard information service "observed" the registration of horses in Czechoslovakia by military intendancy services, followed by their purchase for the army's needs. This information was quite significant as it provided data on the volume of the Czechoslovak army's demand for horses, which was crucial for the analysis of the situation on the borderland conducted by units from Department II of the Border Guard. This information was also essential from a border protection standpoint, as the campaign to "draft" horses into the Czechoslovak army directly translated into an increase in the smuggling of these animals from Poland to Czechoslovakia[18].

Among the intelligence acquired by the Border Guard were reports on the morale within the Czechoslovak army. Information relayed in July 1936 by the head of the Border Inspectorate in Stryj to the Branch of the Independent Information Section (hereinafter: SRI) in Stanisławów indicated that in Carpathian Ruthenia, soldiers from the 154th (Czechoslovak) Artillery Regiment were building a road from Rahov to Yasinia, along with facilities of military purpose. The submitted dispatch contained information that “on the Dumeń mountain pasture, they are building bunkers for anti-aircraft artillery and an airstrip for airplanes. Attached to the unit are several Soviet officers in civilian clothes”[19]. This unit mainly consisted of Sudeten Germans (approx. 700 enlisted men assigned to labour from various units). While performing construction work in the immediate rear of the Polish-Czechoslovak border, these soldiers were ordered by their superiors to avoid any contact with the Polish population, and above all, forbidden from conversing with the Polish Border Guard. The dispatch also included information that soldiers serving in the labour battalion received an extra 2.5 kc daily on top of their pay. However, the supplies and provisions they received were substandard. This, in turn, led to a mutiny in the said unit due to poor food. On June 29, 1936, soldiers from the labour detachments rebelled after being served spoiled meat for dinner. Information obtained from informants indicated that 20 ringleaders of the mutiny were arrested and transported to Khust[20].

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regarding the construction of camouflaged depots and ammunition. In Reconnaissance of Czechoslovak border services, ref. no. 204/1/912.

[17] CAW WBH in Warsaw, Records of Section II of the General Staff of the Polish Army, Information Communiqué of the Border Guard Headquarters No. 7/36 dated August 28, 1936, ref. no. I.303.4.3665.

[18] CDIA in Lviv, records of MIO SG, News from the foreground – letter dated July 1, 1936, from Aspirant Jerzy Huss from the Ławoczne Commissariat to the head of the Stryj Border Inspectorate, ref. no. 204/1/912, p. 65.

[19] CDIA in Lviv, Records of MIO SG, News from the foreground dated July 3, 1936, ref. no. 204/1/912.

[20] CDIA in Lviv, Records of MIO SG, News from the foreground dated July 3, 1936, ref. no. 204/1/912.

In connection with the observed development of a paramilitary organization in Czechoslovakia, dealing with the training of civilians in military preparation (hereinafter: PW), Chief Commissioner Tadeusz Zieliński – head of the Stryj Border Inspectorate, ordered subordinate intelligence outposts, including 1st-line outposts, to investigate the matter and begin gathering information on: the regulations and structure of the military preparation organization; the number and strength of PW units in border towns; the frequency and type of training conducted. In the letter sent to subordinate outposts, the head of the Stryj Border Inspectorate also instructed that reconnaissance be conducted very carefully, so that the relevant Czechoslovak authorities would not find out about the Border Guard information service's interest in the PW organization[21]. As a result of the undertaken reconnaissance, in August 1936, information was confirmed that in the foreground of the Stryj Border Inspectorate, Czechoslovak military services had begun organizing military preparation units. Informants from the foreground reported that in border towns, notices had been posted calling on all men aged 19–50 to register with the organization as volunteers in the event of war. To this end, intensive agitation was conducted among the youth through lectures and presentations[22].

The documentation kept by the Czechoslovak border service and the method of scheduling officers for duty became a subject of interest for the Border Guard information service. This was a very difficult task given that the Czechoslovak border services at the time strictly protected access to their official documentation. Despite multiple attempts over a long period, the Polish Border Guard was unable to "acquire" such materials. However, actions taken in this regard eventually ended in success. In April 1937, an informant from the foreground belonging to border guard Jan Chojecki from the 1st Line Outpost Oporzec, alias "Mucha", handed over during a meeting a duty order for Respicjent Józef Tumma for the operational day of May 12, 1936, torn from an old duty book of the Czech Outpost in Stüdne Wyżne (the so-called Sekretnik). An analysis of the handed-over document showed that border duty was planned in an identical manner to the Polish Border Guard, except that the Czechoslovak duty book consisted of orders sequentially pasted into it[23].

An extremely valuable source of information regarding the scale of activities undertaken on the southern section of the state border by the Border Guard information service were the monthly situational reports drafted by the Western Lesser Poland and Eastern Lesser Poland District Inspectorates of the Border Guard. Each situational report contained a subsection concerning news from the foreground, which included information on the political situation on the Czechoslovak side, about border services, the military, the gendarmerie, as well as important events affecting the state of security. A thorough analysis of the situational reports allows one to familiarize themselves oneself with the situation prevailing on the borderland at the time, but above all, it paints a picture of the immense

[21] CDIA in Lviv, Records of MIO SG, *Letter dated July 15, 1936, from Chief Commissioner T. Zieliński, head of the Stryj Border Inspectorate, to the head of WMIO SG in Lviv regarding military preparation in Czechoslovakia,* ref. no. 204/1/912, p. 104.

[22] CAW WBH in Warsaw, Records of Section II of the General Staff of the Polish Army, Information Communiqué of the Border Guard Headquarters No. 7/36 dated August 28, 1936, ref. no. I.303.4.3665, p. 92.

[23] CDIA in Lviv, Records of MIO SG*, Letter dated June 10, 1937, from Squad Leader Cadet K. Boratyński, head of the Ławoczne Commissariat, to the head of the Stryj Border Inspectorate regarding the format of the order of the Czech Border Guard,* ref. no. 204/1/1094, p. 12.

amount of work performed by the Border Guard information service. It should be remembered that every piece of information, before being included in the monthly report, had to be meticulously verified by the Border Guard intelligence (investigated), and its credibility had to be confirmed.

While conducting intelligence activities on the southern border section, the Polish Border Guard observed and monitored the processes of change occurring on the Polish-Czechoslovak border and in the border service system of our southern neighbour. Of particular interest to the Border Guard was the process of creating a national border formation by Slovakia. Border Guard dispatches reveal that at the turn of February and March 1939, a process of "Slovakisation" began within the border services in Slovakia, consisting of filling official positions in the FG and gendarmerie with Slovaks in place of dismissed Czechs. Those dismissed from service moved to the Czech with their families[24]. It was a two-way movement. During this period, dismissed officials and officers of various services were returning from the territory of Bohemia to Slovakia. The expulsion of Czechs from the service initially caused disorganization within the Slovak border protection system. Due to a lack of trained Slovaks, border authorities had difficulties filling vacant positions. Territorial changes in the area of Slovakia meant that the structure of the Slovak border services and gendarmerie was also changing. This information was continuously corroborated by dispatches from the Western Lesser Poland and Eastern Lesser Poland Border Guard Districts.

An important issue in the field of state border protection was the counterintelligence protection of Polish Border Guard outposts and military facilities located in the formation's operational zone. While executing official duties, Border Guard officers paid special attention to any attempts to penetrate the Polish borderland and reconnoitre Polish border services undertaken by officers of the Czechoslovak Financial Border Guard and the National Gendarmerie. Almost every day, information flowed into the information services regarding the activity of the Czechoslovak border services as well as the Czechoslovak military intelligence in this area. Reconnaissance of the Polish borderland was conducted directly by Czechoslovak officers and gendarmes, as well as with the help of smugglers recruited by border intelligence and individuals crossing the border under local border traffic regimes[25]

Worthy of special attention is the study concerning the Czechoslovak gendarmerie and border services located in the foreground of Border Guard units subordinate to the Bielsko Border Inspectorate, which were compiled at the turn of 1937/1938 and provided as part

[24] Державний архів Івано-Франківської області (hereinafter DAIFO in Ivano-Frankivsk), records of MIO SG. Information contained in the Situational Report No. 3/39 of the commander of MIO SG in Lviv dated April 14, 1939, indicated that in March 1939, over 300 refugees of Czech nationality, along with their belongings, evacuated from the territory of Slovakia in freight wagons via the Łupków railway station to Poland. The refugees were officers and enlisted men of the army, gendarmerie, and FG. Fleeing Slovakia in panic, the Czech refugees sold their property for next to nothing, ref. no. 86/1/120, p. 23.

[25] The above observation is confirmed by information from May 1936, which indicated that the border services of the Western Lesser Poland Inspectorate recorded instances of the Czechoslovak FG gathering information about the Border Guard concerning work methods, achieved results in combating smuggling into Poland, and about the organization of the formation and personnel of border outposts. CAW WBH in Warsaw, Records of Section II of the General Staff of the Polish Army, Information Communiqué of the Border Guard Headquarters No. 5/36 dated July 11, 1936, ref. no. I.303.4.3665, p. 51.

of cooperation to the Independent Information Section of the Command of Corps District No. V in Kraków. Aggregate studies regarding Czechoslovak security services operating on the Polish-Czechoslovak borderland were prepared according to the following scheme:

- information on the deployment and personnel composition, uniforms, and armament of the gendarmerie and national police. The above information consisted of two parts: a descriptive part and a graphic part presenting the organizational chart of the discussed service;
- information on the deployment and personnel composition of the Czechoslovak border service. The above study was divided analogously to the description of the gendarmerie and national police.

The studies were prepared by the Border Guard commissariats in Zebrzydowice, Ustroń, Korbielów, and Cieszyn, subordinate to the Border Guard Inspectorate in Bielsko. The area of intelligence penetration by the Polish Border Guard was the border strip of the Moravian land, whose capital was the city of Brno. This study is located in the resources of the Central Military Archives in Warsaw in the collection of Section II of the General Staff of the Polish Army. Information contained in this study indicates that in the foreground of the Cieszyn Border Guard commissariat, tasks related to state border protection were executed by the Financial Guard Inspectorate in Český Těšín, which oversaw 5 border outposts manned by 23 border guards.

The Financial Guard Inspectorate in Český Těšín was subordinate to the District Inspectorate of the Financial Guard in Brno. Its organization is presented in the organizational chart below.

Information contained in this study reveals that the District Inspectorate in Brno also oversaw the customs service headed by Chief Commissioner Mastnik. The aforementioned report contains information regarding the armament of the border formation, indicating that Czechoslovak border guards heading out for border duty would draw from the outpost's armoury a Mauser cal. 7.9 carbine, manufactured to special order for the Czechoslovak border guard, 15 rounds of ammunition in two magazines carried in a pouch, and additionally, a bayonet with a frog was issued for duty.

The aim of the intelligence was to obtain information on the method of performing duty, the duty hours of border guards, and information on documenting the course of duty in official records. The study revealed that a single duty shift for Czechoslovak guards lasted 9 hours, with guards receiving an equivalent of 8 crowns for the extra 9th hour (constituting overtime). The sum multiplied by the number of “overtime hours” in a given month was paid out during salary disbursement. The duration of duty and its course differed depending on the position held. The commander of a Czech border outpost was scheduled for 9 hours of duty, which he divided into patrol duty and clerical activities related to maintaining official documentation. The aforementioned information also indicated that the commander did not conduct training nor did he inspect the performance of duty by his subordinate officers.

Analysing the method of performing duty by Czechoslovak guards, it was found that during the day, border patrols, observation posts, and other forms of border duty were carried out by single guards, whereas at night these patrols consisted of two persons. The study also included information on the method of documenting the course of duty for a given operational day. This document was the duty book, an integral part of which was the planning of duty for a given day. The duty plan was written using carbon paper in duplicate in the duty book. These pages were divided into narrow strips separated by perforation.

Table 1. Personnel of the Czechoslovak border outposts subordinate to the Financial Guard Inspectorate in Cieszyn

FG Outpost in Dolní Líštná	**FG Outpost in Ropice**	**FG Outpost in Český Těšín**	**FG Outpost in Podobora**	**FG Outpost in Louky**
Personnel count 1+8	Personnel count 1+6	Personnel count 1+20	Personnel count 1+3	Personnel count 1+6
Outpost Commander: przod. Debesz – married Deputy Outpost Commander: przod. Nawratil – married and guards: Zielniczek – married Klimczyk – married Klimek – married Bola single Derbal single Rudzki – single Palmek –single	Outpost Commander: przod. Czernoch – married Nowal – single Gaik – single Polak –single Hajek – single Kotik – single Haznok – married	Outpost Commander: asp. Kaizar Deputy Outpost Commander: przod. Motl przod. Lebloch przod. Plchot przod.Duchon przod. Kilear – dog handler przod. Zezulka przod. Hajka przod. Kula przod. Tomicz przod. Swoboda przod. Kohut przod. Mikula st. straż. Hondziarz st. straż. Mikulaszek st. straż. Howanie ***additionally performing auxiliary duty at the Customs Office in Cieszyn:*** przod. Jański przod. Gil przod. Charnatek przod. Fimaczek	Outpost Commander: st. przod. Zeman st. przod. Safranek st. przod. Respiscak st. przod. Pawlicek	Outpost Commander: przod. Morawie Deputy Outpost Commander: st. straż, John st. straż. Przychoda straż. Chwojka straż. Kaleta straż. Surczek straż. Pekor – dog handler

Source: Author's own compilation based on the study "Deployment of the Czechoslovak Border Guard".

According to the guidelines, a guard reporting for border duty received the original of this strip (the so-called Sekretnik), which recorded his rank, name and surname, time of duty, as well as observation points and designated times at which he was to stop during the patrol. After completing the duty, back at the outpost headquarters, the guard wrote his observations from the course of duty on the reverse side of the strip he had received earlier and then pasted it into the duty book. A border guard assigned to intelligence duty, operating in civilian clothes, received oral instructions from the outpost commander during the pre-duty briefing regarding the course of duty and tasks to be performed. After its completion, the course was documented in the duty book. While performing intelligence tasks, Czechoslovak guards were tasked with establishing contact with the residents of the border zone, during which they were to obtain information regarding smuggling. In the event of discovering violations regarding border protection, i.e., smuggling goods or attempting an illegal border crossing – Czechoslovak guards detained the perpetrators of

the said acts. Furthermore, in the event of detecting misdemeanours, they had the right to impose punitive fines. Consequently, having the authority to impose fines, guards collected punitive fine forms at their outposts prior to duty.

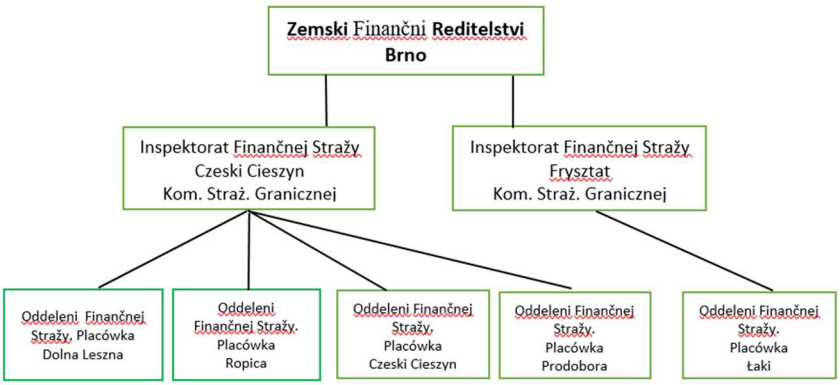


Figure 2. Organizational structure of the Regional District of the Financial Border Guard in Brno

Source: Author's own compilation based on the study "Deployment of the Czechoslovak Border Guard".

Another piece of information contained in the aforementioned document was regarding the method of co-financing the purchase of new uniforms by Czechoslovak guards, which indicated that every border guard received a lump sum of 1,300 crowns for this purpose, corresponding to 234 PLN at the time. The study contains information regarding the training of Czechoslovak guards in border units. These trainings were organised once or twice a month and were conducted by designated officers from the Financial Guard Inspectorate in Český Těšín. Usually, the training did not have a predefined program, and the topics covered current affairs. Participants in these trainings were familiarised with new regulations, ordinances, and orders that were being introduced into service. This represented a change in the adopted training mode, as in previous years, training took place once a week[26].

An interesting point was the order the Border Guard intelligence received regarding the acquisition of textbooks intended for the training of the Czechoslovak Border Guard and manuals. In response, Senior Squad Leader Olszewski, acting duty officer at the Cieszyn commissariat, reported that they were unable to acquire them within the designated timeframe because they could not be bought in Czech bookstores, and those in circulation

[26] Regarding the training of Czechoslovak border services, it was established that they took place once a week. For example, at the headquarters of the District Inspectorate of the Border Guard in Medzilaborce, they took place every Thursday at 10 a.m. The training was conducted by an inspector from Košice. Consequently, since all border guards from subordinate outposts were supposed to participate in the training, this led to a situation where only the duty staff remained in the subordinate outposts for the duration of these training sessions. This organization had a negative impact on the state of the protected border, as it was unprotected during that time. CAW WBH in Warsaw, Records of Section II of the General Staff of the Polish Army, Information Communiqué of the Border Guard Headquarters No. 9/36 dated November 12, 1936, ref. no. I.303.4.3665.

were inaccessible because, quoting: "Czech guards receive them straight from the Office and they could only be purchased from a Czech guard"[27]. This indicates how extremely difficult it was to obtain such documents.

From the aforementioned study, it emerged that there were 5 Czechoslovak gendarmerie stations in the foreground of the Cieszyn commissariat. In the four stations where personnel compositions were identified, 29 gendarmes served. Data showed that gendarmerie stations in the foreground of the Cieszyn commissariat were subordinate to the district command in Cieszyn, which in turn was subordinate to the District Gendarmerie Command in Brno (Verchnij Zemske Cetnice Velitslstvi). Meanwhile, the gendarmerie command answered to the Ministry of the Interior in Prague.

Table 2. Personnel of the Czechoslovak Gendarmerie stations subordinate to the District Gendarmerie Command in Brno

Gendarmerie Station in Louky	**Gendarmerie Station in Stonava**	**Gendarmerie Station in Ropice**	**Gendarmerie Station in Český Těšín**	**Gendarmerie Station in Třinec**
Personnel count 1+3	Personnel count n/a	Personnel count 1+2	Personnel count 1+7	Personnel count 1+13
Station Commander: statni strażmister - Wąszka vierchni czetnik - Kohut czetnik - Prucha czetnik - Vika	Names of the station commander and gendarmes were not identified	Names of the station commander and gendarmes were not identified	Station Commander: Franciszek Nekvapil zastępca Komendanta posterunku Fridz	Station Commander: Velitel oraz żandarmi: Tomczik, Sejczik – przewodnik psa Hruby, Lubena, Ferdla, Czech, (remaining names were not identified)

Source: Author's own compilation based on the study "Deployment of the Czechoslovak Border Guard".

Another service that caught the attention of the Border Guard information service and operated within the city of Cieszyn was the directorate of the National Police. Information indicated that the institution was headed by Director Karol Hromadka. Among the services operating in the foreground of the Cieszyn commissariat, this was the largest Czechoslovak formation responsible for public safety in terms of established posts, with 45 police officers and 10 intelligence operatives subordinate to it. The names of the national police personnel were not established by the Border Guard intelligence because they were mostly new people with whom Border Guard informants had not interacted. Information contained in the report stated that the National Police in Český Těšín was subordinate to the National

[27] Letter from the head of the Cieszyn commissariat dated November 14, 1937, to the head of the Bielsko Border Inspectorate regarding the deployment of the Czech border guard in the foreground, CAW-WBH in Warsaw, Records of Section II of the General Staff, ref. no. I.303.4.268.

Police Command in Brno[28]. An analysis of the aforementioned document indicates that the report was drafted carelessly and did not contain all the information requested by the management of the Border Inspectorate in Bielsko. For instance, it is worth citing here the report on the staffing of the gendarmerie and national police in the foreground of the Border Guard Commissariat in Zebrzydowice. It is a report containing far more detail.

This report additionally specified the operational areas of individual outposts of the Czechoslovak police, gendarmerie, and border service. For example, information about the Police station in the town of Prstná in the foreground of the Border Guard outpost Ruptawa contains personnel data indicating that the station is headed by Senior Police Sergeant Mierdawińsky, that a total of 11 people serve in this unit including 5 civilian intelligence operatives, and that the police station houses a gendarmerie seat where 2 gendarmes serve. The station's operational area was the municipality of Prstná along with its hamlets.

In turn, in the town of Fryštát in the foreground of the Polish Border Guard outpost Marklowice, there is a national police station headed by Senior Police Sergeant Fon, and the staff numbers 12 officers. The operational area of the police station covers the town of Fryštát along with the Mizerov-Hranice hamlet. This town is home to the District Police Command in Fryštát, commanded by Police Commissioner Trypik, with Sub-Commissioner Pokorny as his deputy, and a reserve police detachment of 10 officers, commanded by (praporčík – warrant officer) Lasota, was assigned to the District Police Command in Fryštát. When analyzing this document, it should be noted that the report did not provide the number of serving police officers or their personal details.

This report also contains information about the armament of the Czechoslovak gendarmerie, indicating that gendarmes going on duty in the field draw Mannlicher carbines manufactured by Škoda along with 28 rounds of ammunition, or sidearms (pistols), and sabres. Furthermore, binoculars and electric flashlights were issued for the duration of duty. A single duty shift for gendarmes lasted 8 hours. The organization of the duty roster proceeded as follows: during the day, duty was performed individually, whereas when duty was performed near the border or at night, patrols consisted of 2 or more gendarmes. For every overtime hour, enlisted men received an additional remuneration ranging from 15 to 20 crowns. The field uniform of gendarmes in the 1930s was light green, and gendarmes additionally possessed light green capes and felt caps. As with the Czechoslovak FG, gendarmes received a monetary equivalent each year for the purchase of new uniforms[29].

Presenting information concerning personnel compositions, armament, and the course of duty, this document contained information on the hierarchical structure and nomenclature of official ranks within the Czechoslovak uniformed services responsible for security in the borderland.

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[28] Letter from the head of the Cieszyn commissariat dated January 3, 1938, to the head of the Bielsko Border Inspectorate regarding the deployment of the gendarmerie and police in the foreground. CAW-WBH in Warsaw, Deployment of the Czech Border Guard and Gendarmerie, ref. no. I.303.4.268.

[29] Dispatch from Aspirant Henryk Truchin, acting head of the Zebrzydowice commissariat, dated December 30, 1937, to the Head of the Bielsko Border Inspectorate regarding the deployment of the Czech gendarmerie and police in the foreground of the commissariat, CAW-WBH in Warsaw, Records of Section II of the General Staff, Deployment of the Czech Border Guard, ref. no. I.303.4.268.

According to the pragmatics adopted in the Czechoslovak uniformed services, there were the following ranks, which had Polish equivalents:

Table 3. List of ranks in the Czechoslovak Gendarmerie and Financial Guard

Ranks applicable in the Czechoslovak Gendarmerie	Ranks applicable in the Czechoslovak FG
kapitan – captain	verchni Inspektor I klasy –inspector
nadpraporczyk – lieutenant	verchni Inspektor II klasy – chief commissioner
praporczyk – second lieutenant	inspektor I klasy – deputy commissioner
podpraporczyk – warrant officer	inspektor II klasy – aspirant
statni strażmister – senior squad leader	verchni respicjent – senior squad leader
strażmister – squad leader	respicjent – squad leader
virchni cetnik – senior gendarme	financni strażnik – senior guard
cetnik – gendarme	finansni strażnik – guard

Source: Author's own compilation based on the study "Deployment of the Czechoslovak Border Guard".

The study concerning personnel composition contains information about service rotation, indicating that from the FG Outpost in Čierne in the foreground of the Istebna commissariat, due to entering into a marriage with a woman hailing from the Jablunkov area, guard Zabka was transferred to Carpathian Ruthenia, and in his place, a guard of an unidentified name from a border outpost on the Czechoslovak-Hungarian border was transferred, who was set to assume duty at the Čierne outpost on December 20, 1937. Further in the report, there is information that 3 newly recruited FG guards at the Čierne Outpost were transferred to service on the border with Hungary as of November 1, 1937.

In the dispatches and reports of the Polish Border Guard from this period, one can find information about intelligence activities conducted by Czechoslovak services in the territory of the Polish borderland. In order to illustrate the prevailing situation on the borderland, several selected excerpts from the dispatches of the Border Guard of the Second Polish Republic have been cited for the purposes of this article. While performing tasks in the field of state border protection, Border Guard officers from the Ustron commissariat in June 1936 obtained information that the Czechoslovak gendarmerie was conducting active intelligence, gathering information on the Polish side. The findings indicated that Czechoslovak gendarmes crossed the border into Poland in civilian clothes. During their stay on the territory of the Republic of Poland, they monitored individuals engaged in smuggling goods to Czechoslovakia, took an interest in the prices of selected goods in Poland, and gauged the morale of the Polish population in economic and political terms[30].

While conducting explanatory activities regarding the illegal crossing of the state border by two FG officers, which occurred near Rycerka Gorna on August 25, 1936, in the section subordinate to the Rajcza Commissariat (ZMIO SG in Krakow), it was established that on the Polish side they made contact with a resident of Rycerka Gorna – Jan Zań. During the interrogation of the aforementioned individual regarding this circumstance, it

[30] ASG in Szczecin, Records of ZMIO SG, Dispatch dated June 10, 1936, from Senior Guard Karol Niemiec, head of the Jawornik outpost, to the head of the Commissariat in Ustroń regarding the crossing of the border by Czech gendarmes for the purpose of conducting intelligence, ref. no. 193/191.

was determined that the Czechoslovak services were preparing a provocation in which Polish border guards (guard Krawiec or guard Kotlik) were to be implicated, who, according to the FG guards, were involved in conducting intelligence on their side.

Another case handled by Border Guard intelligence was an incident involving three Czechoslovak guards on January 24, 1937, in the section subordinate to the Border Guard commissariat Korbielów (ZMIO SG in Krakow), evidencing the conduct of reconnaissance activities on the Polish side. From the conducted investigation, it was established that after crossing the border, the Czechoslovak border patrol proceeded on skis towards the town of Gluchaczki, where, during a conversation with a resident of Gluchaczki, Bronisław Jurasz, they attempted to obtain information on whether he had seen Polish soldiers undergoing mountain training at the time, whether there were Polish Army officers among them, as well as the names of border guards serving at the 1st Line Outpost in Przyborow (Korbielow Commissariat, Bielsko Border Inspectorate)[31].

