



Ekonomická
fakulta
Faculty
of Economics

Jihočeská univerzita
v Českých Budějovicích
University of South Bohemia
in České Budějovice

INPROFORUM 2024

Proceedings of the 18th International Scientific Conference
INPROFORUM. Entrepreneurship for Sustainability





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Foreword

The INPROFORUM conference is a traditional event organized by the Faculty of Economics of the University of South Bohemia in České Budějovice since 2007. It has long served as a platform for academics, students and practitioners from the fields of economics, business and administration to share their knowledge, experience, ideas and opinions on current topics.

The subtitle of the 18th annual international conference INPROFORUM 2024 was "Entrepreneurship for Sustainability". This topic demonstrates that sustainability does not have to be an obstacle to growth but can instead become a driving force behind it. Entrepreneurship plays a vital role in the transition to a more sustainable future. By combining innovation, a responsible approach, and economic vision, entrepreneurs can actively address global challenges such as climate change, growing social inequalities, and the need for efficient use of natural resources. Sustainable entrepreneurship is not only a way to protect the planet but also a means of creating long-term value for businesses, communities, and customers. Entrepreneurs have a unique opportunity to bring innovation, introduce new products and services, and design business models that enhance their competitiveness while contributing to positive social and environmental change.

At this year's conference, we had the opportunity to welcome the following keynote speakers to the plenary session:

- **Tim J. Smith, PhD (DePaul University, Chicago, USA)**

Plenary lecture title: "Value-Based Pricing and the Pricing Spineometer"

Abstract: Value-Based Pricing is analyzed in comparison with other pricing approaches, and its advantage in monopolistic competition markets is discussed. A framework for value-based pricing is presented, taking into account organizational pricing decisions at five different levels. Based on these definitions, an organization's pricing capability is assessed using the Pricing Spineometer methodology. This study provides a new perspective on strategic pricing and its impact on organizations' competitive advantage.

- **doc. Ing. Inna Čábelková, Ph.D. (Czech University of Life Sciences Prague (Czech Republic))**

Plenary lecture title: "Innovative Business Models for a Sustainable Future. The Role of Consumers"

Abstract: The lecture focused on defining the roles of consumers in shaping sustainable business models. It demonstrates how demand for eco-friendly products and services supports the adoption of sustainable strategies and business practices, including the circular and sharing economies, as well as new green technologies. Emphasis was placed on the connection between consumer behavior and business models, and on the importance of consumer education and engagement in fostering sustainability. The lecture offers a new perspective on how consumers contribute to sustainable development and innovation in business.

Our participants submitted 66 papers, and 47 of them were presented in the following discussion forums on the topics listed below:

- Sustainable regional development in the EU in the 21st century - from theory to practical solutions
- Towards sustainability in retail, marketing and tourism
- Strategic management and sustainability
- Economic performance and sustainability
- Finance, accounting and taxes: current issues and approaches to their solution
- Economics of agriculture: current trends and its sustainability

The conference INPROFORUM 2024 has been organized under the auspices of doc. RNDr. Zuzana Dvořáková Líšková, Ph.D., the Dean of the Faculty of Economics at the University of South Bohemia in České Budějovice.

We would like to express our gratitude to all the conference participants, members of the conference committee, keynote speakers, and organizing staff. Additionally, we extend our thanks to the reviewers for their valuable feedback on the authors' articles.

On behalf of the organizing committee

doc. Ing. Ladislav Rolínek, Ph.D.
Vice-dean for Science and Research

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Session:

Sustainable Regional Development in the EU in the 21st
Century - From Theory to Practical Solutions

Towards Sustainability: Advancing Bioeconomy Development in the EU

Roman Buchtele¹

Abstract: The bioeconomy involves the use of renewable biological resources such as crops, forests, fish, animals and micro-organisms to produce food, materials and energy. There is great optimism within the European Union about the benefits and opportunities that its development will bring. The path taken by the community of states towards sustainability involves creating a set of accessible indicators to measure the development of the bioeconomy at the EU member state level. The indicators should be largely identical to those of the green economy. The aim is to describe the development of the bioeconomy in the EU using a set of selected indicators. Furthermore, the paper should answer the question: Are there the same driving forces in the development of the bioeconomy as in the case of the green economy? The results showed that the bioeconomy is developing at the EU level. Additionally, correlations were found between several indicators. A question for future direction remains whether the indicators should be expanded, particularly to include socio-cultural or other factors.

Keywords: bioeconomy, EU, indicators, sustainable development

JEL Classification: Q56, O13

1 Introduction

The bioeconomy can be defined as the use of renewable biological resources to produce energy, materials and food in particular (European Commission, n. d.). The main goal of bioeconomy is linked to the basic development concept - sustainable development (World Commission on Environment and Development, 1987). According to FAO (2022), the bioeconomy includes the production, use and protection of biological resources. It also expands the bioeconomy by total knowledge capital, technology and innovation. All activities within the bioeconomy should offer a sustainable solution in all sectors of the economy. McCormick & Kautto (2013) state that there is great optimism associated with the bioeconomy in Europe due to the benefits and the large number of opportunities. The connection with the concept of sustainability represents the key, as it is a basic prerequisite for European countries to avoid the risks associated with the implementation of the bioeconomy. According to the authors, bioeconomy has the power to balance economic, social and ethical aspects. Aguilar, Twardowski & Wohlgemuth (2019) add that, overall, the key factors for the success of the bioeconomy vary globally. These can include various elements of high-tech bioeconomies, but also advanced and basic bioeconomies of the primary sector.

From a geographical perspective, the role of the EU is crucial. According to Patermann & Aguilar (2018), the EU has determined and comes currently first when speaking about determining trends in the bioeconomy within Europe and beyond. Activities related to the Horizon 2020 Program and the creation of a public-private partnership of bio-based industries were particularly important to the EU Strategy on Bioeconomy. If we examine the bioeconomy within the EU, it can be concluded that Germany, the Benelux countries and the Scandinavian countries have the most developed bioeconomy. Aguilar & Twardowski (2022) add that there is consensus in the discourse that the bioeconomy must have a circular character in line with sustainable development. Overall, we can summarize that it represents an effective solution to global problems. Important is the basis of the bioeconomy, which consists of innovation and new technologies that address new socio-economic and political changes.

The bioeconomy at EU level can be measured in several ways. Dolge et al. (2023) created the bioeconomy sustainability index, which contained 13 indicators. Index followed EU countries between 2016-2018. The highest score was recorded in Denmark, Sweden, Germany, the Netherlands and Belgium. Conversely, the lowest values were found in Latvia, Estonia and Hungary. The indicators covered the following areas: socio-economic impact, resource sustainability, innovation, funding and government support. The development of the bioeconomy in the EU can also be monitored at the level of employment and added value. Ronzon et al. (2020) state that since 2016, employment in the

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area of the bioeconomy at the level of the entire community has been growing. In the same way, labour productivity is continuously increasing. However, structural differences between countries were noted, which were reflected in different productivity levels. Eastern Europe, Portugal and Greece have bioeconomies focused more on biomass from fisheries, aquaculture, agriculture and forestry. The countries of Central Europe and Estonia, on the other hand, are more diversified in the direction of the manufacturing sector. Another research that aimed to define the indicators of the bioeconomy was created by Woźniak, Tyczewska & Twardowski (2021). The authors state that environmental factors are most often used to achieve strong sustainability. Environmental indicators include sustainable management of resources. Social and economic indicators are also used. Social ones mainly comprise indicators regarding the transfer of knowledge, social and human capital. Economic indicators then focus on innovation, infrastructure, financial capital or research and development activities. Kardung & Drabik (2021) used 41 indicators in the EU states to measure progress within the bioeconomy in the years 2006-2016. Overall, there have been positive developments, but also differences. The share of renewable sources and recycling grew. On the contrary, in Germany, Latvia, and Slovakia there was a regression in agro-environmental indicators. Research and development grew within the private sector. For the public sector, it decreased. Performance indicators based on an output-based approach can also be used to measure development within the EU in the years 2008-2017. Ronzon, Iost & Philippidis (2022a) state that the agricultural and food sectors were key in the transition in the primary industrial sector of the bioeconomy. Uneven development at the level of EU countries was also detected. The bioeconomy also applies to the service sector. Ronzon, Iost & Philippidis (2022b) tracked the contribution of bioeconomy services to GDP between 2008 and 2017. Services in the bioeconomy grew faster than overall economic growth. The development of the bioeconomy can also be measured through the production-based land footprint (Liobikiene et al., 2020). Even with this indicator, a trend can be noted that almost all EU countries show increasing footprint to biocapacity ratios.

2 Methods

The aim is to describe the development of the bioeconomy in the EU using a set of selected indicators. In this paper, the indicators will be monitored at EU-27 level. For the current situation, data from 2020-2022 are used, according to availability at Eurostat. Only for the Recycling rate of all waste excluding major mineral waste, data from 2018 was used as more recent data was not available for all countries. The second period used was Eurostat data from 2013-2014, which marks the beginning of the post-crisis period in the EU. The indicators were selected mainly with regard to their quantitative measurability and comparability. The selection of specific indicators was inspired in particular by the Cudlínová, Vávra & Lapka (2015) study, which dealt with the greening of the EU economy.

The following indicators were chosen:

- Organic crop area by agricultural production methods and crops (Percentage of total utilised agricultural area) – 2013; 2020
- Recycling rate of all waste excluding major mineral waste (Percentage) – 2014; 2018
- Net greenhouse gas emissions (Tonnes per capita) – 2013; 2021
- Gross domestic expenditure on research and development (R&D) (Percentage of gross domestic product (GDP)) – 2013; 2022
- Value added in biomass producing and converting sectors (Current prices, million euro) – 2014; 2020
- Renewables and biofuels available for final consumptions (Thousand tonnes of oil equivalent percentage share) – 2013; 2021

A total of three indicators are coincident with the article by Cudlínová, Vávra & Lapka (2015), who examined the development of the green economy in the EU. These are the indicators *Gross domestic expenditure on R&D*, *Greenhouse gas emissions per capita* and *Renewables*. The indicator *Value added in biomass producing and converting sectors (Current prices, million euro)* was based on the methodology of Lasarte-López et al. (2023). These are selected NACE sectors (see Table 1) divided by the total NACE for all sectors. Value added in biomass producing and converting sectors relative to the total value added of the economy (all sectors) allows comparisons across countries. Other indicators were selected by the author.

Table 1 Selected NACE sectors for the indicator (Value added in biomass producing and converting sectors)

Section (NACE)	Description
A01	Agriculture
A02	Forestry
A03	Fishing
C10; C11; C12	Food, beverage and tobacco industry
C13; C14; C15	Bio-based textiles
C16; C31	Wood products and furniture
C17	Paper and paper products
C20; C21; C22	Bio-based chemicals, pharmaceuticals and plastics (excl. biofuels)
C2014; C2059	Liquid biofuels (bioethanol and biodiesel)

Source: Own processing according to Lasarte-López et al. (2023)

The procedure for the analytical part is as follows. First, the change in the values of the indicators between the observation periods was calculated. A correlation analysis of the change between the periods was then carried out, but also for the two periods separately. Subsequently, the change in the values of the indicators was subjected to factor analysis. IBM SPSS Statistics was used for statistical calculations.

3 Research results

This section will first describe the overall development of the bioeconomy in the EU based on selected indicators. Subsequently, the indicators were subject to correlation analysis. The correlation analysis was carried out in both periods of interest, and the change correlation was then calculated.

For the indicator "Organic crop area by agricultural production methods and crops", the change between periods at EU level was 3.19%. At the national level, the highest change was recorded in Austria (7.29%), Estonia (6.76%), and Italy (5.36%). The lowest change was measured in Poland (-1.2%), Ireland (0.46%), and Malta (0.56%).

The indicator "Recycling rate of all waste excluding major mineral waste" has shown the highest changes in Lithuania (15%), Slovakia (10%), Croatia (9%), and Hungary (9%). Conversely, the lowest values were observed in Portugal (-14%), Estonia (-9%), and the Netherlands (-6%). It should be noted that data for Greece and Latvia were not available. At the EU-wide level, this change amounted to 2%.

The amount of GHG emissions at the EU level decreased by 0.9 tonnes per capita. The largest reductions were observed in Luxembourg (-5.2), Estonia (-2.9), and Malta (-2.7). Conversely, the largest increases were recorded in Latvia (2.8), Lithuania (1.5), and Poland (0.8).

Gross domestic expenditure on research and development (R&D) at the EU level increased by 0.14%. The highest increases were recorded in Belgium (1.1%), Greece (0.67%), and Croatia (0.63%). In some countries, however, the indicator value actually declined, including Ireland (-0.61%), Slovenia (-0.45%), and Finland (-0.32%).

The value of "Value added in biomass producing and converting sectors" at the EU level decreased by €0.06 million. The highest increases were observed in Lithuania (€1.36 million), Latvia (€0.63 million), and Greece (€0.62 million). The largest decreases were recorded in Ireland (-€1.78 million), Romania (-€1.37 million), and Bulgaria (-€1.08 million).

The value of "Renewables and biofuels available for final consumption" at the EU level increased by 1.94%. The largest increases were recorded in Finland (6.94%), Cyprus (6.18%), and Sweden (5.61%). However, in some countries, the value decreased, specifically in Hungary (-4.18%), Romania (-1.81%), and Latvia (-1.44%).

Table 2 shows the correlation analysis of indicators in the post-crisis period. If expenditure on research and development increases, the recycling rate and organic crop area also rise, and value added in biomass producing and converting sectors decreases. Conversely, when the value added in biomass producing and converting sectors increases, the recycling rate decrease. The final statistically significant relationship indicates that as renewables and biofuels available for final consumptions rise, so does the organic crop area by agricultural production methods and crops, and conversely, GHG emissions decrease.

Table 2 Person correlation of the previous period

	Organic crop area (2013)	Recycling rate (2014)	GHG emissions (2013)	Gross domestic expenditure on R & D (2013)	Value added (bioeconomy) (2014)	Renewables and biofuels available (2013)
Organic crop area (2013)	--					
Recycling rate (2014)	0.169	--				
GHG emissions (2013)	-0.087	0.169	--			
Gross domestic expenditure on R & D (2013)	0.477*	0.468*	0.120	--		
Value added (bioeconomy) (2014)	-0.373	-0.415*	-0.335	-0.562**	--	
Renewables and biofuels available (2013)	0.462*	-0.273	-0.580**	0.093	0.124	--

Source: Own processing; Note: *Correlation is significant at the 0.05 level (2-tailed); **Correlation is significant at the 0.01 level (2-tailed)

In the current period, fewer correlation relationships were found, but all the identified relationships hold true as in the previous period. If expenditure on research and development increases, the organic crop area rises, and value added in biomass producing and converting sectors decreases. Similarly to the previous case, when the renewables and biofuels available for final consumptions increases, the organic crop area rises and emissions decreases. (see Table 3).

Table 3 Person correlation of the current period

	Organic crop area (2020)	Recycling rate (2018)	GHG emissions (2021)	Gross domestic expenditure on R & D (2020)	Value added (bioeconomy) (2020)	Renewables and biofuels available (2021)
Organic crop area (2020)	--					
Recycling rate (2018)	0.054	--				
GHG emissions (2021)	-0.117	0.116	--			
Gross domestic expenditure on R & D (2020)	0.515**	0.371	-0.014	--		
Value added (bioeconomy) (2020)	-0.247	-0.099	-0.380	-0.394*	--	
Renewables and biofuels available (2021)	0.543**	-0.233	-0.419*	0.192	0.010	--

Source: Own processing; Note: *Correlation is significant at the 0.05 level (2-tailed); **Correlation is significant at the 0.01 level (2-tailed)

Table 4 shows the correlation analysis of changes between observed periods. Only one relationship was identified that was not found in the previous individual correlation analyses. As the availability of renewables and biofuels for final consumption increases, the recycling rate decreases.

Table 4 Person correlation of change between periods

	Organic crop area	Recycling rate	GHG emissions	Gross domestic expenditure on R & D	Value added (bioeconomy)	Renewables and biofuels available
Organic crop area	--					
Recycling rate	-0.152	--				
GHG emissions	-0.015	0.248	--			
Gross domestic expenditure on R & D	-0.017	-0.038	0.053	--		
Value added (bioeconomy)	0.231	0.207	0.172	0.308	--	
Renewables and biofuels available	-0.128	-0.438*	-0.153	0.021	0.103	--

Source: Own processing; Note: *Correlation is significant at the 0.05 level (2-tailed); **Correlation is significant at the 0.01 level (2-tailed)

Subsequently, a factor analysis was conducted to identify the underlying (latent) factors influencing the set of observed variables. In other words, factor analysis would simplify and clarify possible hidden relationships between the observed variables. Factor analysis was conducted for the changes between periods. Extraction was done by principal component analysis (PCA), rotation by Varimax method with Kaiser Normalization. First, the Kaiser-Meyer-Olkin Measure of Sampling Adequacy was conducted to determine the suitability of data for factor analysis. The value was 0.339, indicating that factor analysis cannot be performed on this sample, as the value is below 0.5.

4 Conclusions

The aim of the paper was to describe the development of the bioeconomy at EU level. Using the indicators, it was found that the development of the bioeconomy is mostly positive, especially when considering aggregate values for all EU countries. It should be noted that the reduction in biomass value added amounted to several hundred million euros. The geographical distribution is also heterogeneous. For example it cannot be stated that Western Europe is better off than Eastern Europe. In this regard, the factor mentioned by Ronzon et al. (2020) may also play a role. Eastern Europe and some Southern European countries have a bioeconomy more focused on fisheries, aquaculture, agriculture, and forestry, while Central European countries have greater diversification, including a stronger orientation towards the manufacturing sector.

As in the case of the Cudlínová, Vávra & Lapka (2015) research, the correlation of changes between observed periods regarding the available renewables and biofuels and GHG emissions is not confirmed. The research by Cudlínová, Vávra, and Lapka (2015) also focused on the green economy before and after the crisis. In their case, the development could be explained, based on factor analysis, by two components – economic and innovative. If we assume that the green economy precedes the bioeconomy, it should also be possible to explain the development of the bioeconomy using simple macroeconomic indicators. However, in this case, this assumption was not confirmed. Authors such as Dolge et al. (2023) include additional areas in the measurement of the bioeconomy: socio-economic impact, resource sustainability, innovation, funding, and government support. This diversity of indicators is also supported by the research of Woźniak, Tyczewska, and Twardowski (2021). This raises the question of whether the bioeconomy has a much broader scope compared to the green economy. Such a perspective would challenge conclusions that argue that the green economy is the overarching concept (e.g. Loiseau et al., 2016).

For further research and measurement of bioeconomy development, it is necessary to consider the broader areas that the bioeconomy encompasses. It appears that basic macroeconomic indicators, which were previously used to measure the green economy, are no longer sufficient to provide an explanation.