Subsequent information confirming the penetration of the Polish borderland by Czechoslovak services was news acquired in June 1936 by Border Guard officers from the Jawornik Outpost in the Western Lesser Poland District Inspectorate of the Border Guard, indicating that Czechoslovak gendarmes, executing the orders of their superiors, were conducting reconnaissance of the Polish borderland in the Cieszyn area. To this end, Gendarme Krzystek, who originated from Cieszyn Silesia and spoke Polish very well, was dispatched to Český Těšín. The information relayed by a human intelligence source – Senior Guard Karol Niemiec, was credible and, as it was later established, a group of gendarmes indeed crossed the state border into Poland on the basis of tourist passes ("Tarta karte") and stayed in Poland during the second half of June 1936 for 6 days. While pursuing the above case, officers of the Polish Border Guard initiated surveillance of Polish smugglers whom the Czechoslovak gendarmes were supposed to reach[32].

In September 1937, the information service of the WMIO SG in Lviv was investigating the case of Andrzej Kryminski from Oporzec, who was in the service of Czechoslovak offensive intelligence. Confidential information obtained by the Border Guard intelligence indicated that Andrzej Krymiński, collaborating with the Czechoslovak border intelligence from the Outpost in Stüdne Wyzne, contributed in 1936 to uncovering the fact that Czechoslovak citizen Vasyl Futynec was collaborating with the Polish Border Guard[33]. Andrzej Kryminski's incriminating testimony allowed Czechoslovak authorities to arrest

[31] ASG in Szczecin, records of ZMIO SG, Dispatch dated February 6, 1937, from the head of the Bielsko Border Inspectorate to the head of ZMIO SG in Kraków regarding the violation of the state border by organs of the Czech Border Guard, ref. no. 193/72.

[32] CDIA in Lviv, records of MIO SG, Letter dated June 10, 1936, from Senior Guard Karol Niemiec from the 1st Line Outpost Jawornik informing the head of the Border Guard Commissariat in Ustroń about the crossing of the state border by Czech gendarmes for the purpose of conducting intelligence, ref. no. 204/1/912.

[33] Vasyl Futynec, a Czechoslovak citizen, registered by the Border Guard in the 1930s as an informant. The officer handling the aforementioned informant was Guard Karol Wieja from the Oporzec Outpost. Vasyl Futynec was recruited for collaboration with Border Guard intelligence in November 1936 on the basis of incriminating materials, i.e., after proving his involvement in smuggling goods to Poland. After the fact of his collaboration with the Polish Border Guard was uncovered in Czechoslovakia, he was detained as a suspect of espionage on behalf of Poland. After 8 months in custody, he was released due to a lack of evidence. Upon release from custody, he received a court order banning him from residing near the border. His further fate remains unknown.

the Border Guard informant on charges of espionage on behalf of Poland. Consequently, the information service of the Lesser Poland Border Guard received orders to confirm this information and place him under surveillance[34]. During the course of the investigation, it was established that Andrzej Kryminski compromised Vasyl Futynec out of personal motives because the latter had informed the Polish Border Guard of his illegal border crossing into Czechoslovakia. As established, Andrzej Kryminski's collaboration with the Czechoslovak border intelligence was supposed to secure him the "favour and protection" of the Czechoslovak border services during illegal border crossings, as well as during his illegal stay in Czechoslovakia.

Every such activity by Czechoslovak services on Polish territory, as well as illegal border crossings by border guards and gendarmes, was recorded by the Polish Border Guard and forwarded through the Border Guard headquarters in Warsaw to the Ministry of Foreign Affairs. In this case, it provided the basis for diplomatic intervention by the Ministry of Foreign Affairs.

3. CONCLUSION

In summary, it must be stated that the information service of the Polish Border Guard sought to reconnoitre the Czechoslovak uniformed services operating in its foreground. When conducting intelligence operations on the opposing side, Border Guard officers were particularly interested in the Financial Guard formation and the Gendarmerie because their organizational units housed intelligence branches that conducted operations on the Polish side. Collaborating with military counterintelligence via Independent Information Sections operating at Corps District Commands, it executed commissioned tasks on behalf of these institutions. When conducting reconnaissance, the Lesser Poland Border Guard utilized all available tools as well as its existing intelligence apparatus, and the acquired information was forwarded to SRI units. A separate issue was the quality of the information provided to military counterintelligence. The cited sources indicate that these were often incomplete materials containing significant gaps in information; however, assuming that Section II of the General Staff of the Polish Army drew knowledge about the southern neighbour from various sources, the intelligence materials provided by the Border Guard constituted a supplementary piece in the intelligence puzzle. The quality of materials obtained by the Polish Border Guard regarding Czechoslovak services varied and largely depended on the intelligence officers positioned in the Border Inspectorates directing intelligence towards our southern neighbour. An analysis of the available sources indicates that wherever Border Guard intelligence officers performed their duties diligently, the reconnaissance was of a good standard. In summary, another issue worth noting is that conducting intelligence requires adequate financial resources, which the Border Guard lacked. Intelligence activities in this area were funded from a special fund designated for combating smuggling, and this did not balance all the expenditures for this purpose incurred by the Polish Border Guard. Thus, the state of knowledge of the border guard, which found its reflection in the border zone study, varied. It can be stated that it generally corresponded to the actual state of affairs, that is, the organizational structure and personnel composition of the Czechoslovak services. There was a lack of information about the individuals conducting intelligence on the Polish direction, the placement of Czechoslovak intelligence cells

[34] Records of MIO SG, Letter dated November 18, 1937, from the head of the Stryj Border Inspectorate to the head of the Ławoczne Commissariat regarding Andrzej Krymiński, ref. no. 204/1/1130.

within the uniformed services in the foreground, as well as about the agency network. Finally, it is worth emphasizing that behind every piece of acquired information that found its conclusion in the border zone study stood the effort of anonymous officers of the pre-war Border Guard. The final result – the acquired information about the opposing side – depended on their knowledge, skills, and sheer cunning. Another factor affecting the assessment of the state of "knowledge" of the Lesser Poland guards regarding Czechoslovak services is the fact that materials produced in this regard by the Border Guard of the Second Polish Republic and SRI underwent partial dispersion and destruction during the Second World War, resulting in few of them surviving to the present day.

The author has read and agreed to the published version of the manuscript.

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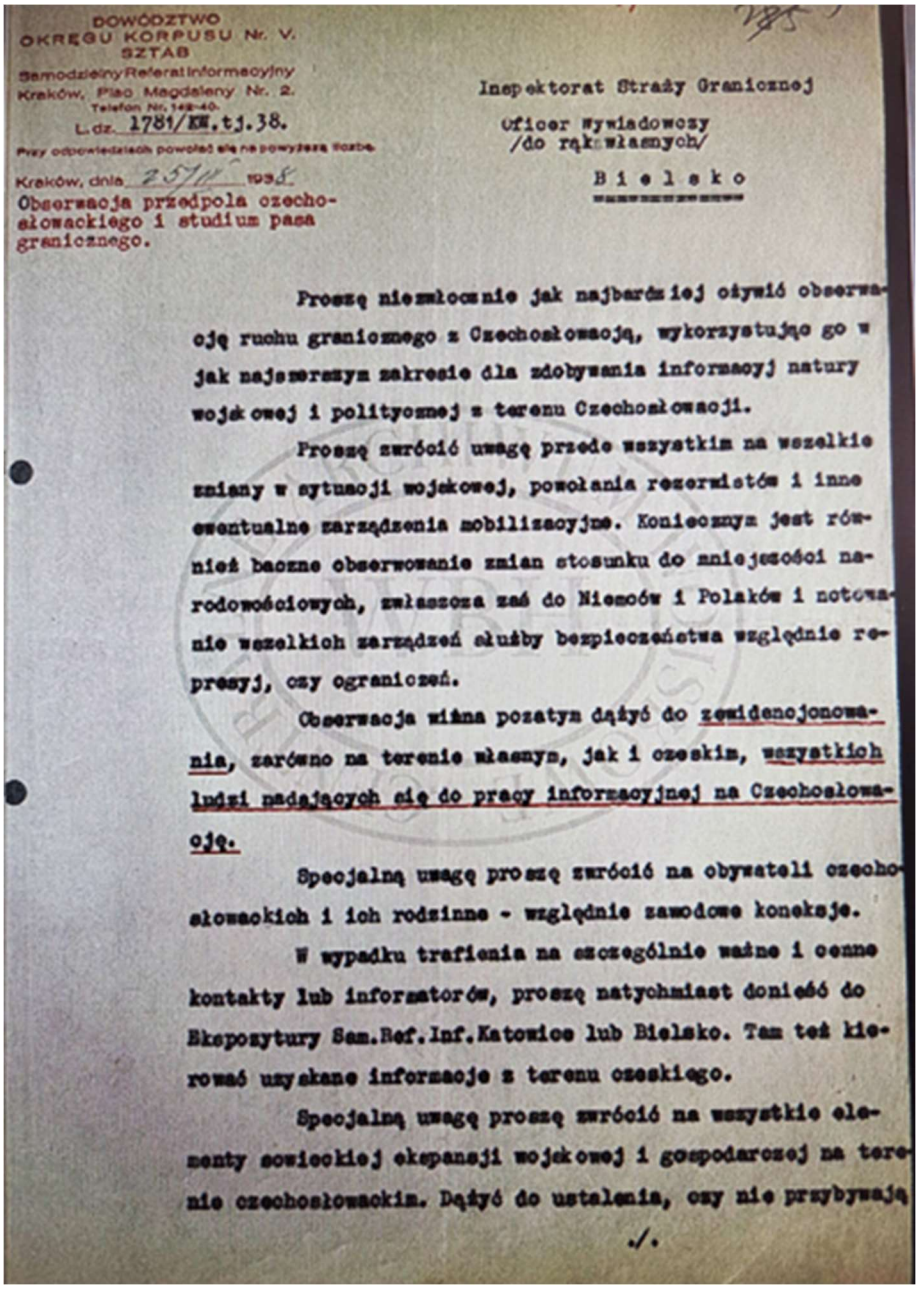
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Central State Historical Archives in Lviv

- Records of the Lesser Poland District Inspectorate of the Border Guard.

State Archives of the Ivano-Frankivsk Region

- Records of the Border Guard.



DOWÓDZTWO
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Telefon Nr. 142-40.

L.dz. 1781/Wyw.tj.38.

Przy odpowiedziach powołać się na powyższą liczbę.

Kraków, dnia 25 III 1938

Obserwacja przedpola czechosłowackiego i studium pasa granicznego.

Inspektorat Straży Granicznej
Oficer Wywiadowczy
/do rąk własnych/
B i e l s k o

Proszę niezwłocznie jak najbardziej ożywić obserwację ruchu granicznego z Czechosłowacją, wykorzystując go w jak najszerszym zakresie dla zdobywania informacyj natury wojskowej i politycznej z terenu Czechosłowacji.

Proszę zwrócić uwagę przede wszystkim na wszelkie zmiany w sytuacji wojskowej, powołania rezerwistów i inne ewentualne zarządzenia mobilizacyjne. Koniecznym jest również baczne obserwowanie zmian stosunku do mniejszości narodowościowych, zwłaszcza zaś do Niemców i Polaków i notowanie wszelkich zarządzeń służby bezpieczeństwa względnie represyj, czy ograniczeń.

Obserwacja winna pozatym dążyć do zewidencjonowania, zarówno na terenie własnym, jak i czeskim, wszystkich ludzi nadających się do pracy informacyjnej na Czechosłowację.

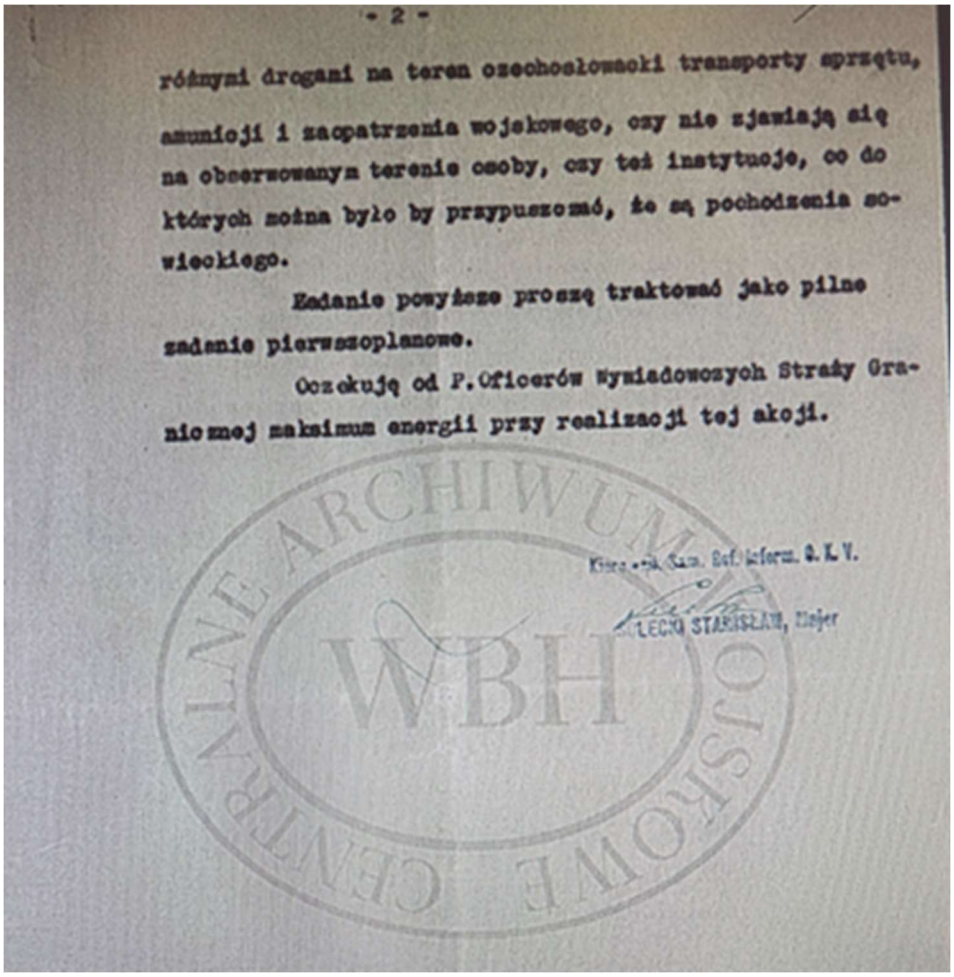
Specjalną uwagę proszę zwrócić na obywateli czechosłowackich i ich rodzinne - względnie zawodowe koneksje.

W wypadku trafienia na szczególnie ważne i cenne kontakty lub informatorów, proszę natychmiast donieść do Ekspozytury Sam.Ref.Inf.Katowice lub Bielsko. Tam też kierować uzyskane informacje z terenu czeskiego.

Specjalną uwagę proszę zwrócić na wszystkie elementy sowieckiej ekspansji wojskowej i gospodarczej na terenie czechosłowackim. Dążyć do ustalenia, czy nie przybywają

./.

Source: Copy of a letter dated 25 March 1938 from Major Stanisław Solecki, Head of the Independent Information Department of the DOK No. in Krakow, to the intelligence officer of the Bielsko Border Guard on the observation of the Czechoslovak foreground and the study of the border strip. CAW-WBH in Warsaw, file no. I.303.4.268, k1



- 2 -

różnymi drogami na teren czechosłowacki transporty sprzętu, amunicji i zaopatrzenia wojskowego, czy nie zjawiają się na obserwowanym terenie osoby, czy też instytucje, co do których można było by przypuszczać, że są pochodzenia sowieckiego.

Zadanie powyższe proszę traktować jako pilne zadanie pierwszoplanowe.

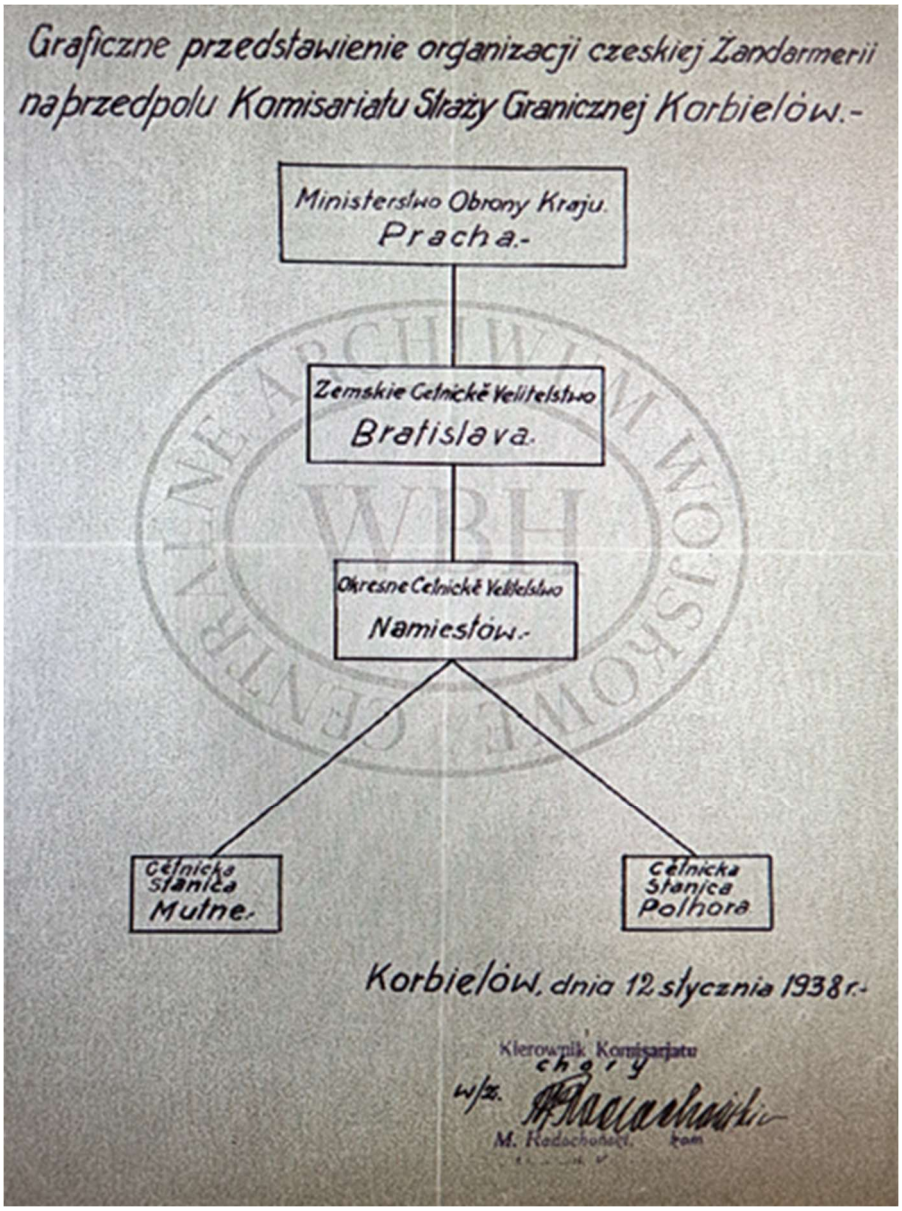
Oczekuję od P.Oficerów Wywiadowczych Straży Granicznej maksimum energii przy realizacji tej akcji.

Kierownik Sekcji Informacyjnej O.K.V.

SOLECKI STANISŁAW, Major

CENTRALNE ARCHIWUM WOJSKOWE WBH

Source: Copy of the letter dated 25 March 1938 of Major Stanisław Solecki..... k. 1zw



Source: CAW-WBH in Warsaw, File set of the Second Division of the General Staff, Deployment of the Czech Border Guard, file no. I.303.4.268, p. 25.

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USE OF OUT-OF-SCHOOL EDUCATIONAL SERVICES BY ADOLESCENTS IN THE CONTEXT OF SELECTED SOCIO-DEMOGRAPHIC CHARACTERISTICS OF PUPILS' FAMILIES

A significant issue within the educational systems of numerous nations, including Poland, is the unequal access to high-quality educational services, notably evident in relation to the socio-economic backgrounds of pupils. This pertains to both state-funded educational institutions and non-school educational services offered by commercial entities. This study aims to ascertain the correlation between pupils' utilisation of out-of-school educational services and specific sociodemographic characteristics of their families, particularly focussing on the pupils' location of residence and the number of children in the household. The findings of a survey involving 415 teenagers aged 13-18 and their parents are contextualised within existing research. The chi-square test for statistical analysis indicated no correlation between the pupils' place of residence (urban or rural) or the number of children in their families and the degree of utilisation of out-of-school educational services by the pupils.

Keywords: out-of-school educational services, school children, number of siblings, urban, rural.

1. INTRODUCTION

In a knowledge-based economy, the issue of education for children and adolescents is a significant and relevant issue. The cultivation of human capital through education dictates economic competitiveness, which affects the overall quality of life within society. Recent changes in Poland's educational system over the past twelve years aim to enhance quality,

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encompassing both state-provided services and reforms, as well as out-of-school educational services offered by private entities. These changes are in line with the trends observed in the services market since the late 1990s. (Rudawska, 2009; Gołąb-Andrzejak, 2021).

The problem within the educational system is the unequal access to high-quality educational services, particularly evident in relation to the background of the students. The literature specifically emphasises the influence of social group affiliation (Sironi, Barban, Impicciatore, 2015) and the effect of the local environment on the achievements of children, adolescents, and adults (Heckman, 2006). An illustration of the influence of membership in a certain social group (caste) on unequal access to education is seen in India, where disparities in educational expenditure are contingent upon a household's status within the occupational hierarchy. This leads to inadequate participation of students from low-income families in higher-quality institutions, potentially constraining their future employment opportunities (Samyak, 2025).

Although in democratic systems, students from different social strata should theoretically have similar opportunities in competing with their peers for their future socioprofessional positions, in practice, students from large cities enjoy privileged access to specialised, professionally delivered educational services (Zabłocki, 2024). Furthermore, the image of education in rural environments, although improving systematically, still diverges from that of schools in urban environments (Matyjas, 2019). This problem seems to be particularly relevant in the Podkarpackie Province, which is the spatial scope of the study and which, compared to other voivodeships, is characterised by the highest ratio of rural residents to the total population. Among the features determining the scope of use of educational services, including those of a non-school character, there is also the number of children in the family. Already in the 1970s, Becker drew attention to this problem when writing about the relationship between the number and ‘quality’ of offspring in families (Becker, 1990). The Nobel laureate pointed out that families in developed countries tend to have few children while investing heavily in the education and health of each child (Becker, Posner, 2013).

The correlations are also evident for Poland. Research by the Educational Research Institute and the Warsaw School of Economics indicates that the familial environment is crucial for a child's educational choices. The study indicated that, on average, hardly one in ten 'only children' attained education at the primary or lower secondary level, whereas in households with three or more children, the ratio was one in five (IBE, 2014). Educational attainment is frequently associated with the degree to which children gain from extracurricular activities. With regard to the Podkarpackie Province, no detailed research has been conducted to date to verify the relationship between the number of children in a family and the nature of their place of residence and the use of out-of-school educational services, which constitutes a specific research gap, the partial filling of which indicates the originality of the research conducted. This article aims to analyse the relationship between the utilisation of out-of-school educational services by youth and specific sociodemographic characteristics of their families, particularly emphasising the pupils' place of residence and the number of children in the household.

The objective set requires answers to the following research questions:

1. Does the characteristics of one's residence affect the utilisation of out-of-school educational services?
2. Does the number of siblings among students influence the degree of utilisation of out-of-school educational services?

With reference to the research questions the authors formulated two study hypotheses:

H.1. Urban youth are more inclined to use additional educational services compared to their rural counterparts.

H.2. Young individuals from households with a limited number of children (1-2 children) are more inclined to utilise supplementary educational services compared to those from larger families (3 or more children).

The achievement of the specified objective and the responses to the research inquiries were dependent on the variety of research methodologies and instruments used.

2. THE NATURE AND DETERMINANTS OF THE DEVELOPMENT OF OUT-OF-SCHOOL EDUCATIONAL SERVICES

Educational services, in the most general terms, can be defined as services in which the seller sells its knowledge or skills, and the buyer acquires these skills (Geryk, 2007). The educational system differentiates between state-provided school education and out-of-school educational services offered by private entities, including preparatory courses for exams, foreign language instruction, and sports or artistic activities.

Despite the educational reforms enacted in recent years, numerous negative perceptions of school education persist. More than 40% of Poles feel that the primary difficulty facing the educational system is the outdated curriculum, while approximately one in three respondents (32%) cites insufficient teacher training (IPSOS, 2024). The dissatisfaction of students and parents/guardians with educational offerings is a key factor influencing the growth of out-of-school educational services. This is due to their fulfilment of certain instructional roles designated for elementary education, and their progressively appealing service offerings align with the expectations of kids and their parents, addressing the deficiencies of the educational system in Poland.

A significant factor in the evolution of the market for extracurricular educational services, which frequently incur substantial household expenses, is the professional participation of women and the corresponding decline in family size, in conjunction with the increasing wealth of society. A significant reason driving the growing interest in out-of-school educational services is the increased awareness among Poles of the necessity of lifelong learning to tackle new problems.

Heckman underscores that skill formation is a dynamic process characterised by significant synergistic elements (Heckman, 2000). The cited Nobel laureate asserts that the new economy relies on credentials and talents, positing that human capital encompasses far more than the intelligence quotient assessed by exams (Flavio, Heckman 2007). Given the rising quality expectations of students and their parents, the primary objective of extracurricular education is to equip individuals who facilitate out-of-school educational activities with the requisite knowledge and abilities in response to environmental cues (Максютов, 2021).

Parents enroll their children in a diverse array of activities, including foreign languages, ballet, dancing courses, sports such as karate or swimming, musical instrument lessons, sketching, pottery, drama club, and more. A multitude of parents perceive the absence of out-of-school educational activities as detrimental to their child's growth, perhaps depriving them of equal possibilities compared to their peers (Karbowniczek, Nowakiewicz, 2015). Selecting particular extracurricular activities may be challenging, since research indicates that fewer than 40% of students formulate strategic objectives for their educational and career trajectories (Kozielska, 2021). Typically, judgements on the

selection of particular out-of-school educational activities are decided by parents, who prioritise not only the optimal final examination outcomes of their children, but also their artistic or athletic growth. This is crucial because, as Mazurkiewicz and Szara (2024) highlight, contemporary cultural engagement encompasses not only the consumption of cultural content but also its creation. It significantly influences individuals' lives, particularly the youth, due to its effect on their well-being.