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Multiple Imputation in R: A Method to Bridging Data Gaps in Regional Sustainability Analysis

Antonín Hořčica¹

Abstract: This study builds on research presented last year on the application of advanced statistical methods in R software to analyze sustainability indicators in EU regions. Using R software, a widely used programming language for statistical calculations and data analysis, the study examines the availability of data from the Eurostat database necessary to calculate the Regional Human Development Index (RHDI) at various NUTS levels. The study evaluates missing data for the period 2000–2020 and explores the potential to impute these values using Amelia software in R, a specialized R package for multiple imputations. This method is used to estimate missing values, enhancing analytical quality. Furthermore, the study validates the methodology for setting limits for the Min-Max method used in the calculation of the subindicators of health, education and income. The data processing methodology recommended by the official RHDI guidelines was verified against actual Eurostat data. The objective was to determine whether Eurostat data could be used effectively to calculate indicators to assess the effectiveness of regional sustainability strategies within the EU.

Keywords: sustainability, R statistics, RHDI, missing data, regional development, NUTS, Amelia

JEL Classification: C14, Q01, R11, R58

1 Introduction

Sustainable development is a key concept in current global politics, playing a fundamental role within the European Union (hereafter the EU), where it is embedded in several strategies. This concept has been implemented in major documents such as *The European Union Strategy for Sustainable Development* (European Commission, 2001) and *The European Green Deal* (European Commission, 2019).

The significance of the sustainability concept lies in the integration of economic development, social cohesion, and environmental protection, which together form the foundation for the long-term prosperity of regions. Within the EU, it is essential to actively monitor progress in this regard. For this purpose, the Regional Human Development Index (RHDI) was developed, initiated by the European Commission, and created by Hardeman and Dijkstra (2014) from the Joint Research Center (n.d.). This index evaluates regions based on three primary components: health, education, and income, which are further divided into six subindicators. The authors selected these components to ensure compatibility with Eurostat data and facilitate meaningful comparisons among EU regions. Although the index is not widely used in practice, it has significant potential due to its components, allowing the assessment of quality of life at the regional level and serves as an effective tool for evaluating regional sustainability. This potential was one of the reasons for selecting this indicator for this study.

Data on regional sustainability are mainly sourced from the Eurostat database, the official statistical office of the European Union (Eurostat, n.d.). Eurostat provides data at various levels of regional division, for which the Nomenclature of Territorial Units for Statistics (NUTS) was established. This system, used for the classification of territorial units within the EU, allows for the comparison of regions not only within individual countries but also across the Union as a whole (NUTS, n.d.). This capability enables the analysis of regional progress in sustainable development and the identification of areas where targeted interventions are necessary at the regional policy level.

For a precise sustainability analysis and effective use of indicators for monitoring and evaluation purposes, complete and reliable data over long periods of time. These data allow not only the comparison of regions in specific years, but also the observation of developmental trends, which is crucial for assessing the impacts of strategic decisions. However, it often happens that some values in time series are missing, necessitating advanced statistical methods to replace these missing values.

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The methodology for the RHDI recommends using multiple imputation with the Amelia tool in the R software. R is a programming language and working environment specifically designed for statistical computing and data analysis. Its open source nature and wide range of packages allow researchers to handle complex data challenges, such as missing values, in a flexible and efficient way. Amelia is one of these specialized packages available in R, developed to perform multiple imputation, a statistical technique that estimates missing data by generating multiple plausible datasets. This approach preserves the relationships between variables and reduces biases in subsequent analyzes. The aim of this study is to validate this method on data for the various dimensions required to calculate the RHDI at different NUTS levels according to Eurostat. This paper follows the author's previous work on sustainability indicators and their analysis using advanced statistical methods (Hořčica, 2023).

2 Goals

The aim of this study is to verify the availability of data required to calculate the Regional Human Development Index (RHDI) in the Eurostat database for various territorial levels, specifically NUTS 0, NUTS 1, and NUTS 2. This requires analyzing data availability over extended time periods, ideally covering the past two to three seven-year programming periods relevant to EU regional policy. Analysis involves not only assessing the extent of missing data but also identifying the causes of these data gaps, which is essential for finding effective solutions to address these deficiencies.

The primary goal is to propose methods for efficiently imputing missing data, with particular emphasis on validating the methodology recommended by the authors of the RHDI framework, using the Amelia software tool in the R environment. This multiple imputation method will be tested on a data set that includes various NUTS levels to assess its efficacy in filling missing values and thus improving the quality of the analysis.

Based on the obtained and imputed data, the RHDI indicator will be calculated for these different NUTS levels. Additionally, a basic statistical analysis, including functional analysis, to evaluate regional trajectories and identify potential trends and disparities in their development. This functional analysis will serve as a key tool to understand regional differences and the effectiveness of regional EU policies aimed at promoting sustainable development.

3 Methods

At the beginning of the chapter, the methodology for calculating the Regional Human Development Index (RHDI) is introduced and applied to updated Eurostat datasets, ensuring compatibility with current data sources and facilitating the assessment of its applicability in the present context. This is followed by a brief description of Eurostat data sources and their availability according to the NUTS regional classification. In addition, the chapter outlines the procedure for addressing missing data through multiple imputation using the Amelia software package in R. Finally, it explores the possibilities of visualizing the results using functional analysis.

3.1 Calculation methodology of RHDI

The methodology for calculating the Regional Human Development Index (EU RHDI) was determined by Hardeman and Dijkstra (2014). This index is structured around three dimensions, each comprising two subindicators:

- Health: life expectancy at birth and infant mortality.
- Education: young people not in education, employment or training (NEET) and tertiary education.
- Income: household disposable income per capita and employment rate.

To ensure data comparability, each indicator is normalized using the Min-Max method, which scales the original values from 0 to 1. The minimum and maximum values are determined from the entire dataset, extended by a linear interpolation projected 5 years forward.

For indicators with a positive trend, normalization is applied according to formula (1), while for those with a negative trend, formula (2) is used. This ensures compatibility across all indicators.

$$\text{Positive trend: } x_t = \frac{x_i - \text{Min}(x_n)}{\text{Max}(x_n) - \text{Min}(x_n)} \quad (1) \quad \text{Negative trend: } x_t = \frac{x_i - \text{Max}(x_n)}{\text{Min}(x_n) - \text{Max}(x_n)} \quad (2),$$

where x_t represents the value of a subindex component of one of the two components within the relevant dimension. The variable x_i denotes the specific value of the component in original units (years, percentages, or monetary terms), with $\text{Min}(x_n)$ as the minimum and $\text{Max}(x_n)$ as the maximum values of the variable.

The resulting RHDI is then calculated as the geometric mean of the averages of the two indicators for each of the three dimensions:

$$RHDI = \sqrt[3]{D_{\text{Health}} \cdot D_{\text{Education}} \cdot D_{\text{Income}}} \quad (3),$$

where RHDI represents the final regional index, and the variables D_{Health} , $D_{\text{Education}}$, and D_{Income} refer to the indices for dimensions of health, education, and income, respectively.

3.2 Data sources

3.2.1 Eurostat

Eurostat (n.d.) is the statistical office of the EU, responsible for collecting and harmonizing data from Member States and ensuring their comparability for analyses at the EU level. These data are essential for the development and evaluation of policies targeting economic growth, employment, social cohesion, and regional development. Eurostat provides statistics through a public database that covers areas such as demographics, economy, environment, and education. Eurostat also plays a critical role in publishing data at the regional level according to the NUTS nomenclature, which enables the monitoring of regional disparities and developments across the EU.

3.2.2 Nomenclature of territorial units for statistics (NUTS)

The Nomenclature of Territorial Units for Statistics (NUTS, n.d.) is a system used within the EU for standardized territorial division of Member States, facilitating international and regional analysis. The NUTS system is organized into several levels, from national to regional, encompassing the following categories:

- NUTS 0: Includes Member States such as the Czech Republic or Germany.
- NUTS 1: Comprise large regions, which may correspond to federal states (e.g., Bavaria in Germany), autonomous communities (e.g., Catalonia in Spain), macroregions (e.g., the South of Italy), or other types of larger territorial units. Some countries have only one region at this level, such as the Czech Republic, which is considered a single region at the NUTS 1 level.
- NUTS 2: Corresponds to medium-sized territorial units often utilized for European regional programs and funding. In the Czech Republic, this includes grouped regions like the Southeast or Northwest. Certain smaller countries correspond to the NUTS 2 level as a whole, such as Malta, Cyprus, and Lithuania.
- NUTS 3: Refers to smaller regional units. In the Czech Republic, this corresponds to regions, such as the South Bohemian Region or the South Moravian Region.

The NUTS system enables precise regional comparisons, the allocation of resources from EU funds, and the evaluation of the impacts of regional policies.

3.2.3 Programming periods

EU programming periods are seven-year time frames designated for implementing and financing EU policies in the areas of structural funds, regional development, and cohesion. Each period has specific budgetary priorities and includes operational programs at both the national and regional levels. Examples of programming periods include 2007-2013, 2014-2020, and 2021-2027. Long-term analysis in multiple programming periods allows tracking of policy impacts and the analysis of regional disparities and their development over time.

3.3 Data availability analysis

Analysis of data availability for calculating the RHDI focuses on different NUTS levels, specifically NUTS 0, NUTS 1 and NUTS 2. For each of these levels, the data required for each dimension of the index (health, education, income) and their subindicators are examined. The analysis is focused on the programming periods 2000-2006, 2007-2013, and 2014-2020.