The decisions made by children and their parents or legal guardians about out-of-school educational services are influenced by environmental challenges and require a comprehensive strategy. Hall (2022) underscores the need for the educational process to focus not only on academic elements, but also on topics relevant to the personal and social development of youth. The referenced author, who researched university students, underscores the critical importance of employing suitable educational approaches, particularly activating techniques (e.g., PBL, RBL), while minimising the hours dedicated to traditional instructional formats.

It is essential to highlight that the future of education, which encompasses out-of-school educational services, will be intricately connected to the rapid advancement of contemporary technology, which experts assert will enhance the personalisation of the delivery method. This is significant, as technology advancements have transformed the client profile from the 'naïve' consumer of the analogue age to the fully aware customer and ultimately to the customer who is in 'continuous reach' (Kozlova, Sukhostav, Anashkina, Tkachenko, Shatskaya, 2019). Furthermore, computer games and their underlying mechanisms are increasingly attracting adherents and becoming more prevalent (Kowalska, 2023), leading to the gradual integration of contemporary educational methods rooted in technological advancements, such as gamification and machine learning algorithms, into the educational system.

3. THE RESEARCH METHODS

The paper employs a critical review of the literature concerning educational services, particularly focusing on the nature and conditions for the advancement of out-of-school educational services. In addition to the literature on the topic, data from the Central Statistical Office, the Public Opinion Research Centre, and specialised reports and databases on youth education (Educational Research Institute, Educational Information System) were also used. The investigation focused on educational services classified under Section P of PKD 85.51 and 85.6 in the Polish Classification of Activities.

The main source of information was a survey executed using the CAWI (Computer Assisted Web Interview) method among two respondent groups: the primary recipients of out-of-school educational programmes, specifically those aged 13-18, and their parents or legal guardians. The questionnaire comprised two sections: one directed at parents or legal guardians and the other towards adolescents. The selection of the age range of students aged 13 to 18 years was predicated on the understanding that this demographic had limited legal ability and their psychophysical development enables them to deliberately engage in the process of selecting suitable services.

Nonrandom purposive sampling was employed in the study method. When verifying the completeness of the data collected and the adherence to the study criteria (age and residence), 415 electronic questionnaires were deemed suitable for analysis. The respondents were residents of the Podkarpackie Province, representing rural and urban regions nearly equally. Approximately 47.75% of the respondents resided in rural areas,

while 53.25% were urban dwellers, including 13.49% from Rzeszów. In the study, about two-thirds of the respondents (69.88%) originated from families with a limited number of children (1-2), while 30.12% were from households with a larger number of children (3 or more). The examined province exhibits the highest number of children per family in the country at 1.75, surpassing the national average of 1.62. Furthermore, it has the highest percentage of families with at least three children at 16.3%, compared to the national average of 11.5%. In contrast, it has the lowest proportion of families with a single child at 47.8%, while the national average is 53.3% (CSO, 2016).

Descriptive statistical methods and the chi-square test for independence were used to assess the acquired data and validate the study hypotheses.

4. RESEARCH RESULTS

CBOS research indicates that as the size of the residential area increases, the proportion of children participating in additional paid extracurricular activities rises systematically (CBOS, 2020, p. 6). Our research partially corroborates this trend, revealing that 82.4% of the questioned people aged 13-18 participated in extracurricular activities, with 78.4% of those residing in rural regions and 86% in urban areas (Figure 1). Compared to the CBOS report, the results in the Podkarpackie Province were markedly elevated, both in terms of rural inhabitants and overall. During the 2020/2021 academic year, the CBOS survey indicated that merely 40% of the general population of school-aged children and youth were expected to attend school in rural regions: 64% in towns with populations up to 20,000; 66% in towns with populations ranging from 20,000 to 99,999; 61% in towns with populations between 100,000 and 499,999; and 83% in towns exceeding 500,000 inhabitants.

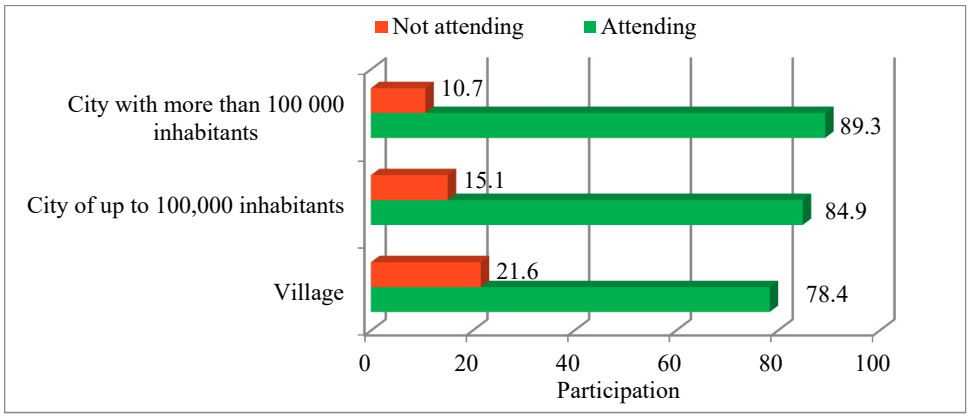


Figure 1. Place of residence of adolescents and attendance at extracurricular activities (%)

Source: own calculations based on survey (n = 415).

Hypothesis 1 was validated by a chi-square correlation test based on the acquired results. The null hypothesis (H0) posits that the place of living does not affect the use of extracurricular activities. The results of the chi-square test indicated no link at the significance level of 0.05; however, a relationship was observed at the level of 0.1 (Table 1).

Table 1. Relationship between where young people live and attendance at extracurricular activities

Statistics	Young people's place of residence and attendance at extracurricular activities (statistics)		
	Chi^2	df	p
Pearson's Chi^2	4.708529	2	0.09496
NW Chi^2	4.854198	2	0.08829
Contingency ratio	0.1059177		

Source: own calculations based on the survey (n = 415).

The results of the study do not provide a basis for rejecting H0. The location of residence (urban or rural) does not affect the participation of youth aged 13 to 18 years in out-of-school educational activities. Consequently, hypothesis No. 1 – Youth residing in urban areas are more inclined to utilise out-of-school educational services than their rural counterparts – was not substantiated. Given the dynamic systems involved in human capital formation, it can be expected that young people living in urban areas are more likely to use out-of-school educational services than their peers living in rural areas. According to this approach, competence development is the result of long-term interactions between the individual and their environment, and the availability of environmental resources is one of the key factors determining educational trajectories. The presented results did not confirm this correlation in quantitative terms, but limited access to infrastructure reduces the qualitative attractiveness of educational provision in rural areas. Difficulties associated with the lack of space for extracurricular activities for young people in some rural areas are highlighted. (Dobrzyniak, 2024). This may mean that the differences between urban and rural areas are evident not so much in the fact of participation itself, but in the scope and quality of available forms of extracurricular education. According to the theory of dynamic systems, the local environment continues to play a key role in shaping access to educational opportunities (Heckman, 2000; Heckman, 2006).

The analysis also examined the number of children in the family, categorising respondents into two groups: 1-2 children and 3 or more children. Regrettably, a distinct category for families with one single child was not established, which would have facilitated a more comprehensive study and should be acknowledged as a limitation of the research.

The relationship between family size and participation in out-of-school educational services can be explained by social learning mechanisms and limitations related to access to resources. According to social learning theory, children acquire educational aspirations, behaviours and orientations through observation and interaction in the family environment. In this context, the intensity of parental involvement and educational patterns present in the family may encourage children to undertake additional educational activities. In smaller families, parents can devote more individual attention to each child, which may increase engagement in out-of-school educational services. At the same time, economic theories of the family emphasize the role of resource dilution in households with more children. (Becker, Lewis, 1973), involving not only financial resources, but also the time, attention and organizational skills of parents.

The study indicated that, with respect to students from families with one to two children and those from families with three or more children, the proportion of adolescents who participated in extracurricular activities was quite similar (Figure 2).

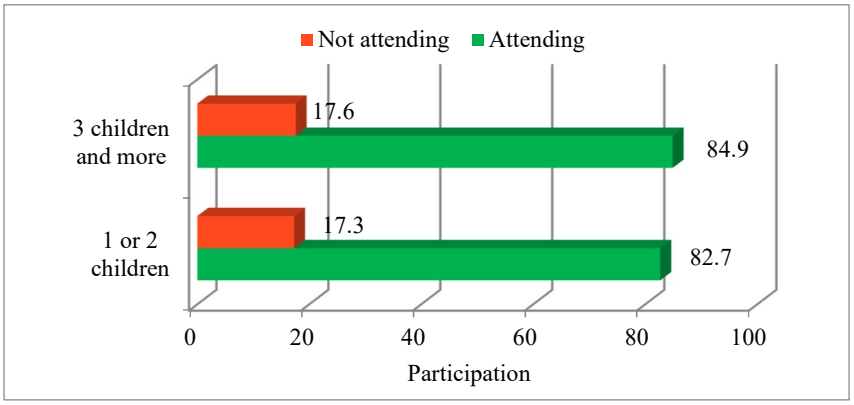


Figure 2. Number of children in the family and attendance at extracurricular activities – responses of young people aged 13-18 (%)

Source: own calculations based on survey (n = 415).

To validate the second hypothesis posited initially, the null hypothesis (H0) was established and examined using the Chi-square test of independence at a significance level of 0.05 (Table 2).

Table 2. Relationship between family size and participation in extracurricular activities by young people aged 13 to 18 years

Statistics	**Family size and participation in extracurricular activities of 13-18 year olds (statistics)**		
	Chi²	**df**	**p**
Pearson's Chi²	0.0000115	1	0.99730
Contingency ratio	0.0001662		

Source: own calculations based on the survey (n = 415).

The test results indicated that there was no basis for rejecting H0. This indicates that hypothesis 2 – Youth from households with few children (1-2 children) utilise out-of-school educational services more frequently than those from families with numerous children (3 or more children) – has not been substantiated. The results of the study do not therefore fit in with the assumptions of social learning mechanisms and the resource dilution hypothesis, according to which it can be assumed that young people from families with fewer children are more likely to use extracurricular educational services than young people from larger households. This may suggest a weakening of the traditional mechanisms for differentiating access to extracurricular education in the context of contemporary social policy. One of the reasons for this result is the additional financial resources provided under the 500+ benefit (from 2024 – 800+), with more than half of parents declaring that they spend part of the additional funds on their children's education

(Kawczyńska-Butrym, Pantyley, Mącik, Smalej. 2021). It should be emphasised that among the students surveyed, there was a clear predominance of private tuition in school subjects (two out of three respondents), and on average, one in three respondents indicated learning additional foreign languages, sports and IT classes, and a slightly smaller group indicated music and art classes. This structure may indicate that out-of-school educational services primarily serve a compensatory function in relation to the school system, rather than solely a developmental one. In rural areas, more often than in cities, the need to supplement deficiencies in school education was cited as a reason for participating in extracurricular activities. It should be emphasised that, apart from the analysed impact of place of residence and number of children in the family, there are many other factors (parents' education, social status, family income) that determine young people's educational aspirations. These findings are consistent with a broader multifactorial approach, according to which educational decisions are the result of overlapping structural and cultural conditions. The influence of education (CBOS, 2025) is particularly emphasised, especially that of the father, whose growth encourages taking on new educational challenges (Długosz, 2020).

5. LIMITATIONS AND FUTURE RESEARCH

Despite its contribution, the study has several limitations that should be considered when interpreting the results. The use of non-random purposive sampling limits the generalisability of the findings; therefore, the results should be treated as exploratory, reflecting participation patterns rather than causal relationships. Moreover, the research was conducted exclusively in the Podkarpackie Province, a region characterised by a high share of rural residents and relatively large family sizes, which restricts the applicability of the results to areas with different socio-demographic conditions. The operationalisation of family size did not distinguish between single-child and two-child households, potentially obscuring more nuanced parental investment strategies. Additionally, the study did not differentiate between the type, intensity, or duration of out-of-school educational services and the temporal overlap of the survey with the COVID-19 pandemic may have affected the organisation and availability of such activities. The findings also suggest practical implications, particularly for rural areas, where limited access to infrastructure-based extracurricular activities may reduce the qualitative attractiveness of educational offers. Future research should employ random or stratified sampling, extend the analysis to other regions and countries, apply longitudinal designs, and examine how technological development, including artificial intelligence, may reshape the market for out-of-school educational services.

6. CONCLUSIONS

The increasing societal recognition of the necessity to invest in the future by enhancing knowledge and cultivating skills and competencies is seen in parents' apprehension for their children's education, as demonstrated by their financial support for diverse extracurricular activities. The selection of extracurricular activities often involves multiple family members, in which both students and their parents or legal guardians play a crucial role. In terms of the respondents questioned, in around two-thirds of the instances, the decision to engage in extracurricular educational activities was predominantly a collaborative option made by youth and their parents or legal guardians. The most frequently selected activities included tutoring in academic topics, followed by sports and language courses.

The statistical research revealed that neither the type of setting (urban or rural) nor the size of the family exerted any influence on the use of extracurricular educational services by the youth. Consequently, it may be inferred that the dominant stereotype positing that parents of only children from metropolitan areas prioritise their children's education would gradually diminish in relevance. Parents, irrespective of their residence or the quantity of their progeny, endeavour to invest in their children's development from the pre-school phase, facilitating active engagement in extracurricular activities during their leisure time, while concurrently ensuring professional care throughout their employment. For several parents, extracurricular educational activities emerge as a logical option in this context, which are subsequently sustained in later phases of the educational journey. The study indicated that extracurricular activities in rural areas were more likely to supplement the knowledge provided in schools compared to metropolitan settings. This was succeeded by an aspiration to cultivate interests and enhance understanding. The market for out-of-school educational services is highly appealing to students; yet, the character of these services will undergo systematic changes in the coming years due to the dynamic advancement of current technology, including artificial intelligence.

All authors have read and agreed to the published version of the manuscript.

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CHANGING TIMES: EXPLORING MALE PRE-SERVICE TEACHERS' AWARENESS OF GENDER-RELATED CHALLENGES FACED BY TEACHERS IN EARLY CHILDHOOD EDUCATION

Male pre-service and in-service teachers face numerous gender-related challenges. They are often stigmatised and frowned upon because the teaching of young children is considered in many societies to be 'women's work'. This paper explores whether male student teachers are aware of the challenges faced by Foundation Phase teachers, and subsequently the challenges they may face when they become Foundation Phase teachers. This qualitative study used focus groups and individual semi-structured interviews to collect data from twenty-eight male students enrolled in the B.Ed Foundation Phase Teaching qualification at a University of Technology. Eleven were fourth-year students, while seventeen were third-year students. Findings revealed that participants were aware of the challenges awaiting them when they enter the teaching profession. They were aware of these challenges before they enrolled in the programme and also experienced and observed them during their teaching practice. The paper contributes to the under-researched issue of male teachers teaching young children. The paper concludes that the participants have realistic expectations of what it entails to be male teachers in a female-dominated field. To encourage males to become Foundation Phase teachers, one recommendation is to raise awareness of the beneficial role men can play in the lives and education of young children.

Keywords: Foundation Phase, male teachers, gender-related challenges, female-dominated field, young children.

1. INTRODUCTION

Historically, women have held jobs such as librarians, nurses, social workers, and primary school teachers, while men have been more inclined to work in industries such as construction, aviation, and manufacturing. Gender has partly shaped these career choices (Cross, Bagilhole, 2002; Williams, 2023). In many societies and cultures, females still dominate these occupations, but more males are opting to 'cross over' into these careers

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(Williams, 2023; Moodley, Moosa, 2023). The article focuses on the growing number of males who want to become primary school teachers in a female-dominated field.

In the South African educational context, the Foundation Phase comprises learners in grades R to 3, typically aged five to nine. It falls under the broad umbrella of Early Childhood Education or Primary School Education (Petersen, 2014; Marais, 2018; Seleti, Greyling, 2021). Globally, female teachers are over-represented in Early Childhood Education, resulting in a shortage of male teachers in primary schools. Male teachers are more inclined to teach older children because older learners are intellectually and psychologically more advanced, and teaching higher grades carries greater status. Some also argue that younger learners need to be 'nannied and babysat', whereas older children are more independent (Moodley, Moosa, 2023). These factors contribute to the shortage of men in this 'motherly profession' (Mofokeng, Ndlovu, 2024).

This gender gap is deeply embedded in cultures and societies and is not necessarily a result of education systems. Popular culture reinforces the belief that men who work in careers traditionally reserved for women are 'anomalies' (Williams, 2023). In an African context, especially, cultural factors often link women's roles to child-rearing (Petersen, 2014). One reason men are hesitant to pursue careers in female-dominated fields is the prevalent societal negativity towards male teachers working with young children. Many societies consider teaching young children 'women's work,' which discourages men from entering the profession. Thus, numerous male teachers in primary schools have reported facing challenges such as loneliness, social isolation, negative perceptions from others, and concerns about appropriate physical contact with children. Male students and in-service male teachers are often viewed as unnatural, sexual deviants, or as being gay and 'sissies', regardless of their masculinity and sexual orientation (Mashiya, 2014; Msiza, 2016; Kewuti, 2018). In addition, some people believe that men cannot handle the responsibility of caring for young children because they are not sufficiently nurturing or loving to meet their needs (Moodley, Moosa, 2023). As a result, male teachers in the Foundation Phase in South Africa are under-represented, and teaching young children remains a predominantly female occupation. Despite these barriers, an increasing number of men choose to become Foundation Phase teachers, and many are already teaching young learners (Petersen, 2014; Sayed, McDonald, 2017; Mncanca, 2021). Some praise these pre-service and in-service male teachers, while others question their suitability.

The article primarily investigated whether male students are aware of and prepared for the challenges they will encounter when they become teachers. It also explored why male students choose to break tradition by enrolling in the B.Ed Foundation Phase Teaching programme and later becoming teachers of young children. The primary research question was: Are male pre-service teachers aware of the gender-related challenges they will face when they become teachers, and if so, when and how did they become aware of these challenges? Limited research in South Africa has examined male students' awareness of gender-related challenges and of being a minority group in primary schools. Instead, research in the Foundation Phase generally focuses on pedagogical strategies and curriculum delivery. Moreover, most gender studies focus on women to address disparities and gender stereotypes, often highlighting women in male-dominated fields (Nyoni, Nyoni, 2012). While numerous studies have examined women entering male-dominated careers, few have explored why men choose to 'cross over' to female-dominated fields (Williams, 2023). This research aimed to fill these gaps. The paper will help male pre-service teachers develop awareness of the gender-related challenges faced by male teachers.

2. LITERATURE REVIEW

The literature sought to address the following issues to gain a better understanding of male students' awareness of their role as Foundation Phase teachers in an environment that is a domain of females:

- The under-representation of male teachers in the Foundation Phase,
- The challenges that lead to the scarcity of Foundation Phase male teachers,
- Motivation to attract and retain male teachers in the Foundation Phase.

The under-representation of male teachers in the Foundation Phase

Globally, male teachers are often in the minority in primary schools (Mncanca, 2021; Mofokeng, Ndlovu, 2024). This is because few males want to become teachers of young children. Foundation Phase male teachers face numerous challenges, which cause many men to shy away from teaching young children. In South Africa, one in five Foundation Phase teachers is male. This aligns with the global trend that men are more likely to teach adolescents than young children (Bhana, McGrath, Van Bergen, Moosa, 2019; Ravhuhali, Lavhelani, Mulovhedzi, Mashau, Mudzielwana, 2019). The gender distribution in the early childhood workforce appears similar across many countries. For example, in Germany, the proportion of male elementary school teachers is 4%; in Finland, 10%; and in the United States it is 2% (Mashiya, 2014). In Africa, the trend is similar - African societies do not welcome men to teach young children. In Tanzania and other African countries, for example, teaching at primary schools is seen as a status job reserved for women because men are believed to lack the patience and motherly instincts to work with young children (Nyoni, Nyoni, 2012; Ravhuhali et al., 2019).

McDowell (2023) cites that the well-documented lack of male primary school teachers is a worldwide phenomenon (e.g., in Australia, see McGrath, Van Bergen, 2017; South Africa, Bhana, Moosa, 2016; Germany, McDowell, Klattenberg, Lenz, 2021; Vietnam, Nguyen, 2020; United Kingdom, McDowell, 2022, and Iceland, Johannesson et al., 2022). Moreover, teacher attrition rates, especially male teacher drop-out, is also an issue (see Amitai, Van Houtte, 2022). In the U.K, male teachers are less likely to work in nursery and primary schools than in secondary schools, with recruitment numbers across all remaining low (14.1% and 35.8%, respectively; Department of Education, 2022). These studies found that, as in South Africa, primary schools lack male representation because males often face backlash, stigmatisation, and criticism, not only in the schools where they teach but also in broader society. However, a new trend shows more male students enrolling in a B.Ed Foundation Phase Teaching degree than in the past, after which they will ultimately become Foundation Phase teachers. While women still outnumber men in many primary schools, more men are now opting to break tradition by becoming teachers of young children (Petersen, 2014; Ravhuhali et al., 2019).

The study was motivated by two factors: first, the researcher's interest in male teachers of young learners; second, the large number of male students enrolled in the B.Ed Foundation Phase Teaching degree at a South African university. Throughout this paper, I use the terms male and female. However, I recognise that these labels imply a binary gender and do not encompass the range of gender identities that exist - not all people are categorised as either male or female. I also acknowledge the complexities and contradictions of gender issues (Cole, Plaisir, Reich-Shapiro, Freitas, 2019).

The challenges that lead to the scarcity of Foundation Phase male teachers

Teaching in the Foundation Phase goes far beyond formal subject instruction, as teachers must also support learners' behavioural, social, emotional, and physical development (Ravhuhali et al., 2019). Foundation Phase teachers are therefore responsible for the holistic education and development of young learners during their most formative years. This endeavour is complex and challenging for both male and female teachers and must be effective to ensure learner success (Meier, Machaba, 2021). In general, many teachers face challenges such as heavy workloads, dissatisfaction with salaries, and burnout, but men, in addition, face gender-related challenges simply because they are male.

The notion persists across many societies that a 'soft' female is expected to care for young children, not the rough male, hence the backlash against males who dare to cross the divide and enter a female domain in the eyes of patriarchy (Nyoni, T., Nyoni, M., 2012). There is also a stigma that men are generally associated with homosexuality, child abuse, and child molestation (Petersen, 2014; Moodley, Moosa, 2023). These views perpetuate gender discrimination, prejudice, and stereotyping, leading to the under-representation of male teachers in Early Childhood Education. Because of these stereotypes, men are deterred from pursuing a career in ECE, as they are depicted as 'abnormal' and feminine (Bhana et al., 2019; Moodley, Moosa, 2023). Their motives are questioned and scrutinised when they pursue careers that involve teaching young children. They are often accused of improper conduct with children, and their sexuality and masculinity are often questioned. The notion thus persists that children, especially young children, are not safe around men and should be protected from them. Despite literature showing the positive impact and role of male teachers, Foundation Phase male teachers generate tremendous controversy and caution. Societies still question males' motives for teaching in early childhood settings, and these men are often frowned upon.

Motivation to attract and retain male teachers in the Foundation Phase

Despite the obstacles male teachers face, research suggests that having male teachers in the Foundation Phase has benefits that outweigh the disadvantages. Although teacher gender seems to have no direct effect on learners' academic performance, men do bring some benefits as teachers of young children, for both boys and girls. Men often introduce sports coaching in schools (Mashiya, 2014). Mashiya (2014) adds that another positive trait of male teachers in the Foundation Phase is that learners seem to like them; they show curiosity and eagerness to participate in class and in sports. Men and women have different caring and nurturing styles: males promote a more active, physical environment, while women foster a nurturing, calm environment. Both caring styles can benefit young children, and children need a balance of these masculine and feminine traits (Bhana et al., 2019). McGrath and Sinclair (2013) assert that the call for more male teachers in primary schools has long been associated with the developmental needs of boys, the importance of positive male role models in schools, the difference they can make in the lives of children, and the disproportionate number of male and female teachers in primary schools internationally (cf. Martino, 2008). Petersen (2014) found that male teachers are categorised into three:

a) The good (those perceived as role models and good teachers),
b) The bad (the Foundation Phase is not suitable for men, because it is traditionally women's work),
c) The ugly (the view that associates men with child molestation and violence against women and children (cf. Moodley, Moosa, 2023).

Although male teachers in the Foundation Phase are often associated with the 'bad' and the 'ugly', many become Foundation Phase teachers because they enjoy teaching young children and can serve as positive role models. Recruiting more male teachers could help challenge the stereotype that teaching young children is better suited to females. Schools are part of society, and people need to consider the benefits of a balanced workforce in primary education. Such an imbalance should not persist because of the misconception that males are incapable of teaching or caring for young children (McGrath, Sinclair, 2013; Kewuti, 2018). Male primary school teachers shape girls' interactions with men, their understanding of men, and, in turn, the development of their self-image (McGrath, Sinclair, 2013). Many children feel they have more in common with people of the same sex and can relate better to teachers of the same gender.

3. METHODOLOGY

Research paradigm

Thomas Kuhn coined the term paradigm. It is described as a cluster of beliefs that dictates what researchers in a particular discipline should study, how research should be conducted, and how results should be interpreted (Bryman, 2012). The interpretivist paradigm underpins this research because it focuses on understanding individual perspectives and the meaning participants ascribe to their experiences (Tshabangu, 2015). The study centred on male students' awareness of the challenges faced by Foundation Phase teachers. Interpretivist research aims to obtain an in-depth understanding of participants' experiences. It often requires the researcher to spend many hours with participants to understand how they experience daily life (Du Plooy-Cilliers, 2024). The researcher conducted in-depth individual and focus group interviews with participants over a period of time.

Research approach

A qualitative research approach was selected because it aims to collect verbal and textual data and to provide an in-depth understanding of participants' actions. Qualitative research explores participants' subjective meanings, and researchers often collect data in natural settings, such as schools, over an extended period (Bezuidenhout, Strydom, 2024). Bezuidenhout and Strydom (2024:199) assert that "as qualitative researchers, we assume that it is difficult, if not impossible, to measure and quantify these subjective experiences and meanings". Qualitative research cannot be reduced to quantification and measurement; instead, it focuses on understanding how people think and the meanings they attach to their actions (Okeke, 2015).

Research design

A research design is a plan or strategy that moves from underlying philosophical assumptions to specify participant selection, the data-gathering or generation methods to be used, and the data analysis to be done (Nieuwenhuis, Jacobs, 2025). This structural framework guides the research process, from formulating questions and objectives to interpreting and presenting the findings. Hermeneutic phenomenology was the most appropriate research design for this paper. It combines two ideas: phenomenology (examining direct human experiences) and hermeneutics (how people find meaning and interpret those experiences). It examines social experiences through the descriptions provided by the people involved (Van Wyk, Taole, 2015). These social experiences are the

participants' lived experiences. The researcher selected hermeneutical phenomenology (or interpretative research) to understand participants' subjective experiences. Hermeneutics is a philosophy used to interpret textual data. Hermeneutical phenomenology argues that interpretation is all we have and that description itself is an interpretative process (Nieuwenhuis, 2007; Van Wyk, Taole, 2015). Themes emerged from participants' lived experiences; for example, some participants reported sitting alone during breaks because, in some schools, no other male Foundation Phase teachers were present. From this observation, I derived theme 5: loneliness and isolation. These lived experiences (e.g., sitting alone at break) can be linked to phenomenology. This interpretation led to the resulting theme: loneliness and isolation (hermeneutics).

Sampling and selection of participants

Purposive sampling was used to gather data from participants with knowledge and experience relevant to the research aim. The sample comprised twenty-eight purposefully selected male students enrolled in the B.Ed Foundation Phase Teaching degree, eleven 4th-year and seventeen 3rd-year students. All the students volunteered to take part in the study. Purposive sampling is particularly effective in qualitative research because it aims to gain insight into specific experiences rather than make generalisations; therefore, samples are often small (Maree, Rajab, Pietersen, 2025).

Data collection

Data were collected through semi-structured individual and focus group interviews. The focus group interviews were conducted first. They consisted of four groups of seven members each. All twenty-eight participants therefore took part in the focus group interviews. These interviews were followed by individual interviews with nine students who had taken part in the focus group interviews. The nine students volunteered for the interviews. I chose semi-structured interviews because they are exploratory and offer the best of both worlds: a structured list of issues to cover, with the freedom to ask follow-up and/or probing questions (Thomas, 2017). The interviews were conducted over two months and were recorded on a cellular phone.

Data analysis

In qualitative research, data analysis involves examining and interpreting non-numerical data to uncover patterns, themes, and meanings. Qualitative data analysis aims to make sense of the phenomenon and therefore does not require quantifying text or conducting statistical analysis (Feza, 2015; Bezuidenhout, Cronje, 2024). For this study, I adopted interpretative qualitative thematic analysis. This widely used method identifies, analyses, and interprets themes in qualitative research. The analysis was based on themes that emerged from respondents' responses to the questions (Feza, 2015; Sundler, Lindberg, Nilsson, Palmer, 2019; Nieuwenhuis, Jacobs, 2025). It entails searching across data to identify, analyse, interpret, and report responses. This method describes data and also involves interpretation in selecting codes and constructing themes (Feza, 2015; Bezuidenhout, Cronje, 2024). The correlation between thematic analysis, interpretivism, and hermeneutic phenomenology lies mainly in the relationship between participants' lived experiences, how they interpreted these experiences, and the resulting themes. I used a six-step process to find, analyse, and report the themes. The process is described in the table below:

Table 1. Six-step process to develop themes

Steps	Action	Description
1	Familiarise	Read the data (e.g. interview transcripts) several times and make notes.
2	Code	Colour-code specific parts of the interviews to determine which themes they fall under. Summarise the meaning, e.g. some participants want to become Foundation Phase teachers because they love children. I colour-coded these and similar responses. From such responses, I derived the theme of altruistic motivation. I searched for the meaning of participants' lived experiences and compared their similarities and differences.
3	Generate theme	Group same colour codes together and place them under relevant themes.
4	Review theme	Review themes and responses to see if the correct responses are placed under the correct themes.
5	Define and name	Each theme is given a name that correlates with the relevant response.
6	Write up	The whole process is revised, and the discussion is written.

Source: (Sundler et al., 2019).

4. FINDINGS AND DISCUSSION

Bantwini and Arowolo (2015) contend that "it is important to remember that there is no single style or approach for reporting the findings from qualitative research". Many factors shape what and how findings are reported, including the research objective and purpose. High-quality reporting of qualitative findings should give the reader a clear understanding of how the research was conducted, how the data were analysed, and how the findings were interpreted and reported (Bantwini, Arowolo, 2015). In this study, 'raw' data were converted into final patterns of meaning, which were conveyed through themes. Most participants said they were aware of the challenges teachers face, particularly those faced by male teachers. They experienced some gender-related challenges in schools during teaching practice. A few participants interviewed individually reported that they chose to be Foundation Phase teachers but were not initially aware of the gender-related challenges. Most participants said they were aware of these challenges but thought they could overcome them and that teaching practice had prepared them. All participants were pre-service teachers when the research was conducted, meaning they were not yet teaching. Most of the responses are based on their experiences during teaching practice. Below are some of the questions I posed to the participants, accompanied by their responses:

Q1: Why do you want to become a Foundation Phase teacher?

Participant 1:

I actually wanted to become a high school teacher, but I was not accepted. But I think I will enjoy teaching the young ones. I had fun with them during teaching practice. I'm passionate about teaching.

Participant 2:

My mother is a Foundation Phase teacher, and she always tells us how she likes teaching the little ones. But I also enjoyed teaching them during teaching practice.

Participants gave various reasons for wanting to become Foundation Phase teachers. They indicated that they expect to enjoy teaching young children.

Q2: What challenges, other than pedagogical issues such as curriculum delivery, do you think male teachers of young children face?

Participant 3:

From what I see, teaching is a challenging career, whether you teach older or young children. But I know men are not really 'welcomed' with open arms in the Foundation Phase. One parent even asked why I want to teach small children. I think the parents are especially concerned.

Participant 4:

Yes, I am. When I went for teaching practice, I noticed how few male teachers there were. In one school, there were nine female teachers and only two male teachers in the Foundation Phase. You do kind of feel isolated and lonely. At one school, there was only one male teacher. He usually spent break alone in his classroom. But many teachers were welcoming.

Many participants reported observing gender-related challenges during teaching practice. Most participants said they have always been aware of these challenges.

Q3: What factors do you think deter men from becoming Foundation Phase teachers?

Participant 5:

People think I cannot teach small children because I'm a guy. I think I can. I know they cry a lot and need to be consoled. But my lecturers warned me about such things. People ask me if I'm gay. I tell them I'm not. It's like asking a father why he wants to have children. Must I be gay to have children and raise them? And people say Foundation Phase teaching is all about playing. That's not true (Laughs).

Participant 6:

At one school a male teacher had a relationship with a schoolgirl. I think she was thirteen. So, we were warned about such cases. Parents worry about male teachers molesting their children…but not the teachers as such. So male teachers are viewed as child molesters by some people. Of course, some teachers are guilty of these things. They give the rest of us a bad name. People are not used to men teaching young children.

This provides evidence of a 'double bind' for male teachers. If they do what female teachers readily do (show care through physical contact), they are seen as 'less of a man' and therefore suspect. Physical contact is often accompanied by accusations of homosexuality. This aligns with findings from McDowell (2023) and Mashiya (2014).

Q4: Do you think you will be resilient and strong enough to handle these challenges? (Participants were asked to substantiate their answers)

Participant 7:

I think so. Only time will tell. So far, I only have experience from teaching practice, but I'm confident I'll be fine.

I hope so. The young ones are so busy and active. But I enjoy teaching them. I'm not scared. I know many people think that male teachers are likely to abuse kids. It is true because these things do happen. But not all of us. So, people look at me funny when I tell them I want to be a Foundation Phase teacher. I think it's good that the kids can be taught by men also, especially those who do not have fathers.

Participant 8:
I got advice from another male teacher at one school about how to handle these things. He has been teaching Grade 3 for three years. He says he sometimes gets those strange questions. He says working with young kids is rewarding for him. He also advised me to just not mess with the kids, and try not be alone with one child in a class.

Participants reported that they still want to become Foundation Phase teachers, despite being aware of the challenges. Their awareness stems from societal perceptions of male teachers and from their experiences in teaching practice.

Five themes were derived from the collected and interpreted data. Some of the themes overlap, while others do not. For example, themes three and four overlap and are related. The research question the paper sought to answer was: Are male pre-service teachers aware of the gender-related challenges they will face when they become teachers? Because the participants are not yet in-service teachers, the paper examined their awareness of these challenges. From the responses and themes, it is evident that the participants are aware of the challenges faced by Foundation Phase teachers and, consequently, the challenges they will most likely face. All the participants indicated that, despite being aware of these challenges, they still want to become Foundation Phase teachers. The participants observed these challenges during teaching practice, and some experienced them when they did teaching practice.

Below are the themes that were derived.

(1) **Altruistic motivation**
Many respondents indicated that they want to become teachers because they love children and are passionate about teaching. They stated that they believe younger children are 'less problematic' than older children, making them easier to handle and discipline (Petersen, 2014; Mofokeng, Ndlovu, 2024).

(2) **Rejection from other programmes**
Some participants stated that they chose teaching as a second option because they were not accepted into other programmes. However, they reported enjoying working with children during teaching practice. These participants said they would teach for a few years and then decide whether to continue.

(3) The desire to challenge and demystify gender stereotypes
Gender stereotyping is the practice of assigning certain characteristics, roles, and expectations to individuals based solely on their gender. One such stereotype is that women are better suited to caregiving and nurturing roles (Ravhuhali et al., 2019). Most participants felt there was a misconception that men should not teach young children. They agreed that men can teach young children just as well as women. This finding aligns with Everitt-Penhale and Ratele's (2015) call to debunk myths about traditional masculinity, a social construct that is widely scrutinised. Participants claimed to possess the qualities that make them good teachers and argued that they should not be discriminated against simply because they are men.

(4) **Misconception about Foundation Phase teaching**
This theme closely aligns with the third theme, which presents the stereotypical view that women are better suited to caregiving and nurturing roles than men, and that men cannot be babysitters or caregivers. Although most Foundation Phase teachers are female, more male teachers are entering this female-dominated field. There is also a misconception about Foundation Phase male teachers and about

Foundation Phase teaching in general. Many people associate Foundation Phase teaching with playing and child-minding. Participants agree that Foundation Phase teaching is more than just playing and babysitting. Foundation Phase teachers have many roles to fulfil, including those of learning mediator, assessor and interpreter, and designer of learning programmes. It is mostly about curriculum delivery, but also about meeting children's developmental needs (Republic of South Africa 1996; Ravhuhali et al., 2019).

(5) Loneliness and isolation

Most participants reported being aware of the loneliness male teachers experience, as they are surrounded by many female colleagues. One participant reported that he did not feel lonely because he was friends with the female teachers. They became aware of this isolation even before enrolling in the programme. In addition, they felt isolated during teaching practice, when male students were outnumbered by female students. This aligns with research by Mashiya (2014), Petersen (2014), and Mofokeng and Ndlovu (2024). However, this challenge did not deter them from performing their duties or from making the best of their teaching practice experience.

5. LIMITATIONS OF THE STUDY

While the methodological design of this study was carefully constructed to ensure coherence and rigour, certain limitations should be acknowledged. Identifying limitations enhances methodological transparency and demonstrates critical reflexivity, both of which are central to qualitative research integrity (Creswell, Poth, 2018; Tracy, 2020). A primary limitation of qualitative research is that its findings cannot be generalised to wider populations because it relies on small samples. Samples are generally small because qualitative research aims to explore individuals' lived experiences and perspectives on a particular phenomenon (Okeke, 2015). This study used a small sample, and all participants were male pre-service teachers from one institution. The study relied heavily on self-reported data from participants during interviews. Self-reported accounts may be influenced by social desirability bias, memory limitations, and the difficulty of measuring feelings, opinions, and experiences. Another limitation of qualitative research is researcher bias, as the researcher's opinions may influence how information is interpreted.

Acknowledging these limitations does not diminish the study's value. Rather, it places the findings within their methodological boundaries and reinforces the interpretive, context-sensitive nature of qualitative inquiry.

6. RECOMMENDATIONS

Based on the findings, the following recommendations are presented as potential solutions:

To become effective Early Childhood educators, male teachers require the same preparation, training, and ongoing professional development as their female counterparts. However, because of the challenges Foundation Phase male teachers face, they may need additional support to address these gender-related issues. Society needs to challenge the stereotype that only females should teach young learners, as children can benefit from both male and female teachers. We need to dispel the negative connotation that teaching, especially Foundation Phase teaching, is a 'motherly' profession. Male teachers should be

applauded, encouraged, and supported for their willingness to teach in primary schools. Children need to know that people of all genders play an important role in their education, holistic development, and care. The article emphasises the need for gender balance in Early Childhood Education, highlighting the growing importance of male teachers in South African schools (Okeke, Nyanhoto, 2021). It specifically urges encouraging men to enter the sector, as they can serve as both effective educators and positive role models. Men should not be excluded on the basis of their gender.

Educational stakeholders need to develop viable strategies to encourage more men to pursue teaching careers in the Foundation Phase and to retain them. Higher Education Institutions should encourage males to study Early Childhood Education. The Employment Equity Act (1998:6(1)) asserts that no person in the workplace should be unfairly discriminated against on grounds such as gender, sex, or marital status; men should therefore not be judged or discriminated against for teaching young children. The Constitution also enshrines gender equality. Sayed and McDonald (2017) argue that policymakers need to nurture a culture in which teaching is a positive and highly esteemed profession for men and women. The value of Foundation Phase teachers must be recognised, regardless of their gender.

7. FURTHER RESEARCH

Further research is needed to explore the phenomenon of male teachers in the Foundation Phase in the South African context from multiple perspectives. Future research could examine male and female role models in education from the perspectives of children and parents, and explore whether and how gender stereotypes are reproduced across generations.

8. CONCLUSIONS

The article aimed to explore male pre-service teachers' awareness of the challenges faced by male teachers in the Foundation Phase. After interpreting and analysing the data, the study found that participants were aware of these challenges even before enrolling in the programme. Based on the findings, participants reported that they remain motivated to become Foundation Phase teachers and that the challenges are not deterrents. Participants reported that male teachers should not be frowned upon because of their gender but should be encouraged and motivated to teach young children, as they bring many benefits to Foundation Phase classrooms. By occupying roles traditionally seen as suitable for women, men can help reduce gender polarisation, stereotyping, and inequalities, and they can contribute to children's gender knowledge. This may be particularly important for some children, allowing them to observe men who are non-violent and who have positive interactions with females (Bhana, et al., 2019). Lastly, participants reported that male teachers should be evaluated on merit, qualifications, competence, and/or experience – not on gender. Teaching young children thus requires a balance of stereotypically feminine and masculine traits: the teacher must be caring, yet authoritative, a listener, and a leader. Schools also benefit when teachers reflect the interests, needs and backgrounds of their students. One important way this can be done is by including both male and female teachers.

The author has read and agreed to the published version of the manuscript.

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PREDICTION OF VOLUNTARY EMPLOYEE TURNOVER INTENTION USING THE GREY RELATIONAL K-NN MACHINE LEARNING MODEL

The aim of the article is to develop a new method for predicting voluntary employee turnover intention based on the Grey Relational k-NN grey machine learning model. The research problem addressed in this study is the need to predict employee turnover intention when HR data are subjective, imprecise, and often expressed through linguistic assessments rather than precise numerical measures. This method combines the core concept of grey systems theory – grey numbers – with the popular k-nearest neighbors machine learning algorithm. The proposed solution enriches machine learning algorithms with tools that enable modeling the uncertainty characteristic of management sciences (through the use of grey numbers). The developed method can serve as an effective decision support tool for HR department managers. The article includes a literature review on voluntary employee turnover intention, presents the research methods applied - Grey Relational Analysis and the k-NN algorithm – and describes the results of the conducted studies on employee turnover intention using the developed Grey Relational k-NN method.

Keywords: voluntary employee turnover intention, machine learning, grey systems theory, k-nearest neighbors algorithm.

1. INTRODUCTION

Voluntary employee turnover intention constitutes a significant area of interest for both human resource management practitioners and management science theorists. Contemporary organizations operate in a dynamically changing environment, where retaining a skilled workforce is crucial for maintaining competitiveness and operational continuity. High employee turnover, especially when initiated voluntarily by employees, can lead to considerable costs, the loss of organizational knowledge, and a decline in team morale. Therefore, predicting turnover intentions, understanding the causes of voluntary departures, and implementing effective strategies to reduce them are essential for the long-term success of enterprises.

The objective of this article is to develop a new method for predicting voluntary employee turnover intention based on the Grey Relational k-NN grey machine learning

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model. This method combines the core concept of grey systems theory – grey numbers – with the popular k-nearest neighbors machine learning algorithm. This enables the use of a method that merges the advantages of machine learning (noted for its high effectiveness with large datasets) with the strengths of grey systems theory (where grey numbers allow for modeling uncertainty typical of social sciences). To achieve this goal, a narrative literature review was conducted for the theoretical part, while the empirical part utilized methods of Grey Relational Analysis and the k-nearest neighbors algorithm.

The literature review presents key theories related to the issue of voluntary employee turnover. The following section introduces the original Grey Relational k-NN method for predicting voluntary employee departures within organizations. The method is based, on the one hand, on the popular supervised clustering algorithm k-nearest neighbors, and on the other hand, on Grey Relational Analysis techniques that enable the use of grey numbers – a construct that effectively models uncertainty characteristic of the social sciences. Subsequently, the article presents the research results regarding the use of the Grey Relational k-NN method for predicting turnover intentions on a purposive sample of 1,030 employees (using the Ariadna research panel). The article concludes with a summary highlighting the novelty and theoretical contribution of the study's findings, practical applications, methodological limitations, and directions for future research.

2. LITERATURE REVIEW

Voluntary employee turnover occurs when the decision to leave an organization is made by the employee rather than the employer (Nowak, 2024a). For organizations, it entails recruitment and training costs, decreased productivity, lowered morale, and loss of knowledge, with potential financial implications reaching several times the annual salary (O'Connell, Kung, 2007). From the employee's perspective, the decision is usually driven by the expectation of better working conditions, career advancement, or higher pay, although it also involves the risk of losing stability and the need to adapt (March, Simon, 1958). The issue of voluntary turnover is critical from a human resource management perspective, as 32% of employees in Poland and as many as 52% worldwide report an intention to leave their current job (Gallup Report 2025).

In the literature on management and occupational psychology, several complementary approaches exist to explain why employees voluntarily decide to leave an organization. Each of these frameworks emphasizes different mechanisms – from subjective dissatisfaction and assessments of market alternatives to rational calculations involving effort and reward, emotional ties, social comparisons, or sudden "shocks" that trigger the decision to leave (Nowak, 2024b).

March and Simon (1958) proposed that the decision to leave depends on two forces: the desirability of leaving the organization, i.e., the level of dissatisfaction with the current job, and the ease of movement, understood as the availability of attractive alternatives or the possession of relevant qualifications. When an employee strongly desires change and simultaneously sees realistic opportunities for a better job, the likelihood of leaving increases. Empirical studies have repeatedly confirmed that subjective satisfaction and perceived alternatives jointly explain a significant portion of turnover variability (Mowday, et al., 1982). Vroom (1964) argued that employees decide whether to stay or leave by evaluating whether their work effort will lead to expected outcomes (expectancy), whether these outcomes will bring desired rewards (instrumentality), and how much they value these rewards (valence). In the context of turnover, if an employee concludes that their

effort will not be adequately rewarded (e.g., lack of promotion or raise), motivation to stay decreases. An attractive external offer may shift the cost-benefit calculation, prompting a change, which Vroom interprets as a rational pursuit of personal gain.

Adams (1965) suggested that employees constantly compare their inputs (time, effort, skills) and outcomes (pay, recognition) to those of others. Persistent perceptions of inequality lead to a sense of injustice – both in distributive (outcomes) and procedural (decision-making processes) dimensions. Long-standing feelings of being treated unfairly are a strong motivator for corrective actions, including leaving the organization. Numerous cross-sectional and longitudinal studies confirm that low perceived fairness correlates with higher turnover intentions. The occurrence of voluntary turnover intentions is also linked to organizational commitment. Allen and Meyer (1991) distinguished three forms of commitment:

- affective – emotional attachment and identification with the organization,
- normative – a moral obligation toward the employer,
- continuance – a calculated assessment of the costs of leaving (loss of benefits, security).

Meta-analyses show that affective commitment most strongly counteracts voluntary turnover, while continuance commitment mainly keeps employees from leaving due to fear of economic or social losses (Panaccio et al., 2014). Normative commitment plays an intermediate role – enhancing loyalty but less strongly than emotional bonds. Kristof-Brown et al. (2005), in another meta-analysis, demonstrated that person – organization fit (alignment of values, goals, and work style with organizational culture) positively influences satisfaction and commitment while negatively affecting turnover intentions and actual departures. Similarly, person – job fit (alignment of skills with job demands) reduces frustration and burnout, lowering the likelihood of turnover.

Lee and Mitchell (1994) noted that turnover decisions may be triggered not only by prolonged dissatisfaction but also by sudden "shocks" – critical events such as a job offer, conflict with a supervisor, or major life change. Their model outlines several turnover paths in which employees confront new stimuli with their values and initial "images" of their careers, possibly leading to a quick decision to leave even in a context of relative satisfaction.

The final theory discussed is job embeddedness. Mitchell et al. (2001) highlighted factors that keep employees in place - the network of social ties within the organization and community, the degree of fit with work and life conditions, and the cost of leaving (loss of relationships, stability, and benefits). Employees strongly "embedded" in their jobs exhibit low turnover tendencies, even when experiencing moderate dissatisfaction, making job embeddedness a valuable complement to traditional motivational models.

Contemporary research on voluntary turnover focuses on identifying causative factors and on methods for predicting and preventing turnover (Nowak, 2024c). One rapidly developing area is the study of turnover intention as a precursor to actual departure. Turnover intention is typically defined as the subjective probability or intention of an employee to leave their current job within a foreseeable time (Asri, 2022). Dozens of studies have confirmed that expressed intention is the strongest single predictor of actual resignation – more so than satisfaction level or tenure (Asri, 2022). A meta-analysis by Griffeth, Hom, and Gaertner (2000) found that the correlation between turnover intention and actual departure is significant and strong (relative to other variables), making it a useful "early warning signal" for employers. As a result, much research focuses on identifying

the factors shaping turnover intentions to enable proactive management of workforce turnover.

Prior research on turnover prediction has frequently used classical statistical and machine learning methods, including logistic regression, decision trees, random forests, support vector machines, neural networks and k-NN. These approaches are valuable for classification, but they usually require subjective survey responses to be converted into precise numerical values. This may reduce the visibility of uncertainty inherent in employee perceptions. The present study therefore applies Grey Relational k-NN, not as a replacement for these models, but as an alternative approach designed for HR data expressed through linguistic and interval-based assessments.

3. METHODOLOGY

Grey Relational k-NN is a supervised classification procedure in which similarity between employees is measured by grey relational grades rather than by a standard distance calculated only on crisp values. In this study, grey numbers are used instead of fuzzy numbers because the survey responses can be represented as simple intervals without defining an additional membership function. This is important in HR research, where employees often express assessments in ordinal or linguistic categories and the researcher cannot precisely determine the degree of membership in each category. The method therefore keeps the uncertainty structure simple and transparent while remaining compatible with the k-NN voting logic. The procedure for applying the Grey Relational k-NN method involves the use of the following concepts:

1. Grey number:

$$\bar{x}_{i,j} = \left[a_{i,j}, b_{i,j}\right], \qquad j = 1, \ldots, p$$

Where:

i – object (employee),
j – feature (explanatory variable),
$a_{i,j}$ – lower bound of the grey numer,
$b_{i,j}$ – upper bound of the grey numer.

2. Hausdorff distance metric: For two objects: $\bar{x}_q$ and $\bar{x}_i$, the Hausdorff distance for each feature j can be calculated as:

$$\Delta_{i,j} = d_H\left(\bar{x}_{q,j}, \bar{x}_{i,j}\right) = \max(\left|a_{q,j} - a_{i,j}\right|, \left|b_{q,j} - b_{i,j}\right|)$$

3. Global minimum/maximum of the Hausdorff distance:
They are determined on the training set according to the following formulas:

$$\Delta_{\min} = \min_{i,j} \Delta_{i,j} \qquad \Delta_{\max} = \max_{i,j} \Delta_{i,j}$$

4. Distinguishing coefficient

$$\rho \in (0,1)$$

5. Grey relational coefficient

$$\xi_{i,j} = \frac{\Delta_{\min} + \rho^* \Delta_{\max}}{\Delta_{i,j} + \rho^* \Delta_{\max}}$$

6. Grey relational grade

For each sample i the summation over features is performed according to the formula:

$$\Gamma_i = \sum_{j=1}^{p} \xi_{i,j}$$

The grey relational grade constitutes the final similarity measure.

The Grey Relational k-NN method can be presented as a procedure consisting of seven steps.

Step 1. Development of a database for grey machine learning (Grey Relational k-NN) for predicting voluntary employee turnover intention.

Each object (employee) i has p features in the form of grey numbers with the following structure:

$$\bar{x}_{i,j} = [a_{i,j}, b_{i,j}], \qquad j = 1, \dots, p$$

The compiled database should contain no fewer than 50 objects (employees). Each object should be labeled as follows:

- 1 – employee exhibiting turnover intention,
- 0 – employee not exhibiting turnover intention.

In this step, it is also necessary to rescale the data (if required). The individual criteria are expressed on different grey number scales. To ensure comparability of the distance metrics, they should be rescaled using the min-max method.

Step 2. Splitting the database into two sets – training set and test set.

Splitting the database into a training set and a test set is a standard procedure in machine learning. In the presented Grey Relational k-NN method, it is recommended to use a common split ratio - 75% of the data for training and 25% for testing.

Step 3. Preparation of global metrics.