3.3.1 Identification of available data for each NUTS level

In the first phase of the analysis, the available data for each of the RHDI indicators collected by Eurostat are identified. For each NUTS level, an overview is provided to determine whether relevant data are available for the selected programming periods and to assess their completeness. The focus is on key indicators such as life expectancy, infant mortality, the NEET rate, tertiary education, disposable income and employment rate.

3.3.2 Causes of missing data

Missing data may have various causes, which are analyzed in this section. The main reasons for missing data can include methodological factors, where certain regions do not meet the criteria for tracking a given indicator or are not systematically measured. Political reasons may involve disparities in national statistics or insufficient harmonization of data collection among EU member states. Administrative reasons can be related to the lack of resources at regional or national statistical offices, leading to improper or insufficient data recording.

3.4 Methods for imputing missing data

Data imputation methods are generally divided into simple and advanced methods. Simple methods include directly filling in missing data based on values from reliable external sources or using average values, for example, from higher territorial classifications, or utilizing historical data even after structural changes to regions, such as historical adjustments in NUTS regions. However, it is essential to consider whether these methods introduce bias, as they may not account for intervariable relationships.

To preserve the structure of the data, multiple imputation is recommended, employing advanced algorithms that maintain the variance and relational structure of the missing data. The R software documentation (R Project, n.d.) describes and provides access to the Amelia package (R Project. Amelia, n.d.), which is also recommended by the authors of the RHDI methodology (Hardeman and Dijkstra, 2014). An objective of this study was to verify its practical applicability to current Eurostat data.

The Amelia package, developed by Honaker, King and Blackwell (2011), requires specification of parameters and distributions for individual variables, allowing it to retain intervariable relationships and estimate likely values based on existing data. Amelia is suitable for temporally ordered data, making it applicable to Eurostat data. Through multiple imputation, Amelia generates several versions of the dataset with varied imputed values, which enhances the estimation of missing data and reduces bias. Amelia employs the Expectation-Maximization (EM) algorithm combined with bootstrapping for iterative filling of missing values, minimizing noise and producing more reliable results than simple imputation. In practice, the imputed datasets are typically averaged. The algorithm further considers temporal sequence and/or geographic location, essential for accurately imputing missing values in complex data structures like economic and social data.

The procedure for applying multiple imputation to subindicators for the RHDI calculation includes data preparation, variable selection, and missing value identification. The data must be converted to a long format, where each combination of variable and time period (e.g., year and region) occupies a separate row, allowing the algorithm to leverage temporal and spatial relationships during imputation. Setting key parameters, such as the number of iterations (typically 5 to 10), is followed by applying the EM algorithm in the Amelia package, which iteratively fills missing values until convergence. Finally, the results can be validated through visualization, which confirms whether the imputed data align with variable trends in the time series.

3.5 Initial functional analysis

The imputed data were used in the R environment to calculate the values for individual dimensions and RHDI at NUTS 0, NUTS 1, and NUTS 2 levels. Basic functional analysis was conducted using the envelope method (Mrkvička, T., 2017), which identifies trends and outliers among regions. This method, included in the GET package by Myllymäki, M., & Mrkvička, T. (2020), provided data visualization and helped identify regions with different trajectories, potentially serving as a basis for regional interventions and sustainability strategies (Hořčica, 2023).

4 Research results

This chapter presents the results of the verification of the data sources and the availability of key indicators. Additionally, the scope and causes of missing data are analyzed, including their imputation using the Amelia package. Finally, a description of the calculation and values of the RHDI index for Czech regions is provided, along with visualization through functional analysis.

4.1 Data sources

Data were downloaded from the Eurostat database, as shown in Table 1, which lists the available periods. The data are current as of the last download in February 2024. Additional periods may be available, although they have not yet been analyzed. The analysis selected the period 2000–2021, corresponding to three programming periods.

Table 1 Overview of key indicators for the calculation of RHDI

No.	Indicator name	Eurostat code	Abbreviation	Period of avail.*
1	Life expectancy	demo_r_mlifexp	LifeExp	1990 - 2020
2	Infant mortality rates	demo_r_minfind	InfMor	1990 - 2020
3	Young people neither in employment nor in education and training (NEET rates)	edat_lfse_22	NEET	2000 - 2021
4	Population by educational attainment level	edat_lfse_04	TertEdu	2000 - 2022
5	Income of households	nama_10r_2hhinc	Income	2000 - 2020
6	Employment rates	lfst_r_lfe2emprt	EmpRat	1999 - 2021

Source: own processing based on EUROSTAT data.

4.2 Analysis of missing data

In the initial review, inconsistent data were identified for certain regions due to historical changes in their geography. This was observed, for example, in Croatian regions, where, in 2016 (before Croatia's EU accession), the original HR04 Kontinentalna Hrvatska was divided into new regions: HR02 Panonska Hrvatska, HR05 Grad Zagreb, and HR06 Sjeverna Hrvatska, which lacked historical data. Therefore, for calculation purposes, the original regions HR03 Jadranska Hrvatska and HR04 Kontinentalna Hrvatska were retained.

Similar adjustments were necessary for the Irish regions IE04 Northern and Western, IE05 Southern and IE06 Eastern and Midland, as well as Slovenian regions SI03 Vzhodna Slovenija and SI04 Zahodna Slovenija, where geographic changes had also occurred.

For some regions, such as Malta for the Income indicator, FRY5 Mayotte, and FI20 Åland for NEET, data were missing for the entire period. For Malta, which has the same data across all three observed levels, household income data in USD were available in the CEIC database (n.d.) for the years 2011 to 2020 per capita, which could be converted using Eurostat coefficients to match the value format used for other regions in PPS 2020. These data were added to all three datasets. For the region FRY5 Mayotte, NEET and TertEdu data were unavailable from 2000 to 2020, so these data were excluded from the NUTS 2 dataset. For the Finnish region FI20 Åland, data were unavailable for the NEET indicator; thus, this region was excluded from the NUTS 1 and NUTS 2 datasets.

Data for each indicator were available for EU27 Member States and for regions at NUTS 1 and NUTS 2 levels. The processed data were analyzed in terms of the frequency of missing values, as shown in Table 2, which presents the data after the dataset adjustments described above. Percentages for EU27 were calculated based on the total number of values for each variable. To calculate the overall percentage of missing values, it was necessary to consider all six variables for each region.

Table 2 Summary of missing data counts and percentages for various regional levels

Variable	EU27		NUTS 1		NUTS 2	
	Count	%	Count	%	Count	%
LifeExp	3	0,53	114	5,97	378	7,56
InfMor	2	0,35	96	5,02	324	6,48
NEET	13	2,29	69	3,61	450	9,00
TertEdu	2	0,35	22	1,15	270	5,40
Income	11	1,94	11	0,57	13	0,26
EmpRat	2	0,35	9	0,47	213	4,26
Total	33	0,97	342	2,98	1759	5,86
Indicator dataset	567		1911		4 998	
Complete dataset	3 402		11 466		29 988	
Countries/regions	27		91		238	

Source: own processing based on EUROSTAT data.

4.3 Imputation procedure

The data for all six indicators were converted to long format and uploaded to R, where basic statistical analysis was performed; these statistics, along with the raw and processed data, are available from the author of this article. The imputation calculations were conducted using the amelia function. Below is a sample of the code from the Amelia package in R software:

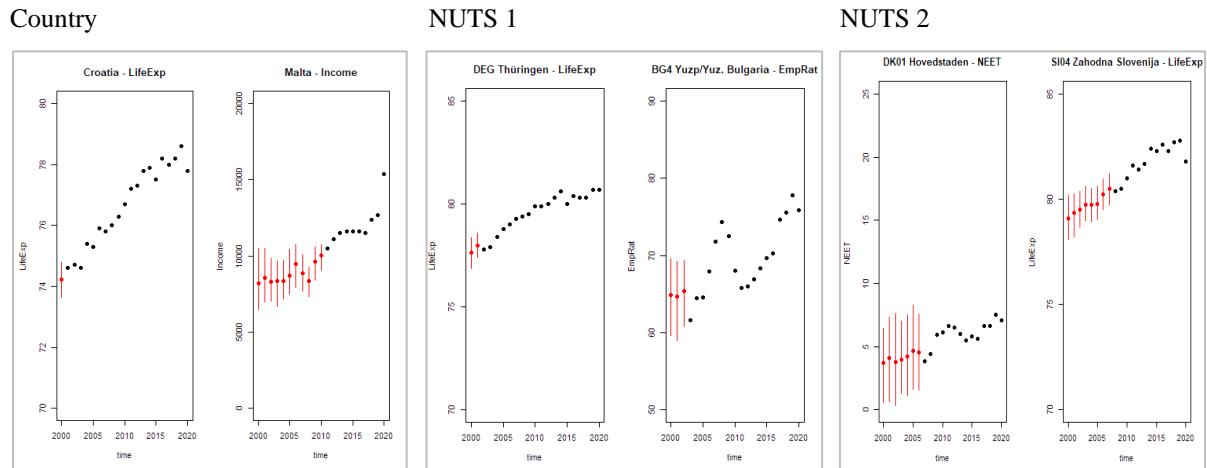
```
a.out.time_NUTS2 <- amelia(NUTS2_df, ts = "Year", cs = "NUTS2", polytime = 1, intercs = TRUE, p2s = 2, m=10)
```

The `amelia()` function is the core function for multiple imputation of missing data. `NUTS2_df` is a time series with missing values subject to imputation, where `ts = "Year"` specifies the time dimension, and a `cs = "NUTS2"` specifies the cross-sectional dimension, containing region names. The parameter `polytime = 1` is used for linear polynomial transformation to model the time trend; other parameters allow for modification, such as setting the parameter to 2 for a quadratic polynomial, with higher values increasing the polynomial trend degree. The setting `intercs = TRUE` enables interaction between temporal and regional variables, and `p2s = 2` sets the Bayesian adjustment of variance to none, weak, or strong. The parameter `m=10` determines the number of imputations. For large datasets, such as `NUTS2`, the number of iterations can reach hundreds or thousands, with computation times extending to several hours.