In the training set:

1. Calculate all Δ values for all pairs of records m,n and all features j:

$$\Delta_{i,j}^{(m,n)} = d_H\left(\bar{x}_j^{(m)}, \bar{x}_j^{(n)}\right) = \max\left(\left|a_j^{(m)} - a_j^{(n)}\right|, \left|b_j^{(m)} - b_j^{(n)}\right|\right)$$

2. Determination of $\Delta_{\min}$ and $\Delta_{\max}$:

$$\Delta_{\min} = \min_{i,j,m,n} \Delta_{i,j}^{(m,n)}, \qquad \Delta_{\max} = \max_{i,j,m,n} \Delta_{i,j}^{(m,n)},$$

Step 4. Specification of the analyzed hyperparameters of the machine learning process and cross-validation assumptions

The proposed method assumes an analysis of the following hyperparameters of the grey-knn machine learning process:

1. Selection of the range of verified hyperparameters:
   - for the parameter $k \in \{1,3,5,7,9\}$
   - for the parameter $\rho \in \{0{,}2; 0{,}5; 0{,}8\}$
2. Assumptions related to the cross-validation process:
   - the training set is divided into 5 equal subsets,
   - for each pair (k and ρ):
     - for each fold:

- train the model on the remaining 4 folds,
- compute Γ_i and predict the label on the validation fold,
- calculate classification quality metrics (e.g., accuracy),

  - compute the average metric (e.g., accuracy) over 5 folds (for each possible combination of k and ρ values),

3. Selection of the combination (k^*, ρ^*) with the best average prediction quality metric.

Step 5. Training the model with optimal hyperparameters.
Execution of the training process on the training set:

- calculation of $\Delta_{\min}$ and $\Delta_{\max}$ for all pairs of grey numbers,
- computation of the distance metric for these pairs according to the Hausdorff criterion,
- calculation of grey relational coefficients,
- calculation of grey relational degrees,
- weighting of neighbors,
- label assignment.

Step 6. Evaluation of the best Grey Relational k-NN model on the test dataset.
Calculation of the final prediction quality metrics of the optimal model on the test set (with cross-validation mechanism).
Step 7. Predicting churn intention for new data.
In this step, for a new employee $(\bar{x}_q)$ the following actions are performed:

1. Calculation of $\Delta_{i,j}$ with respect to each training sample i according to the formula:

$$\Delta_{i,j} = d_H(\bar{x}_{q,j}, \bar{x}_{i,j})$$

2. Calculation of the grey relational coefficient according to the formula:

$$\xi_{i,j} = \frac{\Delta_{\min} + \rho^* \Delta_{\max}}{\Delta_{i,j} + \rho^* \Delta_{\max}}$$

3. Calculation of the grey relational degree according to the formula:

$$\Gamma_i = \sum_{j=1}^{p} \xi_{i,j}$$

4. Majority voting based on the computed Γ_i values – based on this, the label is determined: the employee shows an intention to leave or does not.

4. RESULTS

Step 1. Development of a database for grey machine learning (Grey Relational k-NN) for predicting voluntary employee turnover intention.

The empirical data were collected using an online survey administered through the Ariadna research panel between August 1 and September 30, 2024. The purposive sample included 1,030 economically active employees who declared current employment at the time of the survey and completed the questionnaire. The sample size was determined by panel availability and by the need to obtain a dataset substantially larger than the minimum required for the proposed grey k-NN procedure, enabling stable training/test splitting and

repeated resampling. The study does not claim statistical representativeness for all employees in Poland; rather, it provides an empirical test dataset for assessing the proposed classification method. In addition to demographic questions, respondents evaluated 27 work-related variables using linguistic categories transformed into grey number intervals, as presented in Table 1.

Table 1. Variables influencing turnover intention along with the rating scales

Variable	Name	Scale for the variable				
		Attribute evaluation				
		very poor	poor	average	good	very good
x_1	salary	[0.0; 0.2]	[0.2; 0.4]	[0.4; 0.6]	[0.6; 0.8]	[0.8; 1.0]
x_2	job satisfaction	[0.0; 0.2]	[0.2; 0.4]	[0.4; 0.6]	[0.6; 0.8]	[0.8; 1.0]
x_3	sense of fairness	[0.0; 0.2]	[0.2; 0.4]	[0.4; 0.6]	[0.6; 0.8]	[0.8; 1.0]
x_4	promotion opportunities	[0.0; 0.2]	[0.2; 0.4]	[0.4; 0.6]	[0.6; 0.8]	[0.8; 1.0]
x_5	professional development opportunities	[0.0; 0.2]	[0.2; 0.4]	[0.4; 0.6]	[0.6; 0.8]	[0.8; 1.0]
x_6	work performance	[0.0; 0.2]	[0.2; 0.4]	[0.4; 0.6]	[0.6; 0.8]	[0.8; 1.0]
x_7	working conditions	[0.0; 0.2]	[0.2; 0.4]	[0.4; 0.6]	[0.6; 0.8]	[0.8; 1.0]
x_8	team atmosphere	[0.0; 0.2]	[0.2; 0.4]	[0.4; 0.6]	[0.6; 0.8]	[0.8; 1.0]
x_9	recognition and rewards	[0.0; 0.2]	[0.2; 0.4]	[0.4; 0.6]	[0.6; 0.8]	[0.8; 1.0]
x_{10}	relationships with supervisors	[0.0; 0.2]	[0.2; 0.4]	[0.4; 0.6]	[0.6; 0.8]	[0.8; 1.0]
x_{11}	job stability	[0.0; 0.2]	[0.2; 0.4]	[0.4; 0.6]	[0.6; 0.8]	[0.8; 1.0]
x_{12}	communication within the company	[0.0; 0.2]	[0.2; 0.4]	[0.4; 0.6]	[0.6; 0.8]	[0.8; 1.0]
x_{13}	work-life balance	[0.0; 0.2]	[0.2; 0.4]	[0.4; 0.6]	[0.6; 0.8]	[0.8; 1.0]
x_{14}	independence at work	[0.0; 0.2]	[0.2; 0.4]	[0.4; 0.6]	[0.6; 0.8]	[0.8; 1.0]
x_{15}	level of autonomy at work	[0.0; 0.2]	[0.2; 0.4]	[0.4; 0.6]	[0.6; 0.8]	[0.8; 1.0]
x_{16}	job responsibility	[0.0; 0.2]	[0.2; 0.4]	[0.4; 0.6]	[0.6; 0.8]	[0.8; 1.0]
x_{17}	work engagement	[0.0; 0.2]	[0.2; 0.4]	[0.4; 0.6]	[0.6; 0.8]	[0.8; 1.0]
x_{18}	remote work availability	[0.0; 0.2]	[0.2; 0.4]	[0.4; 0.6]	[0.6; 0.8]	[0.8; 1.0]
x_{19}	flexible working hours	[0.0; 0.2]	[0.2; 0.4]	[0.4; 0.6]	[0.6; 0.8]	[0.8; 1.0]
x_{20}	sense of burnout	[0.0; 0.2]	[0.2; 0.4]	[0.4; 0.6]	[0.6; 0.8]	[0.8; 1.0]
x_{21}	workload	[0.0; 0.2]	[0.2; 0.4]	[0.4; 0.6]	[0.6; 0.8]	[0.8; 1.0]
x_{22}	commuting time	[0.0; 0.2]	[0.2; 0.4]	[0.4; 0.6]	[0.6; 0.8]	[0.8; 1.0]
x_{23}	recognition at work	[0.0; 0.2]	[0.2; 0.4]	[0.4; 0.6]	[0.6; 0.8]	[0.8; 1.0]
x_{24}	organizational management	[0.0; 0.2]	[0.2; 0.4]	[0.4; 0.6]	[0.6; 0.8]	[0.8; 1.0]
x_{25}	job monotony	[0.0; 0.2]	[0.2; 0.4]	[0.4; 0.6]	[0.6; 0.8]	[0.8; 1.0]
x_{26}	employer reputation	[0.0; 0.2]	[0.2; 0.4]	[0.4; 0.6]	[0.6; 0.8]	[0.8; 1.0]
x_{27}	organizational culture	[0.0; 0.2]	[0.2; 0.4]	[0.4; 0.6]	[0.6; 0.8]	[0.8; 1.0]

Source: Author's own work.

The 27 variables operationalize the main theoretical mechanisms discussed in the literature review (Nowak, 2025). Pay, promotion and development opportunities refer to expectancy and reward assessments; job satisfaction, fairness and supervisor relations capture dissatisfaction and equity mechanisms; organizational culture, employer reputation and management quality refer to person-organization fit; engagement, stability and workplace relationships reflect commitment and embeddedness; while workload, burnout, work-life balance, commuting time and flexibility represent work strain and retention conditions. Thus, the variables are not treated as an atheoretical list, but as measurable proxies of turnover drivers identified in prior research.

Step 2. Splitting the database into two sets – training and test sets.

To prepare the data for the machine learning process, a random split was performed to divide it into two subsets: training and test sets. Both sets contain observations described by features (variables) and their corresponding classes (labels). The training set includes 750 examples, which accounts for 75% of the total data, while the test set consists of the remaining 250 records (25%). The data split was carried out using the train_test_split function from the scikit-learn package, which is used to implement machine learning algorithms in the Python environment.

Step 3. Preparation of global metrics.

In this step, all Δ values were calculated for all pairs of records m,n and all features j. Table 2 presents sample Δ values for a randomly selected employee in relation to selected objects from the database.

Table 2. Hausdorff distances for a random employee relative to selected objects from the database

	X_1	X_2	X_3	…	X_{25}	X_{26}	X_{27}
Employee 1	0.2	0.0	0.2	…	0.2	0.4	0.6
Employee 2	0.6	0.2	0.4	…	0.2	0.4	0.4
Employee 3	0.0	0.2	0.2	…	0.2	0.2	0.0
….	…	…	…	…	…	…	…
Employee 1028	0.6	0.2	0.6	…	0.4	0.2	0.6
Employee 1029	0.2	0.4	0.0	…	0.2	0.2	0.4
Employee 1030	0.0	0.0	0.0	…	0.0	0.2	0.2

Source: Author's own work.

Next, the following values were determined: Δ_{min}= 0.00 and Δ_{max} = 0,80.

Step 4. Specification of the analyzed hyperparameters of the machine learning process and cross-validation assumptions

In this step, the machine learning process was conducted on the training set for different hyperparameters. Table 3 presents the results of the training process using the Grey Relational k-NN method on the training set for various values of the parameters k and ρ in the cross-validation procedure.

Table 3. Results of the training process for predicting turnover intention using the Grey Relational k-NN method on the training set for different k and ρ parameters

k	ρ	Average accuracy value
1	0.2	0.8800
1	0.5	0.8800
1	0.8	0.8800
3	0.2	0.8933
3	0.5	0.9067
3	0.8	0.9067
5	0.2	0.8400
5	0.5	0.8667
5	0.8	0.8667
7	0.2	0.8267
7	0.5	0.8533
7	0.8	0.8533
9	0.2	0.8000
9	0.5	0.8000
9	0.8	0.8000

Source: Author's own work.

The best results were achieved for the parameters $k = 3$ and $\rho = 0{,}5$.

Step 5. Training the model with optimal hyperparameters

The Grey Relational k-NN model was trained on the training set using the optimal hyperparameters selected in Step 4 (k = 3, ρ = 0.5).

Step 6. Evaluation of the best Grey Relational k-NN model on the test dataset

The model was then evaluated on the test set. To assess the variability of its performance, the procedure was repeated 100 times with random test-set samplings. Figure 1 presents the distribution of accuracy values, together with their mean and standard deviation.

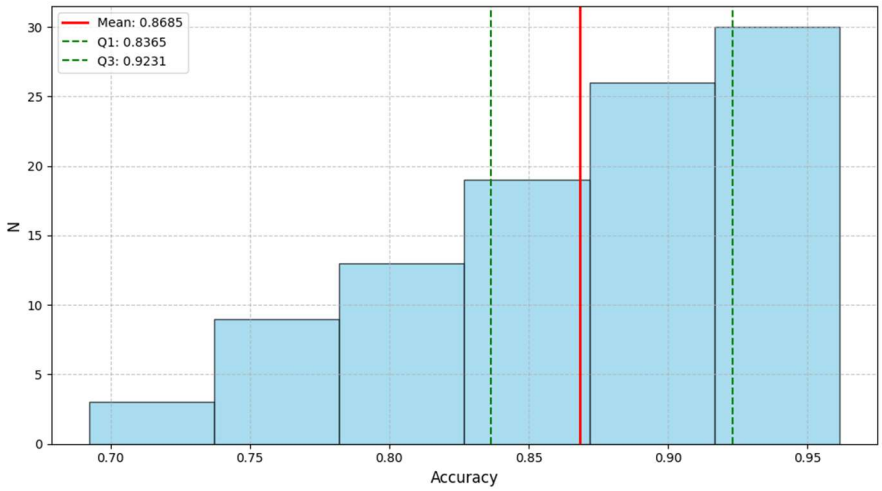


Figure 1. Histogram of the accuracy metric for the Grey Relational k-NN model

Source: Author's own work.

It turned out that the effectiveness of the developed Grey Relational k-NN method in predicting voluntary turnover intention on the test set (as a result of averaging the outcomes from 100 random test set samplings) is 86.85%, with a standard deviation of 0.0649, which indicates the model's stability and high performance. The obtained result should not be interpreted as evidence that the proposed method is universally superior to other machine learning algorithms. Its main advantage lies in the way it represents uncertainty in survey-based HR data. Standard classifiers, such as logistic regression, decision trees, random forests, support vector machines or classical k-NN, usually require the transformation of linguistic responses into crisp numerical values. In contrast, the Grey Relational k-NN method preserves interval information by representing employee assessments as grey numbers. This makes it particularly useful when the aim is not only classification accuracy, but also retaining the uncertainty inherent in subjective evaluations of work-related conditions.

Step 7. Predicting turnover intention for new data

For a sample new employee, the following actions were performed:

1. $\Delta_{i,j}$ was calculated with respect to each training sample *ii*i, and the results are presented in Table 4.

Table 4. Hausdorff distances for the analyzed employee relative to selected objects from the database

	X_1	X_2	X_3	…	X_{25}	X_{26}	X_{27}
Employee 1	0.0	0.2	0.0	…	0.4	0.2	0.4
Employee 2	0.4	0.0	0.2	…	0.0	0.2	0.2
Employee 3	0.2	0.0	0.0	…	0.0	0.0	0.2
….	…	…	…	…	…	…	…
Employee 1028	0.4	0.4	0.4	…	0.6	0.0	0.4
Employee 1029	0.0	0.6	0.2	…	0.0	0.0	0.2
Employee 1030	0.2	0.2	0.2	…	0.2	0.0	0.0

Source: Author's own work.

2. Calculation of the grey relational coefficient $(\xi_{i,j})$ (Table 5)

Table 5. Grey relational coefficients for the analyzed employee relative to selected objects from the database

	X_1	X_2	X_3	…	X_{25}	X_{26}	X_{27}
Employee 1	1.00	0.67	1.00	…	1.00	1.00	0.67
Employee 2	0.50	1.00	0.67	…	1.00	1.00	1.00
Employee 3	0.67	1.00	1.00	…	0.40	0.50	0.67
….	…	…	…	…	…	…	…
Employee 1028	0.50	0.50	0.50	…	0.40	1.00	0.50
Employee 1029	1.00	0.40	0.67	…	1.00	1.00	0.67
Employee 1030	0.67	0.67	0.67	…	0.67	1.00	1.00

Source: Author's own work.

3. Calculation of the grey relational degree Γ_i (Table 6):

Table 6. Grey relational degrees for the analyzed employee relative to selected objects from the database

	Γ_i	Label
Employee 1	18.667	1
Employee 2	20.133	1
Employee 3	20.500	0
….	…	…
Employee 1028	15.033	1
Employee 1029	20.90	1
Employee 1030	18.567	0

Source: Author's own work.

4. Majority voting based on the computed Γ_i values – determination of the label: the employee shows or does not show an intention to leave.

The highest grey relational degrees were observed for the following training set instances (for hyperparameters $k = 3$ and $\rho = 0{,}5$):

1. Employee 286 – Γ_i=*21.833*; label = 0 (no intention to leave)
2. Employee 333 – Γ_i=*21.167*; label = 0 (no intention to leave)
3. Employee 589 – Γ_i=*20.900;* label = 1 (intention to leave)

Among the three nearest neighbors, two do not show an intention to leave. Therefore, the employee under analysis is also classified as not showing an intention to leave.

5. CONCLUSIONS

The analysis contributes to human resource management and computational social science by combining k-NN with grey systems theory for the classification of voluntary turnover intention. The obtained results indicate that the method can predict self-reported turnover intention with high test-set accuracy, averaged over repeated resampling, while preserving the interval uncertainty of linguistic assessments. However, the study does not verify subsequent actual resignations; therefore, the findings should be interpreted as prediction of turnover intention, which the literature treats as an early warning indicator, rather than as prediction of actual turnover events. In practice, the model may support HR managers in identifying employees whose declared attitudes resemble profiles associated with leaving intention, but it should be combined with managerial diagnosis and longitudinal HR data. The main limitations are the purposive sample, the use of an author-developed survey instrument, and the lack of longitudinal information on whether respondents actually left their organizations after the survey. Future research should validate the model on organizational datasets containing actual turnover records, compare it with a broader set of predictive algorithms, and test its usefulness across industries and national contexts.

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TECHNOSTRESS IN ACADEMIA AMONG OLDER SCHOLARS: THE STATE OF THE ART BASED ON A SCOPING REVIEW

This paper uses a scoping review to examine technostress among older academics, focusing on the technological tools causing distress, associated health and educational challenges, and coping strategies. Following the PRISMA Protocol, five databases (Web of Science, Scopus, PubMed, ProQuest, IEEE) were searched, resulting in 27 papers for template analysis and thematic coding. An inductive approach enabled iterative theme refinement. Four technology categories – communication, administrative, research, and mobile – were linked to technostress. Challenges include strained relationships, digital threats, role ambiguity, time pressure, and health issues. Despite these, older academics employ effective coping strategies, such as leveraging technology for teaching, fostering supportive environments, flexible schedules, and advanced communication tools. The findings highlight the importance of balancing technological demands with individual well-being and provide actionable recommendations for institutions to support older academics in managing technostress effectively.

Keywords: technostress, older academics, digitalization, academia.

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1. INTRODUCTION

The "digital university" is the fourth stage of higher education institution (HEI) transformation, founded on disruptive innovations and communication technologies that radically transform the practice of higher education (Sulkowski, 2023). The percentage of users of Information and Communication Technologies (ICTs) among all academic workers significantly increased during the COVID-19 pandemic (Alvarez-Risco et al., 2021; Sun et al., 2020; World Economic Forum, 2022). Universities were suddenly forced into remote teaching and learning (Kulikowski et al., 2021), using multiple technologies. While these tools offer many benefits (Boyer-Davis, 2020), they can also lead to numerous disadvantages for users, including technostress.

Technostress is a multidimensional phenomenon defined as computer anxiety, technophobia (Khasawneh, 2018), digital anxiety (Jamaludin et al., 2023), ICT anxiety (Hsieh et al., 2020), digital stress (Rahul et al., 2017), misfit between a person and the technological environment (Wang, Li, 2019) and maladaptive disorder that originates from and is aggravated by an inability to adapt to or cope with new technologies in a healthy way (Brod, 1984). First reported as a disease, technostress was later described as the adverse effects that technology has on the mind and body of a user (Weil, Rosen, 1997). Further research delivered more nuanced and specific dimensions of technostress, like techno-overload, techno-invasion, techno-complexity, techno-insecurity, and techno-uncertainty (Tarafdar et al., 2007).

Studies in technostress have focused on various employees, such as knowledge workers (Cadieux et al., 2021), health professionals (Golz et al., 2021),information technology(IT) specialists (Satpathy et al., 2021). Some studies focused on senior workers as internet users (Fattori et al., 2024; Nimrod, 2017). However, the impact of digital technologies on the quality of working life among older workers is currently under-researched (Górny et al., 2017; Nadeljko et al., 2023). This issue is particularly significant due to the rising proportion of older workers in the global workforce (EUROFUND, 2023). Given the dynamic changes consisting of learning and teaching via ICT boosted by COVID-19, technostress should be of interest for HEIs also. As digital technologies become more prevalent in higher education, some academics may face challenges which are influenced also by organizational and individual factors rather than age alone. However, limited research has investigated the technology-induced stress experienced by older academics (Rasticova et al., 2022).

The purpose of this paper is threefold. First, it aims to have an in-depth analysis of the literature using the rigorous method of scoping review to synthesize the current state of evidence regarding technostress among older academics. Secondly, it offers a comprehensive and in-depth content analysis regarding three research questions: *RQ1. What kind of technological tools are associated with distress among older academics? RQ2: What types of health and educational challenges do older academics experience because of using various technologies? RQ3: How do older academics cope with the difficulties caused by technology?* Thirdly, it provides recommendations for coping with technostress extracted from the eligible papers in this scoping review.

Our study offers valuable opportunities to refine existing theories of aging (i.e., cognitive aging theory) and coping with stress (i.e., transactional theory of stress). The findings can contribute to the development of Person-Environment Fit theory by identifying mismatches between older academics' technological skills and the increasing

demands of digital tools in academia. By integrating insights from this scoping review into theoretical models, researchers can better understand age-specific responses to technostress and develop targeted interventions to support older professionals in academia.

2. METHODOLOGY

2.1. Search strategy

The scoping review was conducted using PRISMA Protocol (Tricco et al., 2018) and the methodologies described by Arksey and O'Malley (2005) and Peters et al. (2022). The protocol was registered on Open Science Framework (Pivorienė et al., 2024). Inclusion and exclusion criteria concerning the period of publication, language, studied population, topic, and type of paper are presented in Table 1.

Table 1. Inclusion and exclusion criteria

Criterion	Inclusion	Exclusion
Period of publication	Published until October 2023	
Language	English	Non-English
Topic	Technostress/stress in higher education	Stress unrelated to technology
Studied population	Academics of older age (50+). The study must include at least one teacher in higher education aged over 50 years old.	Students in higher education or teachers in other educational institutions (e.g. secondary school teachers). Papers with no academic over 50 years old were excluded.
Type of paper	Peer-reviewed research papers	Conference proceedings, editorial notes, reviews, theoretical papers, grey literature

Source: developed by authors.

To identify potentially relevant papers, five bibliographic databases were searched in September-October 2023: Web of Science, Scopus, PubMed, ProQuest, and IEEE. As per inclusion citeria we adopted 50 years as the threshold because ageing and employment research commonly defines workers aged 50 and above as older workers. This approach is consistent with OECD analyses of older workers, whereas Eurostat's 55-64 category serves primarily as a statistical indicator for labour-market monitoring. The search strategies were drafted and refined through team discussion (Table 2). To ensure the search validation procedure, the search strategy for each database was tested by two team members. The final search results were exported into an Excel file.

Table 2. Search strategies

Data Source	Query used	Specific filters	Time of search
Web of Science	(”technostress” OR ”techno-stress” OR ”stress” OR ”strain” OR ”pressure” OR ”tension” OR ”anxiety” OR ”worry” OR ”distress” OR ”burden” OR ”discomfort” OR ”nervousness” OR ”unease” OR ”apprehension” OR ”agitation” OR ”anguish”) AND (”digital*” OR ”platform*” OR ”apps*” OR ”tech*” OR ”social media” OR ”chat” OR ”online*” OR ”telemedicine” OR ”cyber” OR ”virtual” OR ”computerized” OR ”computerised” OR ”electronic” OR ”ICT”) AND (”teach*” OR ”educator*” OR ”instructor*” OR ”professor*” OR ”tutor*” OR ”mentor*” OR ”academic*” OR ”lecturer*” OR ”trainer*” OR ”pedago*” OR ”master*” OR ”academ*”)	Period of publication English language Peer-reviewed	September 2023
Scopus			
PubMed			
ProQuest			
IEEE	(„stress”, digital and academ*)		October 2023

Source: developed by the authors based on the search strategies.

2.2. Selection of sources and critical appraisal

The team of six researchers discussed and developed a data selection and extraction tool in Excel. A pilot phase consisting of the screening of 50 randomized articles was done for validation. The screening consisted of two stages: 1. Titles and abstracts; 2. Full texts. The two-stage screening process was applied to ensure that all selected references met the eligibility criteria and could be used for data extraction. In both stages of screening, two independent screeners read the title, abstract, full text, and charted data into Excel. Divergent decisions were discussed firstly in pairs, and subsequently in the research team.

Based on the research questions, the team of researchers extracted these data items: Author(s), year, country; Purpose, location of the study, nationality of respondents, educational setting, target population, age group, description of the age group, gender, sample size, percentage of older workers; Research method(s), data collecting method(s), instrument used for investigating technostress, data analysis method(s), results of older age; Definition of technostress, technological tools, description of technology, faced challenges, description of challenges, taken actions, theoretical background for data analysis, recommendations, suggestions for further research, additional remarks. The process of selection is presented in Figure 1.

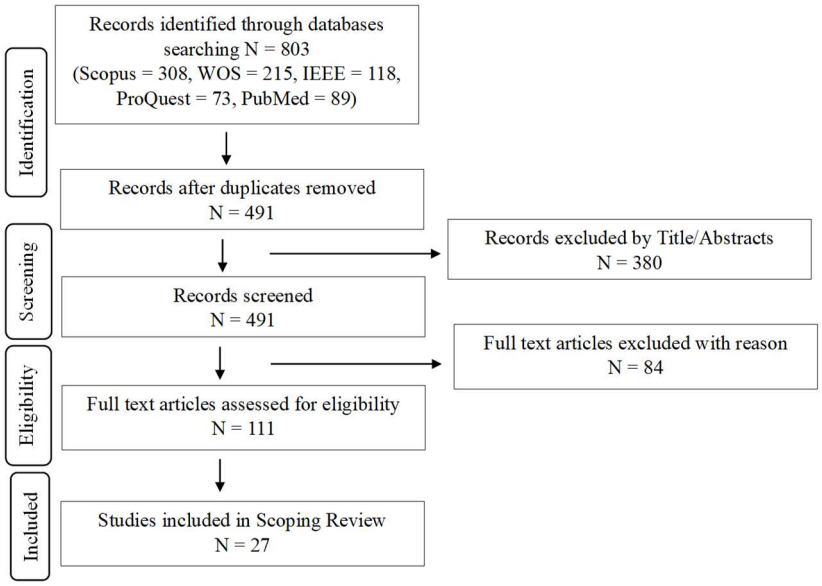


Figure 1. PRISMA protocol

Source: developd by the authors based on the search flow.

3. FINDINGS

The analytical approach used template analysis (King, 2012), and thematic coding (Braun, Clarke, 2022). Adopting an inductive approach, the analysis allowed iterative refinement of themes as researchers engaged with the data, enabling new insights to emerge. This method allowed for a structured organization of data while maintaining flexibility in coding template development, ensuring that themes were aligned with the research questions (Appendix 1). Besides themes, we also synthesized information regarding study characteristics, such as authors, country, type of population, age group, number of participants, type of method, data collection method, type of technostress, and type of technological tool.

3.1. Characteristics of studies

All studies include older academics and authors used age categories, age ranges, and mean age to describe them. There are 4 studies employed in China, 3 in Spain, 2 in Romania, 2 in India, 2 in Pakistan, 2 in Palestine, 2 in Jordan, and 2 in Malaysia. There is one study also in each of these countries: Portugal, Taiwan, Iraq, Egypt, Libya, Sultanate of Oman, Israel, Belgium, United Arab Emirates, USA, Brazil, Sri Lanka, Estonia, and Ukraine. The smallest number of participants is 14 people (García-González et al., 2020), and the highest number is 1813 (Truța et al., 2023). Seventeen studies use quantitative design, three use qualitative design, and two use mixed-method design. Of all, 26 studies included the impact of digital tools on the stress of academics and in one study this was not stated.

3.2. Research questions

3.2.1. What kind of technological tools are associated with distress among older academics?

The reviewed studies reveal a significant trend toward increased integration of ICTs in HEIs, driven by modernization agendas and recent events such as the COVID-19 pandemic(Cazan et al., 2024; Wang, Li, 2019). The rapid evolution of technology pressures older educators to continuously adapt (Cazan et al., 2024; Abilleira et al., 2021; Shaukat et al., 2022) which is reflected in their adoption of various ICT technologies for diverse academic purposes.

In the reviewed papers, four types of technologies related to work in HEI were studied: communication technologies, administrative and teaching technologies, research technologies, mobile technologies (Appendix 1).

Communication technologies (email, social media, collaboration tools) are vital for academic communication but can cause technostress (Truță et al., 2023). Perpetual connectivity leads to techno-invasion, blurring professional and personal boundaries (Dahabiyeh et al., 2022; Marrinhas et al., 2023). Information overload from emails, messages, and notifications pressures academics to maintain an active online presence (Chou,Chou, 2021; Wang, Li, 2019).Social media in academia may increase technostress, especially for older academics (Khlaif et al., 2023a). Expectations for prompt replies and ongoing involvement heighten stress and reduce well-being, as educators juggle time and focus with students' continuous access(Cameron et al., 2016).

Administrative and pedagogical technologies (LMS, VLEs) aim to enhance education but can generate technostress among older educators (Shaukat et al., 2022). Their complexity and frequent updates require ongoing learning and adaptability (Dahabiyeh et al., 2022; Wang et al., 2024). Rapid technological advances subject educators to perpetual technostress due to insufficient knowledge (Abilleira et al., 2021). Swift progression and complexity often elevate stress in older teaching professionals (Khlaif et al., 2023b). Transitioning to online instruction demands significant time investment for resource design and development(Bruggeman et al., 2022). Increased workloads from manual data entry and managing multiple sources add pressure (Siddiqui et al., 2023). The need to produce persuasive online content may lead to feelings of inadequacy and irritation, negatively affecting job satisfaction and commitment (Shaukat et al., 2022).

Research technologies (statistical software, databases, data analysis tools) are essential for advanced research but introduce unique stressors for older researchers (Abilleira et al., 2021). Their complexity and frequent updates can be overwhelming (Dahabiyeh et al., 2022; Siddiqui et al., 2023). The educator's role has shifted from knowledge transmitter to transformer, requiring integration of technology into teaching, which increases challenges in managing time and keeping up with new technologies and pedagogical methods (Shaukat et al., 2022). Researchers must continually update skills amid rapid technological changes, which can heighten anxiety and a sense of obsolescence, negatively impacting productivity and well-being (García-González et al., 2020). Mobile technologies (smartphones, tablets) offer flexibility but also contribute to technostress among older academics (Khlaif et al., 2023b). Constant accessibility leads to work-home conflict, blurring professional and personal boundaries (Wang et al., 2024). Online teaching and continuous availability pressures reduce time for personal matters, disrupting work-life balance and productivity. Users often sacrifice private time for work, feeling overwhelmed (Dahabiyeh et al., 2022). Technology's omnipresence creates expectations of constant

availability, exacerbating technostress and techno-invasion (Dahabiyeh et al., 2022; Khlaif et al.,2023b). These technologies also have psychological and physiological impacts, lowering satisfaction with learning experiences.

3.2.2. What types of health and educational challenges do older academics experience as a result of using various technologies?

Online work exposes older academics to diverse challenges in work, education, and health: student connections, colleague relationships, digital threats, role ambiguity, time pressure, support, work-family conflict, and health issues (Appendix 1). Kostikova et al. (2023) found depression, isolation, family danger, and lack of social life as key negative impacts of online education during wartime for Ukrainian academics. Online teaching offers both advantages and challenges: some academics report easier student interaction, while others note lack of informal contact, student distance, and privacy concerns (Bruggeman et al., 2022; Roy, 2020). Monitoring students in real time is harder online, complicating classroom management (Zhang et al., 2022). Poor student engagement lowers productivity, commitment, and satisfaction (Jena, 2015). Female professors may face emotional exhaustion if unable to shape student attitudes directly (García-González et al., 2020). Active student participation is crucial for effective online learning (Jamaludin et al., 2023), but expectations of 24/7 availability can be burdensome (Jena, 2015). Online teaching impacts colleague relationships: some find collaboration inspiring, others experience isolation and boundary issues Female academics may face uncertainty due to lack of direct communication with supervisors (García-González et al., 2020). Administrators' and colleagues' attitudes toward technology shape academics' technostress experiences(Khlaif et al., 2023a).Digital threats affect feedback, interaction, transparency, and flexibility (Bruggeman et al., 2022). Continuous ICT training is needed, but lack of prior training reduces control and autonomy (García-González et al., 2020). Fear of replacement by tech-savvy colleagues heightens exhaustion (Dahabiyeh et al., 2022).Rapid technological change requires constant adaptation and skill development (Jamaludin et al., 2023). Higher digital literacy lowers psychological distress (Maftei et al., 2023); limited skills increase anxiety (Khlaif et al., 2023a; Abilleira et al., 2021). Technostress is not always related to IT skills (Ibrahim et al., 2007). Many older professors still feel unprepared due to insufficient training (Pucinelli et al., 2022).

University professors face challenges in balancing multiple roles, including teaching, research, and administrative responsibilities (Bruggeman et al., 2022). Professors are expected to conduct research, secure funding, publish scientific articles, and mentor students, adding to their already demanding workload (Jena, 2015; Pucinelli et al., 2022). While online communication is often perceived positively, maintaining an equilibrium between educational duties and research activities remains problematic. Additionally, many older educators lack training in technical support, adding to their workload (Bruggeman et al., 2022). The cognitive demands of online teaching are significant, both qualitatively (requiring high intellectual effort) and quantitatively (due to high workloads and sustained attention). The mental fatigue caused by continuous work pressures can have serious implications for their cognitive and emotional well-being, reducing both efficiency and performance. A lack of autonomy further exacerbates stress, as rigid scheduling and bureaucratic evaluation systems dictate the pace of work, limiting flexibility and control over teaching practices (García-González et al., 2020).

Online education presents a double-edged effect regarding time management. Technological investments made during the transition to online teaching can lead to long-

term time savings, and the urgency of the crisis has accelerated the adoption of innovations. However, the initial design and preparation time for online courses is often insufficient, making the process more time-consuming for both older educators and students (Bruggeman et al., 2022). Another key stressor is the rigid deadlines associated with online teaching. This mode of instruction demands high cognitive and motivational effort while allowing limited flexibility. Time pressure arises when the available time to prepare and deliver content is insufficient to meet the required workload, leading to increased stress and decreased efficiency (García-González et al., 2020; Zhang et al., 2022). Support and resources play an important role in diminishing the technostress. Older faculty members appreciate institutional support, yet a clear vision for online education is often lacking, and more personalized assistance is needed to ensure smooth integration (Bruggeman et al., 2022). To successfully implement online teaching, internal (personal skills and competencies), external (technological tools and access), and organizational (institutional policies and support systems) resources are required (Jamaludin et al., 2023). While technology itself poses challenges, inefficient organizational policies regarding its use often intensify stress, affecting educators' well-being (Wang, Li, 2019). Adequate facilities and infrastructure play a crucial role in faculty acceptance of online teaching. Older academicians feel more confident and engaged when provided with well-equipped resources, whereas a lack of infrastructure can lead to feelings of inadequacy and resistance (Jamaludin et al., 2023) or to decreased job performance (Abilleira et al., 2021). Facilities and support services inspire lecturers to work (Gunasinghe,Nanayakkara, 2021), increasing their subjective well-being (Zhang et al., 2022).

The lack of a fixed schedule in online teaching is often linked to the time dynamics of the profession, where workload spikes, particularly during exams, lead to mental overload. This overload is especially burdensome for female professors, as it hinders their ability to maintain a work-life balance. The increased workload during peak periods, without additional time to manage it, can significantly impact female professors' motivation and exacerbate role conflict. These professors often feel pressured to extend their working hours into evenings and weekends, trying to juggle both work and family demands (García--González et al., 2020). Further findings indicate a significant gender difference in how academics experience workload, with female academics reporting more strain. This can be attributed to traditional gender roles, where women are expected to take on household duties in addition to their professional responsibilities, especially in regions with more conservative views (Khlaif et al., 2023a). In line with these findings, female professors were more likely to report that housework and childcare interfered with their teaching duties, a situation that was exacerbated during the pandemic (Pucinelli et al., 2022). Cultural and gendered expectations further compounded the difficulties faced by female faculty, as they were often responsible for household chores and family care while also teaching online. This dual responsibility led to significant stress and adverse effects, such as lack of family support, insufficient technology expertise, poor student engagement, and overwhelming preparation time, all contributing to the increased burden felt by female academics during the pandemic (Shaukat et al., 2022).

The reviewed articles do not focus extensively on physical health issues, however, several challenges were identified. Older academics working online face physical health challenges due to sedentarism, prolonged screen time, and inadequate ergonomic setups. Spending excessive time in front of a computer without breaks increases the risk of musculoskeletal disorders and visual fatigue. Furthermore, non-ergonomic workspaces and furniture, especially when working from home, exacerbate these issues (García-González

et al., 2020). The findings indicated an increase in psychological stress positively linked to vocal symptoms. Specifically, individuals with low prior psychological stress showed a weaker association between stress and vocal symptoms, whereas those with high prior psychological stress experienced a significantly stronger connection between the two (Besser et al., 2022). Gender differences in stress levels were evident, with female faculty members experiencing significantly higher stress than their male counterparts, although one study yielded contradictory results (Maftei et al, 2023). Women scored higher in five of eight stress measures, including nonwork activity, supervisor and coworker support, work hazards, and job stressors. Additionally, they reported more somatic health issues than male faculty. Employment status also played a role, as full-time faculty experienced significantly higher job stress and worse health outcomes compared to adjunct faculty (Cameron et al., 2016). Academics with pre-existing physical or mental health conditions reported higher burnout and technostress symptoms, indicating that prior health challenges intensify the negative effects of online work (Marrinhas et al., 2023). Additionally, the research shows that due to remote work, 42.1% of participants experienced worsened physical health and 26.3% reported deteriorated mental health. Married academics reported greater negative effects, though the difference was not statistically significant (Mosleh et al., 2022).

These findings highlight the multifaceted health risks associated with online academic work and emphasize the need for institutional support, ergonomic improvements, and mental health interventions to mitigate these challenges.

3.2.3. How do older academics cope with the difficulties caused by technology?

The integration of digital tools in higher education has brought some challenges for older faculty members. Understanding how they cope with these difficulties is critical for improving their general health and effectiveness at work. However, most reviewed studies provide recommendations for faculty members to deal with the difficulties caused by technology rather than detailing specific coping strategies.

A few articles mentioned that older academics' use of digital tools and resources helps control their workloads and reduce technostress. Faculty members who actively seek solutions for incorporating technology into teaching experience lower levels of negative technostress (Gil-Cordero et al., 2023). Lessened technostress among older educators was achieved by raising their awareness of data protection and online pedagogy (Chou, Chou, 2021). Increased digital literacy not only reduces technostress but also improves teaching effectiveness and occupational self-efficacy (Maftei et al., 2023). Comprehensive training for faculty members in various technologies and their integration in the pedagogical process is crucial for enhancing teacher proficiency and alleviating technostress (Abilleira et al., 2021). Specialized training and support for senior teachers, who face greater challenges in integrating information and communication technologies in their work, promote prosocial behaviours and foster teamwork(Wang, Li, 2019). Most of the studies suggest that universities provide training and support in using technological resources, set realistic expectations, and reduce workloads to help older lecturers deal with technostress (Bruggeman et al., 2022; Jena, 2015; Khlaif et al., 2023a; Marrinhas et al., 2023; Pucinelli et al., 2022; Siddiqui et al., 2023); For instance, Mosleh and colleagues (2022) recommended investing in online-related sessions and training for staff to stay updated on adequate pedagogical approaches using online technologies.

To address isolation and balance work with personal activities, faculty members have adapted their schedules and leveraged platforms such as smartphones for voice and text

messaging, as well as video conferencing capabilities (Cameron et al., 2016). This approach was beneficial for regular personal interactions and reduced the stress associated with immediate physical presence, contributing to overall job satisfaction. Flexible hours enabled older staff to practice better time management, with lower stress levels and improved work-life balance (Cameron et al., 2016).

Staying informed about new technological developments, avoiding resistance to change, and using stress-management techniques are recommended to minimize technostress (Jena, 2015). Furthermore, Dahabiyeh et al. (2022) propose that viewing technostress as an opportunity for personal growth can help faculty members integrate sudden changes in teaching methods with positive outcomes, thereby reducing the emotional and psychological distress. In Truta et al. (2023), collaboration between managers and HR specialists is deemed essential for implementing stress-reduction strategies and supporting employees in adapting to technological work procedures; hence, HR departments can play a pivotal role by defining programs that combat stress through health and mindfulness initiatives. Gil-Cordero et al. (2023) also suggested that managing rather than eliminating technostress is crucial, as moderate stress can enhance academic perceptions and mental well-being when coupled with proactive approaches to technology integration in classrooms. Balancing traditional methods with technological advancements is key to preventing overwhelming technological dominance in universities, while also considering gender differences in technology adoption (Gil-Cordero et al., 2023). Reinterpreting technostress as an opportunity and providing early mindset preparation and technology training were recommended as effective strategies to manage stress (Dahabiyeh et al., 2022). It was also recommended to use different resources and mindfulness techniques to overcome university teachers' stress: faith, feelings, socialization, imagination, thinking, physiological activity (Kostikova et al., 2023).

Effective management of organizational demands and the provision of appropriate resources were crucial in mitigating technostress in the reviewed articles. Creating a healthy work environment that fosters engagement in academic activities, physical exercise, and creative collaborations is important. Older faculty members were able to ease anxiety associated with online teaching by fostering a job environment with sufficient resources and lower demands, emphasizing the importance of improving subjective well-being to cope effectively with technological challenges (Zhang et al., 2022). In Gil-Cordero et al. (2023), institutions were recommended to raise awareness and implement mechanisms to support older faculty well-being, particularly post-COVID-19, where technological demands shifted behaviours. Flexible work schedules and advanced communication tools can help reduce stress levels and enhance overall job satisfaction (Besser et al., 2022).

Implementing gender-specific support is recommended to address psychosocial risks for university professors (García-González et al., 2020; Gil-Cordero et al., 2023; Pucinelli et al., 2022; Shaukat et al., 2022). Several studies suggested training programs that focus on the specific needs of women, but also on organizational changes, such as realistic adjustments to teaching loads and deadlines (García-González et al., 2020; Gil-Cordero et al., 2023; Pucinelli et al., 2022; Shaukat et al., 2022). Garcia-Gonzalez et al. (2020) recommended combining remote work with on-site work to help maintain social contact and prevent isolation. Similarly, Shaukat et al. (2022) recommended establishing virtual chat environments for female teachers to support each other during emergent situations like the COVID-19 pandemic, a measure that can enhance psychological flexibility and resilience.

The reviewed studies considered providing mental health support for faculty members, conducting regular audits, and monitoring service quality as essential in reducing technostress. Implementing comprehensive training and wellness programs to reduce stress and enhance the well-being of faculty members is widely recommended in the reviewed articles. These programs should focus on providing technical training, promoting mental health, and organizing stress-relief sessions (Besser et al., 2022; Gil-Cordero et al., 2023).

Gil-Cordero (2023) found that academics' perceptions of their mental health significantly influence their ability to manage technostress, thus faculty members with a more positive perception of their mental health tend to have a stronger academic self-perception and experience lower levels of stress. However, the same study mentions notable gender differences in the way positive mental health interacts with other factors (Gil-Cordero et al., 2023). Male academics generally reported higher positive mental health scores, indicating a more positive perception of their mental well-being compared to their female colleagues. In contrast, female academics exhibited a stronger correlation between positive mental health and organizational commitment, suggesting that their stress level is more contingent on institutional support and work environment (Gil-Cordero et al., 2023). Gunasinghe and Nanayakkara (2021) recommended recognizing individual differences (e.g., age and gender) in designing interventions to support faculty members struggling with technology use.

Offering psychological counselling is also considered to improve older academics' work-family balance and well-being during and after the pandemic (Shaukat et al., 2022). Additionally, reevaluating policies and plans for training and support was recommended as essential in minimizing the negative impact of technology enhancement.

Support from colleagues is also found to be essential for coping with technostress. Insufficient support can exacerbate stress levels, highlighting the need for robust social support systems within universities (Wang, Li, 2019). Fostering positive and inclusive workplace experiences can help faculty members navigate technological pressures more effectively (Gil-Cordero et al., 2023; Wang,Li, 2019). In addition, institutional commitment plays a key role, particularly for female academics, as they are more sensitive to changes in the organizational environment (Gil-Cordero et al., 2023). Engaging in physical activities and creative pursuits was recommended as helping academics to manage the emotional toll of technological challenges. This approach emphasizes the importance of improving subjective well-being to cope effectively with difficulties in online teaching and enhance overall academic performance (Zhang et al., 2022). Family members also can play a crucial role in helping academics manage the challenges posed by technology (Khlaif et al., 2023a; Wang,Li, 2019). In Wang et al. (2023), it was recommended that faculty members actively communicate with their family members because social support from home can buffer work-home conflict. The presence of a supportive social network, including family and friends, is critical in alleviating technostress (Kostikova et al., 2023).

The reviewed literature provides comprehensive recommendations for managing technostress among faculty members. These suggestions include strategies for understanding and addressing digital anxiety, fostering supportive organizational practices, enhancing mental health and well-being, leveraging social support and creative strategies, and improving digital literacy and continuous professional development (Appendix 1). These recommendations aim to create a balanced and effective approach to integrating technology in academic settings, ultimately enhancing the well-being and productivity of educators.

4. DISCUSSION

The findings from the scoping review align with broader literature on technostress among older academics. Our review identifies four distinct categories of technologies contributing to technostress among older academics: communication technologies, administrative and teaching technologies, research technologies, and mobile technologies.

It was confirmed in other studies that communication tools like email, video conferencing platforms (e.g., Zoom), and instant messaging apps essential for academic collaboration can lead to techno-overload and techno-invasion (Wang et al., 2024). Moreover, studies reveal that older academics often struggle with the constant connectivity and rapid pace of communication these tools demand. The expectation of being available 24/7 through communication technologies exacerbates stress levels, particularly among older users who may not adapt quickly to such demands (Agbu,Olubiyi, 2011). Additionally, the fear of inadequacy in using communication tools is more prevalent in older academics comparative to younger colleagues, as they are less familiar with digital-native practices (Wang et al., 2024). Technologies used for administrative tasks (e.g., learning management systems like Moodle) and teaching (e.g., virtual classrooms) critical for modern education can also be overwhelming. Older academics often report higher levels of techno-complexity when navigating these platforms, as they require frequent updates and advanced digital skills (Moorhouse, 2023). Specialized software for data analysis (e.g., SPSS, NVivo) or digital libraries which can be daunting for older researchers who may not have received formal training in these tools(Todd et al., 2020). A lack of institutional training programs further compounds this issue, leaving older researchers feeling alienated from technological advancements in their fields of research.

When working online and utilizing various technologies, older academics encounter a diverse array of challenges related to: connections with students, relationships with colleagues, digital threats, role ambiguity, time pressure, support and resources, work and family conflict, health challenges. It is aligned with other studies showing that the most problematic issues are time pressure, role ambiguity, and health challenges(Idris, 2011).

The integration of new technologies requires significant time to learn, adapt, and incorporate into existing workflows. This “double innovation” problem – understanding how technology works and then integrating it into teaching – adds to the already demanding schedules of older academics. Further, the shift to online work blurs traditional academic roles, creating confusion about responsibilities and duties in teaching, research, administrative duties, and now technology-related tasks (Johnson et al., 2016). Older adults are particularly vulnerable because of pre-existing health conditions or lower levels of digital literacy, with further implications for mental health such as anxiety or burnout (Fox,Felkey, 2014).

Research highlights several effective coping strategies that older faculty members employ to mitigate the negative effects of technostress: leveraging technology to enhance teaching and streamline administrative tasks, fostering a supportive and positive work environment, implementing adaptable work schedules, and embracing advanced communication tools. Among these strategies, leveraging technology and fostering a positive work environment appear to be the most impactful for reducing technostress.

According to studies grounded in Lazarus' stress theory, older workers are more likely to adopt problem-focused coping strategies over time, such as active engagement with technology. These strategies not only reduce strain but also enhance their ability to adapt to evolving technological demands(Hauk et al., 2019; Lazarus, Folkman, 1987). Studies

show also that social coping strategy like seeking help from colleagues or mentors, can mitigate feelings of isolation and inadequacy, which are common among older academics navigating unfamiliar technologies. The same authors noticed that using modern communication tools like video conferencing software or instant messaging platforms simplify older scholars' interactions and reduce barriers caused by physical distance or unfamiliarity with digital communication methods(Murray et al., 2022).

The interplay between age, coping strategies, and technostress reveals that older academics possess unique strengths – such as resilience and emotional regulation – that enable them to adopt functional coping mechanisms over time. However, institutional support remains crucial for maximizing the effectiveness of these strategies (Hauk et al., 2019).

Given the ongoing digitalization of higher education, technostress in academia represents an important and still evolving area of research.

5. CONCLUSION

The scoping review identifies four categories of technologies contributing to technostress among older academics: communication technologies, administrative and teaching technologies, research technologies, and mobile technologies. These tools, while essential for modern academic work, present significant challenges, including difficulties in maintaining connections with students, strained relationships with colleagues, digital threats, role ambiguity, time pressure, inadequate support and resources, work-family conflict, and health-related issues. Despite these challenges, older academics employ several effective coping strategies to mitigate the impact of technostress. These include leveraging technology to enhance teaching and streamline administrative tasks, fostering a supportive and positive work environment, adopting flexible work schedules to balance professional and personal responsibilities, and embracing advanced communication tools.

This study has some limitations. Firstly, we only included peer-reviewed papers written in English, which explains the shortage of papers in other languages. Their inclusion could have resulted in larger number of themes identifies. Nevertheless, approximately 90% of the scientific communication, including research papers are published in English (MacKenzie, 2015), therefore we consider having identified the relevant trends on the topic. Secondly, the eligible papers analysed all age groups, including teachers over 50 years old. Studies focusing on older academics only are scarce. However, when extracting the data we took into consideration this limitation of the studies and we selected the results applicable to our population of interest. Hence, we results are relevant for above 50 years old teachers in academia.

The scoping review highlights several key recommendations to help older academics manage technostress effectively. These strategies focus on addressing digital anxiety, fostering supportive organizational practices, enhancing mental health and well-being, leveraging social support and creative strategies, and improving digital literacy through continuous professional development.

Although this scoping review maps the existing literature, the heterogeneity of the included studies highlights the need for further empirical, qualitative, and mixed-method research to develop a deeper understanding of older academics' experiences across specific organizational and cultural contexts. Also more in-depth studies could investigate how technostress evolves over time among older academics as they adapt to new technologies. This could provide insights into whether coping strategies become more effective with

experience or if cumulative stress worsens over time. Research could explore how structured support systems – such as mentoring programs or dedicated IT assistance – impact the ability of older academics to manage technological demands. In broader sense to contribute more to theory of agism, comparative analyses between older academics and their younger counterparts could be investigated to identify age-specific challenges and coping mechanisms. This could help tailor interventions more effectively for different demographic groups.