The imputed data can be displayed graphically using the `tscPlot()` function, as illustrated in Figure 1. Selected examples of imputed data for various regions and indicators are shown here.

Data validation was conducted using basic statistical methods to identify unrealistic values and assess outliers, skewness, and kurtosis according to methodological recommendations. The analysis was performed on the most extensive dataset for the NUTS 2 region, with basic statistics presented in Table 3. Skewness and kurtosis values for the NEET and InfMor indicators reveal asymmetry and the presence of extreme values. This indicates that while most regions have lower values, some regions show significantly higher values, suggesting notable regional differences, likely due to socio-economic disparities. In addition, histograms were generated to visualize the data distribution, which showed slight skewness; however, the values remain within an acceptable realistic range.

Figure 1 Examples of data imputation for selected regions and indicators



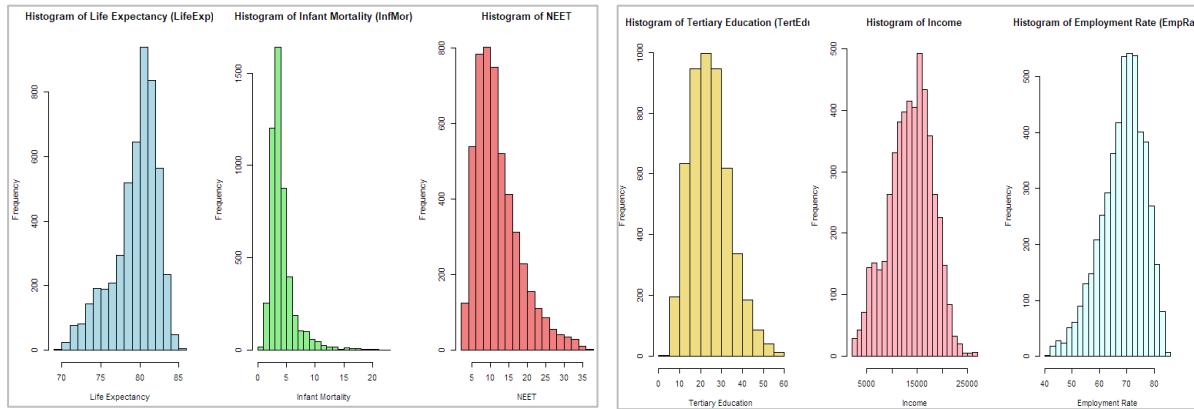
Source: own processing based on EUROSTAT data.

Table 3 Summary statistics for key variables for NUTS2 region after imputation

Variable	Mean	Std_Dev	Min	Max	Skewness	Kurtosis
LifeExp	79,5014	2,893741	69,4	85,8	-0.9266112	3.390583
InfMor	4,2278	2,374283	0,0	23,0	2.8737808	14.797107
NEET	12,0035	6,049099	2,0	36,6	1.1524171	4.320024
TertEdu	24,4049	9,437044	3,6	59,7	0.5450497	3.101606
Income	13 694	4 338	2 100	26 700	-0.236727	2.662249
EmpRat	68,5898	7,9871	40,3	85,6	-0.6169516	3.108149

Source: own processing based on EUROSTAT data.

Figure 2 Histograms of variables for RHDI calculation for NUTS2 regions



Source: own processing based on EUROSTAT data.

4.4 Calculation of the RHDI index

To calculate the RHDI, minimum and maximum values were determined from the imputed datasets, supplemented with data projected five years forward using linear extrapolation. Statistics before and after linearization, together with the final min and max values, are presented in Table 4.

Table 4 Summary statistics for key variables for the NUTS2 region, linearized

Variable	Original dataset		Dataset after linearization		Final min and max values	
	Min	Max	Min	Max	Min	Max
LifeExp	69,39	85,8	69,39	86,84	69,39	86,84
InfMor	0,0	23,00	-1,154	23,00	0	23,00
NEET	2,0	36,64	1,147	36,65	2,0	36,65
TertEdu	3,6	59,70	3,6	67,90	3,6	67,9
Income	2 100	26 700	2 100	28 597	2 100	28 597
EmpRat	40,30	85,60	40,30	90,48	40,30	90,48

Source: own processing based on EUROSTAT data.

The determined min and max values were used for normalization to a range of 0 to 1 using formulas (1) and (2). Subsequently, calculations were performed for the dimensions of health, education, and income. RHDI values were derived from the geometric mean of the dimension values. As an example, Table 5 presents the indicator values, dimension values, and the RHDI index for the Czech region CZ03 Jihozápad.

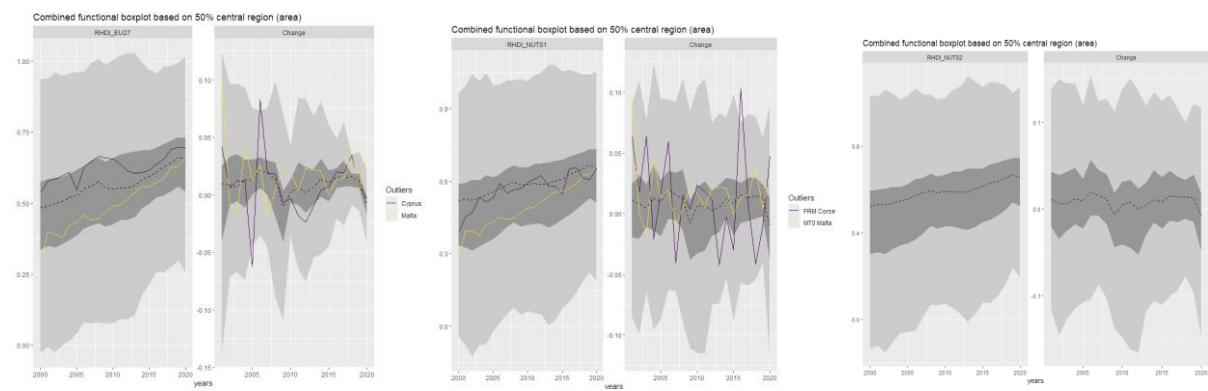
To illustrate visualization options, functional boxplots were generated using the envelope method. The resulting graphs are presented in Figure 3. In Figure 3, it can be observed that there is some convergence in RHDI values at the country level; however, this trend stopped toward the end of the observed period, probably due to the COVID-19 pandemic. Cyprus and Malta deviate slightly from the general trend, although these deviations are not significant, and similar patterns are noted for the NUTS1 and NUTS2 regions.

Table 5 Normalized indicators, dimensions, and RHDI index values for the Czech region CZ03 Jihozápad

Year	LifeExp	InfMor	NEET	TertEdu	Income	EmpRat	D _{health}	D _{education}	D _{income}	RHDI
2014	0,5536	0,9087	0,8423	0,2177	0,3472	0,6873	0,7312	0,5300	0,5172	0,5852
2015	0,5190	0,8826	0,8676	0,2348	0,3623	0,7211	0,7008	0,5512	0,5417	0,5937
2016	0,5652	0,8739	0,8338	0,2411	0,3623	0,7430	0,7195	0,5374	0,5527	0,5979
2017	0,5594	0,8739	0,8845	0,2551	0,3887	0,7769	0,7167	0,5698	0,5828	0,6197
2018	0,5594	0,8957	0,9070	0,2566	0,4038	0,7968	0,7275	0,5818	0,6003	0,6334
2019	0,5767	0,8957	0,8901	0,2597	0,4265	0,8028	0,7362	0,5749	0,6146	0,6384
2020	0,5190	0,9000	0,8507	0,2519	0,4189	0,7908	0,7095	0,5513	0,6049	0,6185

Source: own processing based on EUROSTAT data.

Figure 3 Functional boxplot of RHDI for EU27 countries, NUTS1 and NUTS2 regions



Source: own processing based on EUROSTAT data.

5. Conclusion

The data required to calculate the Regional Human Development Index (RHDI) was verified to be available to a sufficient extent; however, due to various factors, primarily frequent changes in the structure of NUTS regions, the data are not always complete. For NUTS 0, nearly 1% of the data are missing, for NUTS 1 nearly 3%, and for NUTS 2 almost 6% of the dataset. Two regions were excluded due to missing data for the entire period, data for one region were supplemented from alternative sources, and for some Croatian, Irish and Slovenian regions, data from the original regions were used due to geographic changes. This consideration should be taken into account when interpreting the results.

Under these circumstances, data imputation methods become relevant. The Amelia package for multiple imputation, recommended by the authors of the RHDI methodology, can be considered an effective solution. The results indicate that despite partial data gaps, reliable estimates of missing values can be obtained, providing a foundation for calculating the key health, education, and income indicators needed for RHDI.

Other steps in calculating the RHDI were also verified, such as determining the min and max values based on the linearized trend. While this is a suitable method, due to temporal changes, it may need recalculating after some time, unlike the HDI according to UNDP methodology (n.d.), which uses fixed values. The subsequent steps in calculating the RHDI proceeded smoothly according to the established methodology.

Visualization through functional analysis enables the identification of regional differences and developmental trends, providing valuable input for strategic planning in regional policies focused on sustainability. Future research thus opens avenues for applying both advanced multiple imputation methods and functional time series analysis to more detailed mapping of differences between countries and regions. This could facilitate comparisons with other indicators, not only for sustainability but also for economic, social, and environmental parameters. The ability to compare changes across programming periods is also significant.