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Appendix 1. Template of thematic analysis for research questions

Theme	Authors
RQ.1 Technological tools causing technostress	
Communication technologies	(Cameron et al., 2016; Cazan et al., 2024; Dahabiyeh et al., 2022; Khlaif et al., 2023a; Marrinhas et al., 2023; Wang & Li, 2019)
Administrative and pedagogical technologies	(Abilleira et al., 2021; Bruggeman et al., 2022; Dahabiyeh et al., 2022; Khlaif et al., 2023b; Shaukat et al., 2022; Siddiqui et al., 2023; Wang & Li, 2019)
Research technologies	(Abilleira et al., 2021; Dahabiyeh et al., 2022; García-González et al., 2020; Shaukat et al., 2022; Siddiqui et al., 2023)
Mobile technology	(Dahabiyeh et al., 2022; Khlaif et al., 2023a,b)

RQ2: Types of health and educational challenges	
Connection with students	(Bruggeman et al., 2022; García-González et al., 2020; Jamaludin et al., 2023; Jena, 2015; Zhang et al., 2022)
Relationship with colleagues	(Bruggeman et al., 2022; García-González et al., 2020; Khlaif et al., 2023b)
Digital threats	(Abilleira et al., 2021; Bruggeman et al., 2022; Dahabiyeh et al., 2022; García-González et al., 2020; Jamaludin et al., 2023; Khlaif et al., 2023b; Pucinelli et al., 2022)
Role ambiguity	(Bruggeman et al., 2022; García-González et al., 2020; Jena, 2015; Pucinelli et al., 2022)
Time pressure	(Bruggeman et al., 2022; García-González et al., 2020; Zhang et al., 2022)
Support and resources	(Abilleira et al., 2021; Bruggeman et al., 2022; Gunasinghe et al., 2021; Jamaludin et al., 2023; Wang & Li, 2019; Zhang et al., 2022)
Work and family conflict	(García-González et al., 2020; Khlaif et al., 2023a; Pucinelli et al., 2022; Shaukat et al., 2022; Wang et al., 2024)
Health challenges	(Besser et al., 2022; Cameron et al., 2016; García-González et al., 2020; Marrinhas et al., 2023; Mosleh et al., 2022)
RQ3. Coping strategies	
Utilizing to digital tools and resources	(Chou&Chou, 2021; Gil-Cordero et al., 2023)
Creating a supportive and positive job environment	(Gil-Cordero et al., 2023; Khlaif et al., 2023a; Wang & Li, 2019; Zhang et al., 2022)
Adopting flexible work schedules and advanced communication tools	(Cameron et al., 2016)
Recommendations	
Understanding and addressing digital anxiety	(Dahabiyeh et al., 2022; Gunasinghe &Nanayakkara, 2021; Jamaludin et al., 2023; Jena, 2015; Khlaif et al., 2023b; Truța et al., 2023)
Fostering supportive organizational practices	(Bruggeman et al., 2022; García-González et al., 2020; Gil-Cordero et al., 2023; Jena, 2015; Khlaif et al., 2023a; Marrinhas et al., 2023; Pucinelli et al., 2022; Shaukat et al., 2022; Siddiqui et al., 2023; Wang et al., 2023; Wang & Li, 2019)
Enhancing mental health and well-being	(Besser et al., 2022; Dahabiyeh et al., 2022; Gil-Cordero et al., 2023; Mosleh et al., 2022; Shaukat et al., 2022)
Leveraging social support and creative strategies	(Khlaif et al., 2023; Kostikova et al., 2023; Wang & Li, 2019; Zhang et al., 2022)
Improving digital literacy and continuous professional development	(Abilleira et al., 2021; Gunasinghe& Nanayakkara, 2021; Maftei et al., 2023; Shaukat et al., 2022; Wang & Li, 2019)

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DEVELOPMENT OF LOGISTICS IN THE CONTEXT OF THE DIGITAL REVOLUTION

The digital economy significantly influences the development of logistics. Global internet access has made the flow of data and goods seamless. This study analyzes the impact of modern technologies – such as cloud storage, IoT, robotisation, artificial intelligence, and digital twins – on warehousing and transportation. The paper defines the concept of the digital economy and examines practical implementations by DataConsult S.A. and Mecalux Ltd.

The findings indicate that the key benefits of digitalisation include increased precision and operational safety, alleviating monotonous, physical tasks, and reducing human exposure to hazards. The publication combines theory with practice, mapping out the direction of industry automation.

In the coming years, the Polish economy will face structural challenges. Rising labour costs and a shortage of manual workers will force investments in robotisation. Digitalisation is permeating all industries, proving that digital transformation in logistics has become a necessity.

Keywords: artificial intelligence, digital economy, digitalisation in logistics, modern technologies.

1. DIGITAL ECONOMY VS LOGISTICS

The digital economy is associated with the Internet economy and regarded as the era of network intelligence, as it connects intelligent machines and people through technology (Tapscott, 2014). The shape and size of key components of the evolving digital economy are significant, including e-commerce and, more broadly, the integration of computers and related technologies in the workplace. Equally important is the process through which companies develop and utilise advancements in IT and e-commerce. Changes in the structure and operation of markets are also evident, such as shifts in the distribution of goods and services and the nature of both international and domestic competition. The social and economic consequences of the IT revolution are noticeable, including the impact

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of IT investments on productivity and the transformation of population characteristics into primarily network users (Brynjolfsson, Kahin, 2002). The digital economy also means the integration of technology with economic and social activities carried out by people through the use of internet connections and related technologies. Achieving this requires appropriate infrastructure to support modern digital technologies, as well as devices used to access them, and applications and functions that ensure the efficient operation of businesses, institutions, and the public (Dahlman, Mealy, Wermelinger, 2016). As part of the 2030 Digital Decade Policy Programme, the European Commission annually develops a ranking for countries to monitor the evolving technological landscape. The purpose of this report is to summarise the methodology of the DESI (Digital Economy and Society Index) over the years and propose adjustments to better align the updated index with the new European digitalisation goals. Poland currently ranks 24th in the DESI ranking, having been in 21st place in 2016. In terms of individual dimensions, Poland is ranked 24th for Human Capital and Integration of Digital Technologies, 25th in Connectivity, and 22nd in Digital Public Services. As far as specific indicators are concerned, Poland performs above the EU average in only five areas: fixed broadband take-up with a minimum speed of 100 Mb/s, fibre-to-the-premises (FTTP) coverage, broadband price index, pre-filled forms, and open data. It is worth noting that Poland does not fall significantly behind the EU average in any indicator (How to Measure the Digital Decade, 2022).

In the context of logistics and logistical processes, the digital economy supports data integration and blurs the boundaries between product manufacturing, production factors, and the services provided. Additionally, physical labour is becoming increasingly automated, while intellectual work is growing more flexible due to the application of artificial intelligence. The digitalisation process has taken on a global and universal character (Śledziewska, Wołoch, 2020). New technologies influence processes in trade, such as enabling product certification and full verification, reducing language barriers, facilitating easier payments for purchased products, lowering compliance costs for customs regulations, expediting customs clearances, and advancing logistics and transportation technologies that support domestic and cross-border trade (World Trade Report, 2023).

2. SELECTED EXAMPLES Of MODERN DIGITAL SOLUTIONS IN LOGISTICS

The development of digitalisation in logistics is closely linked to digital transformation, specifically the technologies employed in the Fourth Industrial Revolution, which has given rise to Industry 4.0. These technologies include, among others, the automation and intelligent management of document flows within companies, as well as the organisation of operational processes. Key elements in logistics management in this context include (Digital Transformation in Logistics, 2021):

1. Cloud data storage,
2. The Internet of Things (IoT) along with the necessary devices,
3. Robotisation,
4. Artificial intelligence in logistics,
5. Simulation using digital twins.

Cloud solutions play a crucial role in the implementation of new digital technologies by providing space for databases, various applications, and other essential IT resources, as well as delivering computational power through internet-based platforms. Users are required to pay only for the resources they actually consume (Co to jest chmura obliczeniowa?, 2023). An increasing number of software programs for optimal warehouse management are now available on the market in the SaaS model (Software as a Service),

which can replace traditional on-premise versions (installed on a company's server). This approach allows for a significant reduction in initial investment costs required for implementing a Warehouse Management System (WMS), as it eliminates the need to purchase the entire technical infrastructure; instead, users pay monthly licensing fees (Transformacja cyfrowa w logistyce, 2021). From a technical perspective, a cloud solution combines two processing methods (Chojka, 2012):

1. Cluster computing (grid computing), which is based on parallel processing, involves connecting multiple servers into a cluster. This setup combines their computational power, resulting in a single structure with a very high processing capacity.
2. On-demand computing (service-based processing) utilises virtualisation and resource aggregation into so-called pools. In this model, the physical hardware (e.g., servers or storage) becomes irrelevant. Instead, resources such as storage space, computational power, or bandwidth are grouped into pools. When needed, virtual machines with specific parameters can be allocated from these pools.

The integration of cluster computing and on-demand computing creates a massive container that can be utilised flexibly and from which virtual machines with desired parameters can be generated as required. This container is referred to as the cloud. The are 5 type of cloud services (Table 1).

Table 1. Basis types of cloud services

Type of service	Description	Access to:
Infrastructure as a Service, IaaS	The cloud contains only the physical infrastructure. Servers, storage systems, and networking hardware are hidden and virtualised. Based on this foundation, the user installs and configures the operating system, database systems, and end-user applications.	Storage space and computational power
Platform as a service, PaaS	The user receives an environment (platform) from the provider, where they can develop their own applications. All layers below this level, such as the operating system, server infrastructure, and storage, are located within the cloud.	A wide range of applications and software
Software as a service, SaaS	Virtually everything, apart from the end-user application, is virtualised and placed in the cloud. The user treats the software as a service, without needing to worry about application compatibility with their device or the installation process. They simply order a specific solution, which is provided by the service provider. Examples include services offered by Google (e.g., Docs, Gmail) or companies providing web hosting services.	Specific software
Data Storage as a Service, dSaaS	The cloud enables remote data storage, along with backup software that automatically copies data to the public cloud for safekeeping.	Solutions for secure access to data
Integration Platform as a service, IPaaS	A package of cloud services that integrates fragmented applications and processes across cloud and on-premises environments.	Infrastructure that integrates programs and applications operating in diverse operating environments

Source: Own study compiled on the basis of (Chojka, 2012; Śledziewska, Włoch, 2020).

Another criterion for classifying clouds is the method of their design, creation, and subsequent management. In this context, five categories of clouds can be distinguished (Table 2).

Table 2. Types of computing clouds based on cloud design, creation, and management method

	Public cloud	**Private cloud**	**Hybrid cloud**	**Community cloud**	**Edge cloud**
Definition	Publicly accessible to a wide range of clients, i.e., anyone who wishes to use the cloud service.	Available exclusively for a specific organisation or enterprise.	A combination of public and private clouds.	Shared by a group of entities with similar interests.	Enables data processing close to the source of its generation.
Main providers	AWS, Azure, Google, Cloud Platform, etc.	Own centers of data or hosted by providers.	Project-dependent.	Community- or branch-dependent.	Example providers: EdgeConneX, Vapor IO.
Applications	Data storage, server deployment, web application development, and ready-to-use SaaS services.	Designed for organisations with high security and compliance requirements, often with established processes in these areas.	Flexible scalability, suitable for storing sensitive data.	Facilitates collaboration within a specific industry and ensures efficient resource utilisation.	Ideal for Internet of Things (IoT), 5G, and real-time data analytics.
Advantages	Scalability, flexibility, low entry cost, global availability, no need for contracts or resource reservations.	Full control over data, ability to implement any security policies and compliance regulations.	Flexibility and control, with resource scaling based on demand.	Shared costs and resources, collaboration within the industry.	Rapid real-time data analysis, cost efficiency, and low network delay (latency).

Source: *Rodzaje chmur obliczeniowych/Wybierz właściwą ścieżkę transformacji cyfrowej*, 2023.

The flow and exchange of information in logistics largely determine the rationality of cooperation within the entire supply chain network. Consequently, managers and senior-level professionals involved in logistics operations rely heavily on the pivotal role of modern IT infrastructure. Therefore, one can now witness a growing demand for solutions such as logistics clouds. The market for IT systems designed to support and automate business processes, including cloud-based solutions, encompasses not only hardware infrastructure but also a variety of IT system classes dedicated to improving specific

areas of an enterprise. Examples include warehouses and their associated processes, transportation processes, and the overall operations of the business. Cloud computing is employed to implement solutions that support transportation management (in TMS-class systems) and other supplementary aspects of transport management, such as securing network capacity, robust visibility and sudden event management, as well as auxiliary functions like transportation payroll and auditing. (Majchrzak, 2021).

The Internet of Things (IoT) refers to a network of interconnected physical objects equipped with sensors that enable the flow of data between them. Objects within the network identify and communicate with other devices digitally. The development of IoT depends not only on network bandwidth but also on advancements in miniaturisation, exemplified by the creation and evolution of smart sensors, a combination of a traditional sensor with a microprocessor, with a crucial component being a specialised set of electrical circuits. These circuits allow the sensor to monitor and control both itself and other devices. Various types of smart sensors are currently used in industries, such as pressure, temperature, infrared, and proximity sensors. Their primary purpose is to continuously monitor the operation of machines and devices, enabling proactive failure prevention. They are also integral to the automation of transport and supply chains, ensuring optimal movement of devices and vehicles in production halls, and aiding in inventory management in warehouses. Additionally, they support energy consumption control by aligning usage with actual needs. The development of the Internet of Things (IoT) is also transforming people's lifestyles, as smart sensors are embedded in devices such as clothing or accessories like watches, bracelets, and rings. These devices are designed to monitor physical body functions and are particularly popular among individuals who lead healthy lifestyles or work in healthcare. The advancement of IoT is also a key factor in the development of smart cities, incorporating smart buildings, smart homes, and, consequently, smart transportation (Śledziewska, Wołoch, 2020).

The use of IoT in warehouse operations can significantly impact processes across various areas. Regardless of their specifics, desirable outcomes always include cost reduction, improved workplace safety, and enhanced quality and efficiency of operations. IoT enables numerous improvements in order fulfilment processes. These solutions provide better control over each link in the supply chain. Based on previously collected data, quick reactions and appropriate decisions can be made, or the system can operate entirely autonomously. In logistics, the Internet of Things encompasses smart devices such as autonomous warehouse trucks, automated packing stations, transport monitoring systems, warehouse process oversight systems, and cloud-based solutions (DataConsult, 2024). Areas of logistics where IoT solutions bring noticeable improvements include optimisation, workplace safety, asset protection, shipment tracking, automation, and work analysis (Table 3).

Table 3. Areas of logistics where IoT solutions significantly improve work quality

Area of Logistics	Improvements
Optimization	The Internet of Things enables control over every aspect of warehouse operations. This includes, e.g., the monitoring of internal conditions (continuous temperature or humidity measurements and alerts when values exceed acceptable thresholds), managing inventory, locating items, and monitoring the performance of equipment. The collected data is rapidly transmitted to the relevant departments or utilised by the system for autonomous optimization.

Table 3 (cont.). Areas of logistics where IoT solutions significantly improve work quality

Area of Logistics	Improvements
Workplace Safety	The use of various sensors and security systems enables monitoring of the technical condition of equipment, reducing the risk of workplace accidents.
Property Protection	Smart security systems, such as surveillance cameras or motion sensors, enhance the effectiveness of asset and facility protection while enabling the reconstruction of potential incidents.
Shipment Tracking	Thanks to IoT solutions, there is a growing shift away from using barcodes, which required significant manual effort to scan. A more advantageous approach now involves using RFID tags and transferring data to the cloud. As a result, the employee's role is limited to loading goods, without the need for barcode scanning.
Automation	In warehouses and logistics centres, automated and autonomous solutions, such as warehouse trucks or packing stations, can be implemented. These solutions reduce the workload and minimise the risk of human error.
Work analysis	IoT enables the measurement of employee performance and the identification of areas for improvement, such as through additional training or skill development.

Source: DataConsult, 2024.

Robotics in logistics allows for achieving maximum work efficiency in warehouse facilities. In the field of warehousing, it involves the use of robots designed to automate the flow of goods and enhance the efficiency of logistics operations. Some warehouses are fully automated, while in others, employees are assisted by robots in tasks such as moving and transporting loads, preparing orders based on requests, or organising inventory on shelves. A key advantage of robots in warehouses is their ability to operate 24/7 with minimal supervision by personnel. Additional benefits include high precision, increased efficiency, and improved safety (Robotisation in Logistics – Modern Technology in Warehousing, 2022). Robotics continues to evolve, and its applications are increasingly visible in logistics (Table 4).

Table 4. Robotics in logistics – examples of applications

Example of robotics	Application
Automated guided vehicles (AGV)	Transport devices similar to forklifts that do not require operator control, as they move along predetermined routes. They automatically transport goods, relieving humans from this tedious and repetitive work. AGVs can operate between different zones within the same warehouse or between a production line and the storage area for finished products or raw materials.
Autonomous Mobile Robots (AMRs)	Devices equipped with artificial intelligence and machine learning capabilities, enabling them to navigate warehouses independently and perform various tasks. To achieve this, they are fitted with sensors, control software, and digital warehouse maps.

Table 4 (cont.). Robotics in logistics – examples of applications

Example of robotics	Application
Automatic storage and transport systems	These include, amongst other things,. pallet stacker cranes, container stacker cranes, and Pallet Shuttle systems, which can pick up and place loads without operator supervision. Additionally, automatic transport devices, such as pallet conveyors, transport loads to where they are most needed without the involvement of warehouse staff.
Industrial robots	These devices facilitate order preparation and the handling of heavy loads. They are equipped with rotation and sliding mechanisms, enabling them to perform functions similar to a human arm and hand. These robots can operate fully autonomously (such as pick-and-place robots equipped with vision recognition systems) or collaborate with humans.
Robot-warehouse software collaboration	The coordination of robot operations is ensured by a Warehouse Management System (WMS), which assigns tasks and monitors their execution. Such a solution is essential in highly advanced technological facilities where the processes of load transportation and order picking are carried out entirely by robots and automated handling devices.

Source: *Robotyzacja logistyki – nowoczesna technologia w magazynie,* 2022.

An example of a digital technology associated with the fourth industrial revolution is artificial intelligence (AI). AI is related to fields of computer science focused on developing various algorithms and constructing machines. The attributes referred to as "intelligence" in this context include systems' abilities to make skilful decisions, learn and evolve, adapt to environmental changes, and engage in abstract reasoning, etc.. Research on AI technology draws inspiration from human behaviours, which are then translated into algorithms and computer programs. The essence of AI lies in utilising algorithms and neural networks to process and analyse information. Granting machines human-like qualities, such as learning, planning, reasoning, and even creativity, is possible due to access to vast data resources. The more data provided, the greater the accuracy of trained models (Gettyimages, 2024). The development of artificial intelligence in logistics can lead to significant transformations in the functioning of supply chains (Table 5).

Table 5. Artificial intelligence in logistics

Examples of AI	Application
Analysing and forecasting market trends	Artificial intelligence is utilised to process vast amounts of data from various sources, both internal (e.g., product sales history) and external (e.g., social networks, media). The results of these analyses provide accurate insights into customer behaviour and needs, enabling the creation of much more precise market trend forecasts.
Automatic warehouses	Artificial intelligence enhances the allocation of available resources within logistical processes and improves the planning of operations related to the flow and distribution of inventory. Additionally, it reduces the risk of errors caused by human factors. This is particularly relevant to mistakes in order completion processes and instances where improper handling leads to damage to the cargo.

Table 5 (cont.). Artificial intelligence in logistics

Examples of AI	Application
Analysis and optimisation of goods flow	In internal logistics, a warehouse management system records all activities and processes taking place within the warehouse. The software analyses the collected data and uses it to plan how the applied devices (robots, automatic and semi-automatic systems) will handle the cargo. In external logistics, on the other hand, fleet management and order distribution rely on data gathered by artificial intelligence regarding traffic density and road conditions. This information is used to optimise routes and transit times for carriers.
Increased control over information flow throughout the supply chain	Advantages: • Automated inventory monitoring: Software continuously tracks warehouse inventory and independently makes decisions, such as replenishment needs triggered by the risk of product shortages. • Traceability: For product identification and tracking, artificial intelligence can use collected data to make decisions, such as re-routing shipments to ensure faster delivery to customers. • Customer interaction via chatbots: These computer programs act as virtual assistants, capable of engaging in natural language conversations with people using artificial intelligence. They can understand the meaning of customer questions and provide accurate answers, gathering valuable insights into customer needs. A significant advantage of chatbots is their ability to handle multiple conversations simultaneously.

Source: *Sztuczna inteligencja w logistyce i przykłady jej zastosowania*, 2020.

Table 6. Examples of digital twin technology in logistics

Example of a digital twin	Application
Software for structural calculations	In internal logistics, software is used for structural calculations to ensure the stability of storage systems, properly design warehouse layouts, and meet the technical requirements outlined in the applicable national regulations. A digital twin of the facility, created using such software, can be tested to assess its behaviour under adverse conditions such as rain, snow, or wind. This approach is particularly useful when designing warehouses in regions prone to seismic activity, as safety becomes the primary focus from the initial stages of planning, including the safety of the structure, storage systems, cargo, and, most importantly, the employees.
Automatic Warehouse Studio (AWS)	The Automatic Warehouse Studio program is used for designing automatic warehouses and allows the creation of a three-dimensional representation of the facility. Its built-in simulator enables testing and evaluating the performance of automated equipment before installing the control software in the actual warehouse. This significantly reduces the implementation time for automatic warehouses and allows for solutions that are perfectly tailored to the client's logistical planning needs.

Table 6 (cont.). Examples of digital twin technology in logistics

Example of a digital twin	Application
Easy Builder and Easy Assistant	Easy Builder – tool for designers that allows the customisation of the WMS to align with the client's logistical planning needs. Companies and partners with in-house IT departments can modify warehouse management system functions, such as reorganising workflows. Easy Assistant – an advanced tool enabling the creation of a digital twin of a warehouse to test changes in layout or strategies for assigning items to locations. It allows simulations of new picking methods, adjustments to product rotation, and layout modifications within the warehouse.

Source: *Cyfrowy bliźniak – 3 przykłady zastosowań w logistyce*, 2022.

A digital twin can be described as a virtual replica of an existing object, process, or system, connected to its digital counterpart in virtual reality. This technology can be utilised in various fields, including industry and transportation. It enables the simulation of real-world object behaviours under different conditions, providing a better understanding of their operation and, consequently, facilitating the optimisation of their performance. Digital twins can be used to predict and prevent failures, enhancing safety, saving time, and reducing costs. In logistics, digital twins can be created and applied to nearly every link in the supply chain, from warehouses to transport vehicles. Their scope includes modelling, simulation, and real-time monitoring. By leveraging data from sensors, IoT devices, and advanced algorithms, digital twins provide a comprehensive vision of logistics functions, helping to identify areas for improvement and optimise operations (Cyfrowy bliźniak w logistyce, 2023). Undoubtedly, digital twin technology contributes to improved efficiency and workplace safety in logistics (Table 6).

3. CONCLUSIONS

The digital revolution has been deeply transforming the global economy for several decades, and this process continues to accelerate. As a consequence of dynamic market growth and intense competition, institutions and enterprises are constantly seeking and implementing advanced ICT (Information and Communication Technology) solutions aimed at optimising supply chains, increasing productivity, and improving the quality of services provided.

Achieving these objectives is made possible, among other means, through the implementation of WMS-class (Warehouse Management System) systems, artificial intelligence (AI) algorithms, the Internet of Things (IoT), and above all, autonomous mobile robots (AMRs/AGVs) and advanced robotic arms, which significantly automate tasks previously performed by humans.

The primary, measurable benefits of implementing digital solutions and automation in the field of logistics and warehousing manifest themselves across several key operational areas. Firstly, they enhance the safety and precision of operations by eliminating errors in order picking processes and reducing accidents involving forklifts. Secondly, they alleviate the burden on human capital through the eradication of monotonous, repetitive, and strenuous physical labour, including operations related to the transport of heavy loads.

Finally, they optimise the working environment, as machines take over tasks in difficult or health-hazardous environments, such as cold rooms, freezers, or high-dust zones.

In the coming years, the Polish economy will face unprecedented structural challenges. To close the gap with the technological leaders of Western Europe and achieve a higher robot density rate, radical investment outlays will be indispensable. The key megatrends forcing these changes are rising labour costs, inflationary pressures, and a deepening demographic crisis, resulting in a drastic decline in the supply of workers willing to perform simple manual tasks. The development of digitalisation permanently determines the future of the TFL (Transport – Forwarding – Logistics) sector. Resistance to these changes is futile; instead, strategic management of digital transformation and the full adaptation of organisations to Logistics 4.0 standards are becoming top priorities.

All authors have read and agreed to the published version of the manuscript.

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Krzysztof SUROWIEC[1]

ECONOMIC POWER OF BRICS+ MEMBERS AND PARTNER COUNTRIES WITHIN THE BLOCK

The power of states and its components within each organization are crucial in shaping the balance of power. The aim of this paper is to characterize the BRICS+ Group and its partner countries in terms of economic power and other categories (global shares in GDP, population, and area). The study also describes the countries associated with the Group, known as partner countries. The main research tool in this article is the Sułek model, which was applied to calculate state power. The study examines changes in economic power between 1991 and 2024 for both the BRICS+ Group and its partner countries within the Group. Statistical data for calculating power were obtained from the World Bank, the IMF, and economic portals. The subject of this article falls within the scope of security/geopolitics, particularly power metrics. The calculations also present changes in the geopolitical structure of the world.

Keywords: BRICS+, powermetrics, security, power, China and Russia.

1. INTRODUCTION

The BRICS+ Group and its partner countries have achieved increasing power in the last decade of the 21st century, complementing each other in many areas, in spite of the relatively loose organization of the Group itself. This article describes the ten BRICS+ countries and partner countries associated with the Group and hoping to join it. The aim of this paper is to characterize the BRICS+ Group and partner countries in terms of economic power and other categories (global shares in GDP, population, and area). Economic power was calculated using the Sułek model. The sum of the shares of all countries associated with the Group was assumed to equal 100%. To better characterize the Group, the structural conformity coefficient was calculated, also based on the research of Professor Mirosław Sułek. The study focuses on the changes in economic power between 1991 and 2024 of both the BRICS+ Group countries and their partner countries within the organization. The statistical basis for this article is based on data from the World Bank and the International Monetary Fund (IMF), as well as economic portals. This article was initiated as a result of the considerable interest in the development of BRICS+ and the rivalry between BRICS+

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countries, including the United States. The article focuses on security/geopolitics, with particular emphasis on power metrics. Based on power calculations and the respective shares of the selected countries, the article presents the balance of power within the BRICS+ Group, including its partner states. The topic was chosen because of the limited body of work on the power of contemporary political and economic organizations.

2. POWER AND POWERMETRIC MODEL BY MIROSŁAW SUŁEK

Power is a fundamental property of state action. The science of powermetrics characterizes the entities of international relations in terms of measuring and modeling power (energy, power, potential). Powernomics, on the other hand, is the study of the power of a state as a political entity. According to Bertrand Russell, "the fundamental concept of social science is power, in the same sense that energy is the fundamental concept of physics" (Russell, 2001). This energy, or power, manifests itself in the form of power in internal relations and in the form of power in the science of international relations. It is appropriate to agree with R. Aron's thesis that "the most important feature of every international system is the balance of power" (Aron, 1995). The study of power consists of quantitative components that are objectively measurable or qualitative, depending largely on the researcher. This article uses the Sułek model, which is easy to calculate and, with improvements, creates an objective picture of state power. It is based on a number of *historically constant factors*, including people, space, time, and the results of collective human action. It is a formal model, easy to understand and apply. Economic power consists of economic results (gross domestic product), demographic factors (population), and spatial factors (territorial area).

The formal model of economic power used in this paper is objective. Several other models of power exist, although some are outdated and more difficult, and therefore not used in this article.