This approach contributes to a deeper understanding of regional development trends within the EU and their progress towards sustainable development by allowing more accurate tracking of regional differences, identifying key factors influencing their growth, and evaluating the effectiveness of regional policies. Through a comprehensive time series analysis, it is possible to address current challenges and adjust policies to support the long-term economic, social and environmental development of regions.

Acknowledgement:

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Regional Disparities and Investment Aid: Evaluating Economic Development in Slovakia's Less Developed Regions

Lenka Hvolková¹

Abstract: Each national economy can be characterized by regional differences, with varying economic outcomes across different areas. These regional disparities are typically addressed through various tools aimed at achieving sustainable regional development. The governments of the Slovak Republic have implemented, and continue to implement, various forms of aid designed to elevate less developed regions to the level of more prosperous ones. One such tool is the provision of regional investment aid to investors entering these underdeveloped regions. The primary objective of this paper is to analyse the situation in the less developed regions of Slovakia, assess their level of development compared to more developed regions, and evaluate the regional investment aid provided to investors in these areas over last years. The paper uses available secondary data from the Statistical Office of the Slovak Republic to identify regional disparities, as well as data from the Ministry of Economy of the Slovak Republic on the aid provided to businesses during the selected period.

Keywords: regions, disparities, investment aid, Slovakia, development, support.

JEL Classification: P25, R11, P45

1 Introduction

Regional development is influenced not only by external investments or economic aid but also by internal factors such as local entrepreneurship, innovation, institutional quality, and social capital (Rodríguez-Pose, 2018). Regions with robust local networks and high levels of social capital tend to demonstrate greater resilience and achieve sustainable development, even when starting from lower levels of economic activity or technological advancement (Storper, 2019). Modern theories of regional development highlight the critical role of endogenous resources and factors, offering a broader perspective on regional disparities beyond traditional economic indicators. These theories, particularly those linked to divergence and growth models, propose that regional disparities can serve as sources of innovation and development opportunities. Divergence theories also suggest that economic disparities are shaped by historical development trajectories and the endogenous capacities of regions, which can either amplify or reduce these disparities (Martin & Sunley, 2020). This perspective challenges the conventional reliance on economic indicators such as GDP per capita or industrial output, emphasizing the importance of considering a broader socio-economic context. Key elements such as education systems, healthcare services, and local governance are vital to shaping regional development outcomes. Incorporating these modern theories into the analysis of regional disparities would provide a more holistic understanding of the drivers of regional development and reveal the limitations of relying exclusively on traditional indicators (Iammarino et al., 2019).

In Slovakia, the issue of regional disparities came to the forefront in the 1990s. During this period of dramatic transformation, there was a significant territorial redistribution of the economy and a moderate concentration of jobs, though the population distribution (housing) remained unchanged (disparities were primarily influenced by demographic factors and led to a slight decline in concentration levels) (Hampl, Müller, 2011). Economic transformation increased the dynamics of regional development, and differentiation trends emerged as a consequence of competing mechanisms (Matlovič, Matlovičová, 2011).

The state has a broad range of tools at its disposal to reduce regional disparities, one of which is state aid in the form of investment support. According to Piovarčiová and Martincová (2012), effective state support for investments can, on one hand, lead to stability in public functions by increasing tax revenues and reducing unemployment benefit expenses, provided that the investments create new jobs. On the other hand, when the inflow of investments is driven by state support through investment aid, it imposes costs on the economy in the form of the aid itself, as well as the expenses

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related to supplementary measures and administrative costs. When considering the provision of certain types of investment aid, it is important to bear in mind that offering significant advantages to foreign investors can have negative impacts on the national economy. There is a risk of corruption and clientelism, and favouring foreign investors may put domestic entrepreneurs at a significant disadvantage, which does not benefit the local economy.

State aid consists of measures that meet cumulative criteria, including the advantage granted or provided from public funds and attributable to the state, an economic benefit to the recipient, an impact on market competition, and an effect on internal trade within the European Union (Ferencz et al., 2019). Wishlade (2003) shares a similar view, noting that state aid is provided from state resources and can take any form. However, for the aid to be applied, it must distort economic competition by favouring certain enterprises. Investment aid is one form of state aid. According to Ferencz and Jaššová (2009), investment aid involves investment in newly created jobs generated by these investments. This support is granted to registered businesses in Slovakia. The amount of aid depends on where the company is established or expanding its activities, with regional investment aid aimed at supporting both domestic and foreign investors to reduce regional inequalities (Act on Regional Investment Aid). As such, the support is intended to be directed toward less advantaged regions of Slovakia. Slovakia offers a variety of forms of support to both incoming investors and established businesses. Regional investment aid can benefit small and large, new and expanding enterprises—both domestic and foreign—that invest in new production capacities within industrial production programs (SARIO, 2022). According to the OECD (2022), regional investment aid is the main tool of the Slovak government to support investments that enhance the economy's competitiveness and productivity.

2 Methods

In line with the objective of this paper, secondary data from two institutions were utilized. The first set of data comes from the Statistical Office of the Slovak Republic, accessed through the DATAcube database. We focused on analysing three key indicators in greater detail: gross domestic product (GDP) per capita, the unemployment rate, and nominal labour productivity per employed person. We will add the values of additional indicators to the ones mentioned – the average nominal wage per employee and the number of enterprises. This set of five indicators will be used to identify the less developed regions in Slovakia. The period under study varied depending on the available data – for each indicator, we chose the last five years to work with the most recent data possible.

In the next part of the research, we will use data from a database of business entities that have received regional investment aid since 2002, when the aid program was initiated. This database, compiled by the Ministry of Economy of the Slovak Republic, provides a comprehensive overview of the support granted. It includes information on the volume and type of aid, the country of the applicant, and other relevant details.

3 Research results

The following text presents the results of the analysis, which can be divided into two main areas: the identification of the least developed regions of the Slovak Republic based on available secondary data, and the evaluation of the level of support provided to businesses located in these regions through (regional) investment assistance.

3.1 Identification of the less developed regions of the Slovak Republic

The theory presents a wide range of different indicators that can be used to assess the level of economic activity in specific regions. In this paper, we focus in more detail on three selected indicators: regional gross domestic product per capita, the registered unemployment rate, and labour productivity per employee. Table 1 provides information on the development of regional gross domestic product per capita (in current prices) during the period from 2018 to 2022.

Table 1 Regional Gross Domestic Product per Capita (at Current Prices) in EUR

	2022	2021	2020	2019	2018
Bratislava region	41,139.37	38,956.59	39,339.25	39,975.75	39,206.73
Trnava region	21,209.16	20,103.75	18,873.78	19,596.65	17,843.00
Trenčín region	17,377.76	15,449.53	14,047.99	13,945.07	13,684.27
Nitra region	16,589.25	15,474.48	14,797.21	14,844.87	13,465.84
Žilina region	17,841.60	16,275.82	14,855.26	15,475.56	14,199.95
Banská Bystrica region	15,877.32	14,215.95	12,286.99	12,528.34	12,083.03
Prešov region	12,304.68	11,250.94	10,415.62	10,578.51	10,473.55
Košice region	16,876.05	15,687.48	14,114.30	13,855.42	13,384.81
Slovak Republic	19,975.86	18,427.12	17,112.71	17,316.25	16,502.85

Source: Statistical Office of the Slovak Republic

Regarding the situation at the national level in Slovakia, we can confirm an overall positive trend. GDP per capita increased from approximately €16,503 in 2018 to nearly €19,976 in 2022, representing a relative growth of 21%. In the first two years of the observed period, the worst results were recorded in the Prešov, Banská Bystrica, and Košice regions. However, in the final year, the Nitra region replaced Košice as one of the regions with the lowest GDP per capita. As a result, the Nitra, Prešov, and Banská Bystrica regions are considered as less developed regions in terms of this indicator.

In addition to the value of gross domestic product, we will also consider information on the unemployment rate in the analysed regions. The following table summarizes the values of this indicator based on available data over the last five years, from 2019 to 2023.

Table 2 Registered unemployment rate (in %)

	2023	2022	2021	2020	2019
Bratislava region	2.94	3.24	4.38	4.71	2.83
Trnava region	3.45	3.60	4.16	5.18	2.63
Trenčín region	3.61	3.69	4.28	5.39	3.20
Nitra region	3.62	3.85	4.80	5.50	2.93
Žilina region	3.99	4.63	5.32	6.53	3.96
Banská Bystrica region	7.01	8.48	9.01	9.83	6.69
Prešov region	8.36	9.98	10.75	11.39	8.19
Košice region	7.06	8.69	9.98	10.55	7.57
Slovak Republic	5.08	5.90	6.76	7.57	4.92

Source: Statistical Office of the Slovak Republic

The registered unemployment rate in Slovakia showed a generally positive trend throughout the observed period, except for a decline in 2020 compared to 2019, when the indicator worsened. However, comparing the first and last years of the analysed period, we can observe an overall deterioration, with the rate increasing from 4.92% to 5.08% (a rise of 3.25%). When identifying less developed regions, we see a consistent pattern throughout the entire period, with the Banskobystrický, Košický, and Prešovský regions consistently reporting the highest unemployment rates.

The following table identifies the development of labour productivity per employee in the period from 2017 to 2021 across the regions of the Slovak Republic.

Table 3 Nominal labour productivity per employed person (in EUR)

	2021	2020	2019	2018	2017
Bratislava region	47,493	45,618	45,608	44,048	42,421
Trnava region	37,772	35,809	36,668	34,173	32,932
Trenčín region	29,411	26,858	26,115	25,423	24,119
Nitra region	30,228	28,479	28,233	26,214	25,776
Žilina region	28,829	26,860	27,217	25,788	25,093
Banská Bystrica region	28,667	26,202	26,644	26,077	25,229
Prešov region	26,421	24,925	25,179	25,478	23,249
Košice region	34,355	31,034	30,089	30,168	29,775
Slovak Republic	33,938	31,788	31,742	30,712	29,584

Source: Statistical Office of the Slovak Republic

According to the available data, we can confirm a positive trend in the development of productivity at the national level of the Slovak Republic. It increased from €29,584 in 2017 to €33,938 in 2021, which represents a growth of over 14%. In 2017, the regions with the lowest labour productivity were Prešov, Trenčín, and Žilina. However, by 2021, the situation changed. The Prešov region still showed the lowest value of this indicator, but the other two regions with the lowest labour productivity were Banská Bystrica and Žilina. Therefore, we will consider these two regions to be less developed in terms of this indicator.

In the following table, we summarize the findings for individual indicators, identifying the three regions that achieved the worst results for each indicator. We also include two additional indicators: the average nominal monthly salary per employee expressed in EUR and the number of businesses in the respective region. For both indicators, we identified the three regions with the lowest salary values and the smallest number of businesses.

Table 4 Regional Gross Domestic Product per Capita (at Current Prices) in EUR

Indicator	Less developed regions		
	Prešov region	Banská Bystrica region	Nitra region
Regional Gross Domestic Product per Capita (at Current Prices) in EUR	Prešov region	Banská Bystrica region	Nitra region
Registered unemployment rate (in %)	Prešov region	Košice region	Banská Bystrica region
Nominal labour productivity per employed person (in EUR)	Prešov region	Banská Bystrica region	Žilina region
Average nominal monthly wage of an employee (EUR)	Prešov region	Banská Bystrica region	Nitra region
Economic subjects	Trenčín region	Banská Bystrica region	Trnava region

Source: own processing according to data from the Statistical Office of the Slovak Republic

Based on the conducted analysis, we can confirm that there are varying situations in identifying less developed regions of Slovakia depending on different indicators. On the other hand, we can identify that the regions that most frequently repeated and achieved poorer values for selected indicators compared to other regions were the Prešov and Banská Bystrica regions. The Prešov region is more focused on traditional industries, such as agriculture and manufacturing, while the Banská Bystrica region has a mixed economy with an emphasis on forestry, mining, and manufacturing. However, these regions lack a strong presence in high-tech industries, unlike the Trnava region. Weaker connections to high-tech and innovative sectors are also evident in the region's educational institutions. In contrast, the Bratislava region benefits from closer ties with business entities in this area of the economy. Innovation indicators, such as patents and research and development (R&D) activity, also show lower performance in these regions. Both regions face population decline due to migration—either to more developed regions of Slovakia or abroad—in search of better job opportunities. Additionally, both regions are characterized by less developed transportation networks, limiting their ability to attract investors and integrate into broader economic markets. Conversely, highways and rail connections in the Bratislava and Trnava regions are much more extensive, enabling better economic integration with Europe. For this reason, we will devote greater attention to these regions in the next part of the contribution.

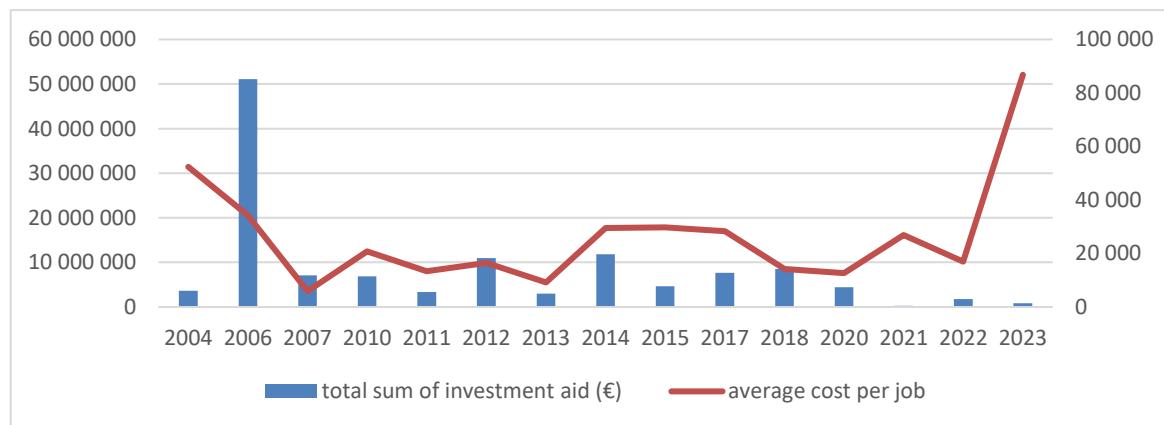
3.2 Regional investment aid in less developed regions of Slovakia

To give less developed regions a better chance to receive more support for their growth and subsequently improve their economic position, it is essential to assist both the businesses that are already established there and those that are relocating to these areas. One of the supportive tools for this purpose is (regional) investment aid, which has been available since 2002. The focus on regionality—specifically, stronger support for less developed regions—has been emphasized more significantly since the legislative change in 2018.

In the Banská Bystrica region, a total of 32 investment projects have been supported since 2002, representing nearly 14% of all projects in Slovakia. In absolute terms, the region received support amounting to €126,028,997. These projects also promised to create 6,245 new jobs. An analysis of the structure of the supported businesses confirms that both Slovak and foreign entities received aid. Of the 32 total projects, 7 were Slovak companies, 6 were from Germany, and companies from Austria, Spain, Italy, Belgium, and other countries were also represented. The most common form of support was tax relief, with businesses receiving over €84 million (67.12% of total aid). The second most frequent form of support was a contribution towards the creation of jobs, with the state providing €20,226,258 (16.16%). As part of the aid analysis, it is important to examine the portfolio of activities of the supported business entities. In the Banská Bystrica region, these activities span ten categories based on the SK NACE sectoral classification of economic activities. Although the structure is relatively diverse, the most prominent category is Group 29 – Manufacture of motor vehicles, trailers, and semi-trailers, which accounts for over 43% of the total value of support. The second largest category is Group 25 – Manufacture of fabricated metal products (except machinery and equipment), representing nearly 21%. Following this, Group 24 – Manufacture and processing of metals ranks third, with a share of 10.07%. All other categories contribute less than 10%.

The following figure shows the development of financial support obtained from 2002 to 2023, along with a calculation of the cost of investment aid per job created.

Figure 1 Investment aid and average cost per job in Banská Bystrica region



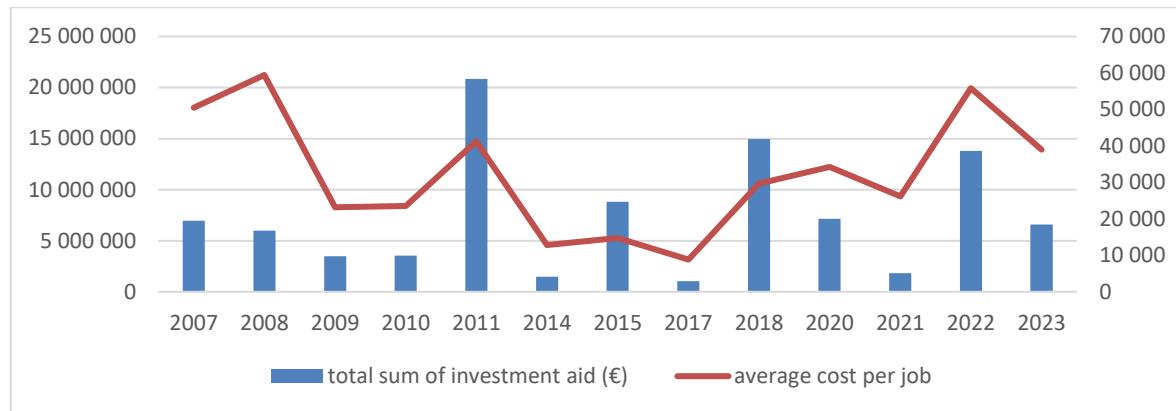
Source: own processing according to the database of the Ministry of Economy of the Slovak Republic

In terms of support over time, the years with the highest inflow of aid into the region were primarily 2006 (6 projects received support exceeding €51 million), 2014 (1 project received €11,800,000), and 2012 (3 projects received nearly €11 million in state aid). During the observed period, the costs per job created also varied significantly, ranging from €5,923.92 in 2007 to €86,800 in 2023.

In the Prešov region, 26 projects have received support since 2002, accounting for 11.35% of all projects in Slovakia. In terms of the total amount of aid that flowed into this region, it reached €96,451,645. These projects promised the creation of 3,073 jobs. Regarding the structure of investors who received support, the majority were foreign investors (only 2 Slovak businesses were supported). The most common investor countries were Germany (7 projects), followed by Austria, the USA, Italy, and the Czech Republic. Businesses most frequently received tax relief (€45,681,625) and grants for asset acquisition (€27,928,467). In the case of categorizing projects based on the SK NACE economic activity classifications, it can be confirmed that eight categories were represented in the Prešov Region. Like the Banská Bystrica region, this can be evaluated as a relatively diverse portfolio of supported projects. However, in terms of the percentage share of the total financial resources provided, Group 29 – Manufacture of motor vehicles, trailers, and semi-trailers, had the most significant representation, accounting for 46.32%. Group 25 – Manufacture of fabricated metal products (except machinery and equipment), had a much smaller share at 19.16%. All other groups represented less than 10%.