Military power consists of military-economic factors (military expenditure, which is part of GDP), demographic-military factors (number of active-duty soldiers), and spatial factors (territorial area). Geopolitical power is the resultant of civilian and military power and is calculated as the arithmetic mean of civilian power and tripled military power (Sułek, Szymala, 2025). The power of individual states is a fraction of this value. The research results will be presented in milimirs (mM), i.e. thousandths of the global power - global power = 1000. The Sułek model has the following form:

- $P_e = PKB^{0.652} \times L^{0.217} \times a^{0.109}$
- $P_w = W^{0.652} \times S^{0.217} \times a^{0.109}$
- $P_g = \frac{Pe + (2 * Pw)}{3}$

Symbols: P_e – economic power, P_w – military power, P_g – geopolitical power,

PKB – gross domestic product, L – population, a – territory, W – military expenditure, S – number of soldiers in active service.

States compete for power in a world of limited resources; it's a zero-sum game. The pursuit of maximizing their own power is intended to satisfy states' security needs. The growth of one state causes a corresponding decline in the others. This article does not include research on the shares of military and geopolitical power within the Brics+ Group and partner states, as these are more dependent on the decisions of the states themselves and not as objective as economic power.

3. BRICS+ GROUP AND PARTNER COUNTRIES – ORGANIZATION, INSTITUTIONS

The BRICS+ intergovernmental bloc/organization/group, which was in force until September 2025, includes Brazil, Russia, India, China, South Africa, Egypt, Ethiopia, Indonesia, Iran, and the United Arab Emirates. In 2024, at the 16th BRICS+ summit in Kazan, a new category of state integration was introduced, the so-called partner states. These include Belarus, Bolivia, Cuba, Kazakhstan, Malaysia, Nigeria, Thailand, Uganda, Uzbekistan, and Vietnam. The idea of the BRICS Group is associated with Russian Foreign Minister Yevgeny Primakov. The term BRIC itself was coined in 2011. The Group's summits were initiated in 2009 (Russia, China, India, Brazil). A year later, South Africa joined, and the bloc's name was officially changed to BRICS (Sułek, 2009). The informal acronym BRICS+ (Plus) was coined in 2024 to reflect the new members. BRICS+ competes globally with the United States (Stewart, 2024) and the so-called West, emphasizing different values and political and social systems.

In an October 2024 article in The New Indian Express, Yeshi Seli argued that BRICS+ is a counterweight to the wealthy nations of the Group of Seven (G7). Citing the Economist Intelligence Unit, he also wrote that after 2045, the economies of BRICS+ countries will surpass those of the G7. According to the author's calculations

> in 2020, the size of the BRICS+ economies reached $20 trillion, while the G7 economies reached $40 trillion. The EIU estimates that by 2025, the BRICS+ economies will reach $30 trillion, while the G7 economies will exceed $50 trillion. In 2030, these figures will reach $40 and $60 trillion, respectively.

Another important factor influencing the growing importance of the BRICS+ in the coming decades will be that oil production in the BRICS+ countries already accounts for almost 30% of global oil production (Seli, 2024).

It should be noted that, according to the author's calculations based on data from the World Bank and the International Monetary Fund, the BRICS+ excluding partner countries accounts for approximately 46% of the world's population (compared to 10% of the G7) and 25% of the world's land area. accounts for 37.3% of global gross domestic product – more than twice as much as the EU (14.5%).

The BRICS+ bloc places importance on annual meetings, during which new directions are set and issues are discussed. The summits are held on a rotating basis once a year, and a chairperson is elected from among the heads of state who will serve as the interim chair of BRICS+[2]. In addition, a number of meetings between ministers and officials are taking place to address specific issues (over 200 meetings took place in 2024 alone (European Parliament, 2024). In 2025, Brazil, led by President Luiz Inácio Lula da Silva, took over the presidency of the organization, and the 17th BRICS+ summit was planned for July 6-7, 2025, in Rio de Janeiro.

BRICS+ has extended an invitation to Turkey and Algeria as partner observer states, but Ankara has not yet made a decision on this matter, and Algiers has withdrawn its application to join BRICS+. Similarly, Saudi Arabia has not yet decided whether to accept the invitation, and Argentina, led by President Javier Milei, has officially announced its

[2] The first five-member BRICS summit took place in 2011 in China, and the nine-member BRICS summit took place in 2024 in Russia.

withdrawal from the invitation to join BRICS+. The following countries are still being considered for participation in the project: Azerbaijan, Pakistan, Bangladesh, Sri Lanka, Myanmar, Senegal, and Venezuela.

An analysis of international relations in 2025 led Joseph Nye Jr. to state that "BRICS is not a new turning point in world politics". The claim that BRICS+ is becoming a new center of power in world politics and consolidating the Global South is also misleading. The main BRICS+ countries: Russia, China, and India, are located north of the equator and all compete for leadership. BRICS+ as an organization is limited by the rivalry between China and India, a situation further exacerbated by China's traditional friendship with Pakistan. Newly admitted members also compete and dispute: Egypt with Ethiopia, Iran with the UAE.

An interesting aspect of the BRICS+ rivalry with the US is the desire to replace the dollar's global dominance with its own, for example, based on gold. Gold represents the largest alternative to the dollar for BRICS+ members. The organization is also considering digital currency projects, which are intended to contribute to de-dollarization. This term refers to the declining role of the US dollar in international relations, as measured by the changing share of the US dollar in international debt securities, derivatives and payment transactions, international reserves, and cross-border bank loans (Turner, 2024).

4. SHARE OF BRICS+ AND PARTNER COUNTRIES WITHIN THE ENTIRE GROUP (GDP, POPULATION, TERRITORY, ECONOMIC POWER)

Individual components of economic power have a significant impact on BRICS+'s operations and the pursuit of its own interests, including imposing its will on other members. These include GDP, population, and territory. All of these factors raise or lower the standing of countries within the Group and influence many issues. Table 1 presents the GDP shares of the entire BRICS+ Group and partner countries, expressed as percentages.

Looking at the GDP shares of the countries within the BRICS+ Group from 1991 to 2024, we can see the following results: China accounts for the vast majority of GDP in the broader BRICS+ Group. Since 2015, it has exceeded 50% of the Group's total GDP. In 2020, China reached its peak in this regard, reaching 59% of GDP among the twenty member and partner countries. China's share increased by 41 percentage points during the period under review. Having such a large GDP and share among the Group's countries makes it easier for Beijing to expand its economy, finance investments and strengthen its influence.

India is the second-largest country in terms of GDP share in the Group, but its share has only reached 11-12% since the Cold War. Brazil has seen significant declines in its share over the last decade. Brazil, whose GDP share reached 15-23% by 2010 compared to the BRICS+ countries, has now fallen to only 6.8%. Russia has followed a similar path, having a GDP share of 22% (almost a quarter) among the BRICS+ countries in 1991, still a Soviet Union. In the following decades, Russia experienced a rather sharp decline in its share within the twenty BRICS+ countries and partner states. In 1995, a few years after the collapse of the USSR, its GDP share fell by half compared to the 1991 figure for the future BRICS countries. In 2024, it stood at only 6.1% compared to the remaining countries. Russia's GDP share has declined by 16 percentage points over the past thirty years. This demonstrates how weak and uncompetitive the Russian economy is compared to China's and, increasingly, India's.

Table 1. GDP shares within the entire BRICS+ Group and partner countries in 1991-2024 (in %, BRICS+ and partner countries)

Country	1991	1995	2000	2005	2010	2015	2020	2024
China	16.62	21.77	33.24	34.78	40.11	53.63	58.92	57.37
India	11.71	10.68	12.85	12.48	11.04	10.20	10.73	12.16
Brazil	14.85	22.80	17.99	13.56	14.55	8.74	5.92	6.84
Russia	22.45	11.72	7.13	11.62	10.05	6.61	5.99	6.12
The RSA	5.86	5.09	4.16	4.16	4.39	2.75	1.68	1.26
Iran	5.71	2.86	3.01	3.42	3.21	1.98	1.05	1.36
Ethiopia	0.60	0.23	0.23	0.19	0.20	0.31	0.43	0.45
Indonesia	5.06	5.99	4.53	4.35	4.98	4.17	4.25	4.37
The UAE	2.24	1.95	2.86	2.75	1.98	1.80	1.40	1.70
Egypt	1.62	1.78	2.74	1.36	1.44	1.60	1.54	1.22
Belarus	0.80	0.41	0.35	0.46	0.38	0.27	0.25	0.22
Bolivia	0.23	0.20	0.23	0.15	0.13	0.16	0.15	0.15
Cuba	1.05	0.90	0.84	0.65	0.39	0.42	0.43	-[3]
Kazakhstan	1.08	0.60	0.50	0.87	0.98	0.89	0.69	0.93
Malaysia	2.13	2.63	2.57	2.18	1.68	1.46	1.35	1.39
Nigeria	2.58	4.18	1.90	2.67	2.42	2.39	1.73	0.79
Thailand	4.26	5.02	3.47	2.88	2.25	1.95	2.01	1.71
Uganda	0.14	0.17	0.17	0.14	0.18	0.16	0.15	0.18
Uzbekistan	0.60	0.40	0.38	0.22	0.33	0.42	0.27	0.36
Vietnam	0.42	0.62	0.86	0.88	0.97	1.16	1.39	1.43
BRICS+	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**

Source: own calculations.

Of the remaining BRICS+ and partner countries studied, almost all saw significant declines in their shares after the Cold War: South Africa by 4.5 percentage points; Iran by over 4 percentage points; and almost all the others also saw their shares decline after thirty years. Only two countries, besides the aforementioned China and India, improved their GDP shares within the BRICS-affiliated countries. These were Uganda and Vietnam, which tripled their shares. Comparing the beginning and end of the period under review, it can be observed that in 1991, seven countries had GDP shares above 5%. By 2024, this figure had fallen to only four, with China holding a significant lead over the others.

Table 2 presents the populations of BRICS+ and partner countries within the entire Group in percentage terms in the years 1999-2024.

Table 2. Population within the entire BRICS+ Group and partner countries in 1991-2024 (in %, BRICS+ and partner countries)

Country	1991	1995	2000	2005	2010	2015	2020	2024
China	37.61	36.97	36.09	35.03	33.95	33.09	32.25	31.28
India	28.89	29.47	30.24	31.03	31.56	31.84	32.05	32.39
Brazil	4.96	4.96	4.97	4.96	4.92	4.84	4.77	4.72
Russia	4.85	4.55	4.19	3.86	3.63	3.47	3.32	3.24
The RSA	1.36	1.37	1.35	1.33	1.33	1.36	1.38	1.43

[3] No data.

Table 2 (cont.). Population within the entire BRICS+ Group and partner countries in 1991-2024 (in %, BRICS+ and partner countries)

Country	1991	1995	2000	2005	2010	2015	2020	2024
Iran	1.96	1.91	1.90	1.93	1.97	1.98	2.01	2.02
Ethiopia	1.63	1.77	1.93	2.11	2.30	2.49	2.72	2.90
Indonesia	6.10	6.13	6.18	6.20	6.25	6.25	6.28	6.32
The UAE	0.07	0.08	0.10	0.13	0.17	0.20	0.22	0.24
Egypt	1.96	2.01	2.09	2.18	2.26	2.39	2.50	2.60
Belarus	0.33	0.31	0.29	0.26	0.24	0.23	0.21	0.20
Bolivia	0.24	0.24	0.25	0.25	0.26	0.26	0.27	0.28
Cuba	0.35	0.34	0.32	0.30	0.29	0.27	0.26	0.25
Kazakhstan	0.57	0.51	0.44	0.43	0.43	0.43	0.45	0.46
Malaysia	0.60	0.62	0.66	0.69	0.73	0.75	0.77	0.79
Nigeria	3.26	3.40	3.61	3.90	4.23	4.57	4.89	5.13
Thailand	1.82	1.81	1.80	1.77	1.74	1.69	1.64	1.61
Uganda	0.59	0.63	0.69	0.75	0.82	0.90	1.02	1.11
Uzbekistan	0.69	0.70	0.71	0.71	0.72	0.74	0.77	0.76
Vietnam	2.19	2.21	2.21	2.18	2.22	2.23	2.24	2.27
BRICS+	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**

Source: own calculations.

Looking at over thirty years of demographic development in the BRICS+ and partner countries, changes in this regard are noticeable. First, the population shares and size between China and India have become very even. In 1991, China had 37.6% of the population, and India 28.9% of the current BRICS+ countries. The difference between them was 8.7 percentage points. By 2024, the difference in these shares is only 1 percentage point, favoring India. Both countries now account for almost two-thirds of the BRICS+ countries' population potential. The other largest population shares in the group are currently held by Indonesia (6.3%), Nigeria (5.2%), Brazil (4.7%), Russia (3.3%), Ethiopia (2.9%), Egypt (2.5%), Vietnam (2.2%), and Iran (2.0%). The remaining shares hover around 1% or less. Table 3 presents the area of countries within the entire BRICS+ Group and partner countries in the years 1991-2024 in percentage terms.

Table 3. Area of countries within the entire BRICS+ Group and partner countries in 1991-2024 (in %, BRICS+ and partner countries = 100)

Country	Shares in %
China	18.21
India	6.26
Brazil	16.21
Russia	32.56
The RSA	2.32
Iran	3.32
Ethiopia	2.16
Indonesia	3.65
The UAE	0.19
Egypt	1.91

Table 3 (cont.). Area of countries within the entire BRICS+ Group and partner countries in 1991-2024 (in %, BRICS+ and partner countries = 100)

Country	Shares in %
Belarus	0.40
Bolivia	2.09
Cuba	0.21
Kazakhstan	5.19
Malesia	0.63
Nigeria	1.76
Thailand	0.98
Uganda	0.46
Uzbekistan	0.86
Vietnam	0.63
BRICS+	**100**

Source: own calculations.

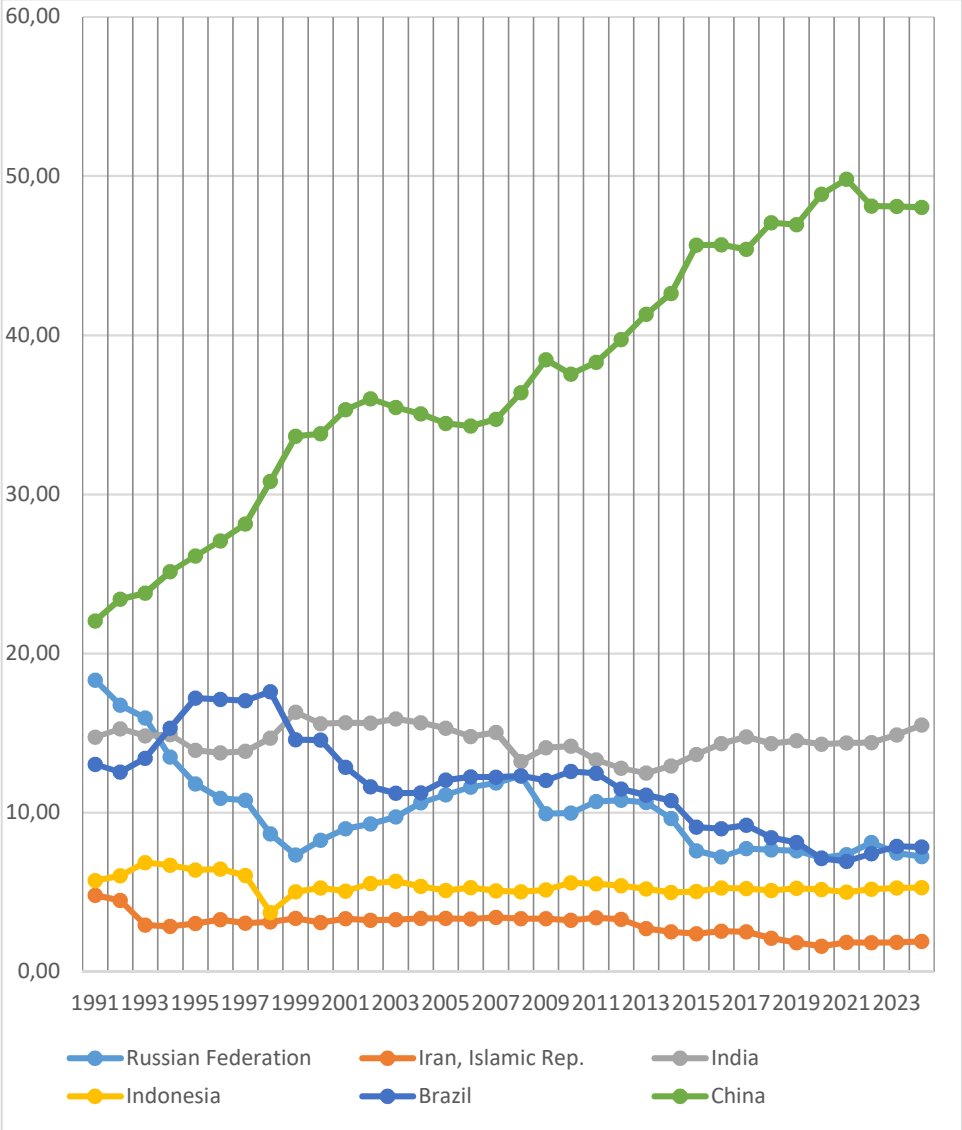
Russia has the largest territory within BRICS+ and partner countries, accounting for a one-third share (33%). This is followed by China (18%), Brazil (16%), India (6.3%), and Kazakhstan (5.2%). Table 4 presents the percentage share of the BRICS+ and partner countries in the economic power of the entire Group.

Table 4. Shares of economic power within the entire BRICS+ Group and partner countries in 1991-2024 (in %, BRICS+ and partner countries)

Country	1991	1995	2000	2005	2010	2015	2020	2024
China	22.05	26.13	33.82	34.47	37.55	45.66	48.87	48.03
India	14.75	13.92	15.59	15.32	14.19	13.66	14.31	15.51
Brazil	13.04	17.20	14.56	12.05	12.59	9.10	7.13	7.84
Russia	18.33	11.80	8.27	11.13	9.98	7.62	7.16	7.25
The RSA	4.35	3.96	3.42	3.52	2.59	1.91	1.69	1.62
Iran	4.81	3.04	3.10	3.37	3.24	2.40	1.61	1.91
Ethiopia	1.02	0.55	0.55	0.50	0.52	0.72	0.92	0.97
Indonesia	5.74	6.40	5.27	5.12	5.60	5.06	5.18	5.30
The UAE	0.91	0.86	1.16	1.18	1.02	1.00	0.87	1.02
Egypt	1.99	2.13	2.80	1.79	1.87	2.04	2.04	1.77
Belarus	0.72	0.46	0.40	0.47	0.40	0.33	0.31	0.28
Bolivia	0.36	0.33	0.35	0.26	0.24	0.29	0.28	0.29
Cuba	0.81	0.73	0.68	0.56	0.40	0.42	0.43	-[4]
Kazakhstan	1.30	0.87	0.74	1.04	1.12	1.08	0.92	1.13
Malaysia	1.63	1.88	1.85	1.68	1.43	1.33	1.29	1.32
Nigeria	2.99	4.11	2.46	3.11	2.97	3.03	2.53	1.53
Thailand	3.42	3.79	2.94	2.59	2.19	2.00	2.06	1.85
Uganda	0.27	0.31	0.31	0.28	0.33	0.31	0.32	0.36
Uzbekistan	0.76	0.58	0.56	0.39	0.51	0.61	0.46	0.35
Vietnam	0.75	0.96	1.18	1.19	1.28	1.45	1.66	1.70
BRICS+	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**

Source: own calculations.

[4] No data.



Graph 1. The share of the economic power of the six largest countries within the entire BRICS+ Group and partner countries in the years 1991-2024 (in %. i.e. BRICS+ and partner countries)

Source: own calculations.

As with GDP shares, China also holds a significant advantage in the share of economic power within the entire BRICS+ Group and its partner countries (Surowiec. 2023). In 2024. this share reached 48%, an increase of 26 percentage points compared to 1991, when it stood at 22%. While in 1991 and 1995, India, Brazil, and Russia did not lag behind China in terms of the analyzed share of economic power. Beijing's advantage has grown

significantly in this regard (Surowiec. 2024). Approaching 50% of the share of economic power within the Group, China is leveraging its position to build influence and invest in Africa, South America, and Russia. India held a stable share of economic power during the analyzed period, ranging between 13.7% and 15.5%. Despite its great potential and relatively rapid development, India's economic power growth remains relatively low, for example, compared to China, Brazil's share of economic power within the Group has collapsed.

Graph 1 presents the economic power shares of the strongest BRICS+ countries within the Group as a whole from 1991 to 2024.

As recently as 1991, Brazil's share of the economic power within the Group was 13%, reaching a peak of 17.2% in 1995. In the following years, this share decreased to 7.8% in 2024. The decline between the peak in 1995 and 2024 amounted to 9.4 percentage points, Russia followed a similar path, its share falling sharply after the collapse of the USSR in 1991, and later during the economic crises under Boris Yeltsin and subsequent invasions of Ukraine (Sułek. Białoskórski. 2018). In 1991. Russia's share relative to the other BRICS+ and partner countries was 18%. and in 2024 it was only 7.2%. Also stable in the economic power share during the analyzed period were Indonesia (5.1-6.4%); Ethiopia (1%); The UAE 1%; Egypt 1.7-2.8%; Kazakhstan 0.8-1.3%; Malaysia 1.3-1.9%; Uganda and Uzbekistan. Among the remaining BRICS+ and partner countries, significant declines in their shares over the past thirty years have been recorded by: The RSA, Iran, Belarus, Nigeria, and Thailand. Vietnam significantly improved its share by 1 percentage point.

5. STRUCTURAL CONFORMITY COEFFICIENT OF THE BRICS+ GROUP AND PARTNER COUNTRIES

The economic power of regions, international organizations, and other sets of states can be calculated in two ways. The first involves combining all the member states of the organization as a whole and summing the GDP, population, and area of individual states. We insert this data into Professor Sułek's power model. The second involves summing the powers of the individual member states of a given organization. The presented methods yield different results, so we introduced the so-called structural conformity coefficient of the entities comprising the organization, which is expressed by the following formula:

$$wzs = \frac{\sum_{i=1}^{n} pi}{PREG},$$

where:

wzs – structural conformity coefficient.

pi – power of state i.

n – number of states.

PREG – power of the region calculated as a whole.

This formula and its characteristics were included in a publication by Mirosław Sułek (Kiczma, Sułek, Szymala, 2023).

The structural conformity coefficient can be less than 1, equal to 1, or greater than 1. It is less than 1 when the merger of countries into a single entity improves the structure of the whole. When it equals 1, the structure remains unchanged (this is the maximum congruence). When it exceeds 1, it worsens the structure of the whole. Table 5 presents the economic power of the BRICS and partner countries in the years of their accession to

the organization. along with the structural conformity coefficients. Although Indonesia officially joined BRICS+ in 2025, it is included with indicators for 2024 due to the lack of data and calculations for 2025.

Table 5. Economic power of BRICS+ and partner countries (in mM. i.e. world = 1000) with structural conformity coefficients (2009-2024)

Year	BRICS countries and their partner countries	Sum of powers	Power of the whole/uniform	WZS
2009	Russia, China, Brazil, India	200.981	212.697	0.945
2010	Russia, China, Brazil, India, The RSA	224.273	236.576	0.948
2011		236.770	250.678	0.945
2012		242.815	257.691	0.942
2013		248.569	264.686	0.939
2014		251.680	268.147	0.939
2015		252.642	270.678	0.933
2016		252.405	270.227	0.934
2017		261.631	279.263	0.937
2018		263.252	282.615	0.931
2019		264.515	284.106	0.931
2020		263.480	285.367	0.923
2021		272.425	295.591	0.922
2022		273.145	294.814	0.926
2023		268.398	287.031	0.935
2024	Russia, China, Brazil, India The RSA, Ethiopia, Egypt, The UAE, Iran, Indonesia, Belarus, Bolivia, Cuba, Kazakhstan, Malaysia, Nigeria, Thailand, Uganda, Uzbekistan, Vietnam	334.713	355.277	0.942

Source: own calculations.

Looking at the results, it can be seen that the coefficient between 2009 and 2024, when BRICS+ was undergoing enlargement and in 2024, when cooperation with partner countries began, was at a comparable level. The lower the structural conformity coefficient, the greater the power of the region as a whole. and vice versa. BRICS+ has had a high coefficient of compatibility from the outset, which over the past decade or so has fluctuated between 0.92 and 0.95. This indicates that the level of development of BRICS+ is balanced. It is worth noting that the coefficient of structural conformity of the BRICS+ countries, despite subsequent enlargements, has been very stable and approximately equal to 1. Including the BRICS+ partner countries and Indonesia for 2024 did not distort the index, but rather caused it to increase slightly to the level of 2012, when only five countries were members of the Group.

6. CONCLUSIONS

This paper presents the distribution of economic power shares among the BRICS+ countries and their partner states. This was intended to define the balance of power within the entire Group. The shares of each of the twenty countries associated with the broader Group were also presented in categories such as GDP, population, and land area.

A quantitative method, Professor Sułek's model, was used to calculate the shares of economic power among the BRICS+ and partner states. To better illustrate the countries joining the Group at different times, the so-called structural conformity coefficient, also developed by Professor Sułek, was calculated. The economic power of the BRICS+ Group and partner countries, as part of their global shares, was described in the article "Economic Power of the Brics Group and Partner Countries" (Ostasz, Surowiec, 2025). This article aims to provide a more detailed analysis.

Within the BRICS Group, including partner countries, in 2024, China holds the largest share in GDP, reaching 57%. Only India exceeds this figure with a double-digit percentage at 12%. In terms of population, China and India each hold almost one-third of the share (2024). This also contributes to the growth of their economic power. In the BRICS Group, including partner countries, China has a significant advantage in the latter category, with its share approaching 50%. It is worth noting that it doubled in the years following the Cold War. Besides China, only India, Uganda, Vietnam, and the United Arab Emirates improved their share of economic power between 1991 and 2024. India's share of economic power remained stable at approximately 13-15% during the period under review. The remaining countries lost their share of economic power within the Group as a whole. A particularly noticeable decline is the share of Russia and Brazil as economic powerhouses. South Africa and Iran over the years studied. Research on the power of states within the organization has demonstrated the usefulness of Sułek's model, pointing to development trends in BRICS+ member states and partner states.

Despite common interests in some matters, BRICS+ and partner states share many differences, both politically, economically, and geopolitically. Within the Group itself, there is a competition for maximizing power. China's enormous rise in importance after the Cold War predisposes it to lead countries dissatisfied with the current balance of power in the world and the US's dominance in the international arena. The aim of this article is achieved by applying Sułek's economic power model and the structural conformity coefficient.

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