The following graph presents the development of the total volume of investment aid received during the monitored period, along with a calculation of the cost of investment aid per job created.

Figure 2 Investment aid and average cost per job in Prešov region



Source: own processing according to the database of the Ministry of Economy of the Slovak Republic

In terms of support over time, the years with the highest inflow of aid into the region were primarily 2011 (2 projects received nearly €20.9 million), 2018 (1 project received nearly €15 million), and 2022 (4 projects received state aid amounting to nearly €14 million). During the observed period, the costs per job created also varied significantly, ranging from €8,823.53 in 2017 to €59,453.27 in 2008.

4 Conclusions

Every country experiences differences in the level of economic development across its regions. The causes of regional disparities are varied, and the economy of Slovakia is no exception, with some regions achieving better results and others facing lower levels of economic development. Various indicators can be used to determine these differences. Through the analysis of selected indicators, we identified that the least developed regions of Slovakia are the Prešov and Banská Bystrica regions.

The government can address regional disparities and improve the economic situation in less developed regions through various tools. One possibility is to encourage a stronger inflow of investors who can stimulate economic activity in these areas. For this reason, we focused on analysing the support for Slovak and foreign investors through the provision of (regional) investment aid. We found that since 2002, more projects have been supported in the Banská Bystrica region compared to the Prešov region, resulting in a larger amount of financial resources being obtained. However, considering that stronger support for less developed regions has been more emphasized since 2018, the situation in the Prešov region has improved. It received €44,287,008 through the support of 13 projects. The Banská Bystrica region, on the other hand, has recorded support for 10 projects since 2018, comparable to Prešov, but these projects received only €15,903,904 in total.

In recent years, less developed regions of Slovakia have received stronger support through regional investment aid aimed at reducing regional disparities and promoting economic activity in these areas. This support included subsidies for creating new jobs, tax relief, and other forms of incentives designed to attract investors and stimulate the growth of local businesses. An example of such measures is the significant increase in investments in regions such as Banská Bystrica and Prešov, where projects in industrial production, technology, and infrastructure were supported. This aid aimed not only to boost employment but also to enhance the competitiveness of local economies and improve the overall quality of life for residents.

In the coming years, it will be crucial to monitor several factors to objectively evaluate the effectiveness of this aid. One of the main indicators will be the number of jobs maintained and the reduction in unemployment rates. It will also be important to assess whether average wages have increased and whether regional economies have succeeded in diversifying their production and reducing dependence on a single sector. In addition to quantitative indicators, such as economic and social statistics, it will be essential to analyze qualitative aspects of development. These include the regions' ability to retain young people, improve the quality of education and healthcare, foster innovation, and leverage local

resources. If these factors are not strengthened, regional aid may be perceived merely as a temporary stimulus with no lasting effect.

Evaluating the impact of this support will provide the government and regional authorities with valuable insights into how to better target future measures. If the aid proves effective, it could lead to its expansion into other less developed areas, thus contributing to more balanced regional development in Slovakia. However, if weaknesses are identified, it will be necessary to adjust the strategy to ensure that regional investment aid becomes more sustainable and focused on long-term growth.

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Comparative Insights into Circular Economy Implementation in Central Europe: Progress and Sectoral Challenges

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Abstract: The transition to a circular economy is essential for addressing resource overuse and environmental challenges in Central Europe. This study examines the implementation of circular economy practices in six countries – Slovakia, Hungary, the Czech Republic, Austria, Poland, and Slovenia by analyzing key indicators, including waste generation, recycling rates, circular material use, and GHG emissions. Using comparative analysis of 2018 and 2020 data from EUROSTAT, along with sectoral analysis and a qualitative SWOT evaluation, the article identifies regional performance trends and sector-specific challenges. A development index quantifies progress across sectors such as manufacturing, construction, energy, and households, while comparisons with academic studies contextualize findings. The results reveal Austria's leadership in recycling and innovation and Slovakia's advancements in circular material use, alongside persistent challenges in Hungary and Poland related to declining recycling rates and weak infrastructure. While progress is evident, the study emphasizes the need for targeted investments in innovation and infrastructure to fully realize the benefits of a circular economy in Central Europe.

Keywords: Circular economy, indicators, SWOT analysis

JEL Classification: O44, Q01, Q53, R11

1 Introduction

The concept of the circular economy began to take shape in Ayres's 1994 study on industrial ecology, aiming to create a system that mimics natural processes. It gained prominence as a distinct approach in the early 21st century, focusing on shifting from a linear production and consumption model to a circular one that minimizes waste and maximizes resource efficiency. This approach slows down, closes, and narrows material and energy flows, contributing to reduced resource consumption, waste, emissions, and energy losses. Several authors highlight that this can be achieved through strategies such as extending product lifecycles, repair, reuse, refurbishment, and recycling (Geissdoerfer, 2017; Jurkovič, 2020). Kirchherr et al. (2017) argue that the circular economy (CE) transcends the traditional linear product lifecycle model by emphasizing the reduction, reuse, recycling, and recovery of materials at every stage of production, distribution, and consumption. This holistic approach not only promotes sustainable development but also addresses critical issues such as environmental protection, economic sustainability, and social justice across various levels from individual products and consumers to industrial parks, cities, and regions. Complementing this perspective, the Ellen MacArthur Foundation (2017) describes the circular economy as a renewable and regenerative system. It advocates for the recovery of materials, a transition to renewable energy sources, and the elimination of harmful chemicals that impede material reuse. Ultimately, the goal is to achieve complete waste elimination through innovative design in materials, products, systems, and business models. The European Union has long been a driving force in promoting the idea of a circular economy, focusing on using resources more efficiently. A major milestone in this effort was the European Commission's Thematic Strategy on the Sustainable Use of Natural Resources (2005), which laid the groundwork for current circular economy policies across the EU. This strategy emphasized the importance of measuring how efficiently resources are used and aimed to decouple economic growth from resource consumption. The ultimate goal was to reduce environmental damage while improving how resources are utilized (European Economic and Social Committee, 2019). Later, the Roadmap to a Resource Efficient Europe (2011) further embedded circular economy principles into EU policymaking. It called for a transition to an economy that is not only resource-efficient but also sustainable and adaptable (European Commission, 2012). The European Commission took a significant step toward advancing sustainability in 2015 by launching its first Circular Economy Action Plan (2015–2019). This initiative was designed to set Europe on the path to a circular economy by implementing concrete and ambitious measures. The plan focused on every stage of a product's lifecycle, from production and consumption to waste management and the promotion of secondary raw materials markets. It also introduced a

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proposal to modernize waste legislation, ensuring it aligned with circular economy goals (European Commission, 2015). Building on this foundation, the European Commission introduced a Circular Economy Package in 2018, which brought together various initiatives to strengthen circular practices. This package included tools to monitor circular economy progress, a report on critical raw materials, a strategy for addressing plastics within the circular economy, and an analysis aimed at harmonizing chemical, product, and waste policies. By 2019, the package was finalized, complemented by a report detailing the progress of the action plan and a working document focusing on sustainable product strategies within a circular economy framework. The Action Plan was later updated, and forms a central part of the European Green Deal and highlights the pivotal role that cities play in advancing the circular economy (European Commission, 2020; OECD, 2021). Furthermore, the Organisation for Economic Cooperation and Development (OECD) plays a key role in guiding member countries in this transition, particularly through initiatives like the RE-CIRCLE project (OECD, 2022), which supports the shift towards circular practices across various sectors.

This article hypothesizes whether implementation of circular economy practices has led to measurable improvements in key indicators of circular economy among selected Central European between 2018 and 2020. The selection of countries was chosen based on the publication by Rybárová and Majdúchová (2024). By investigating these indicators, the article seeks to identify areas of significant progress, reduction, stagnation and highlight persistent challenges by comparative analysis of indicators, and swot analysis.

The article is significant for informative purposes, providing a comprehensive overview of circular economy practices and trends in Central European countries. It serves as a valuable resource for further research, academic projects, and discussions on sustainability and resource management. Both students and academics can benefit from its structured and data-driven analysis of circular economy indicators. Additionally, it holds personal significance, as it contributes own future research.

2 Methods

The analysis was based on statistical data sourced from the EUROSTAT platform, ensuring reliable and comprehensive coverage of the selected indicators. Data were systematically extracted for six Central European countries: Slovakia, Hungary, the Czech Republic, Austria, Poland, and Slovenia. Indicators selected for analysis included municipal waste generation, recycling rates (municipal waste, plastic packaging, and all waste excluding mineral waste), circular material use rate, and GHG emissions from production activities.

The years 2018 and 2020 were selected as the focus of the analysis because they represented the latest available data within the EUROSTAT platform at the time of the study. This timeframe allowed the evaluation of recent developments and trends in circular economy performance while ensuring data reliability and consistency.

The statistical tables obtained from EUROSTAT were tailored to focus on the six selected countries. Adjustments were made to isolate data specific to these countries, and the results were organized into structured tables to facilitate cross-country comparisons.

A comparative analysis of the indicators was conducted to evaluate the progress and changes across the selected countries between 2018 and 2020. This analysis aimed to identify areas of improvement, regression, and alignment with EU averages, providing a comprehensive understanding of each country's performance. Additionally, a sectoral analysis was carried out to examine waste generation and GHG emissions across key economic sectors, including construction, manufacturing, energy, and households. The sectoral findings were systematically compared with the results of relevant studies and articles by authors cited in the research.

Changes over time were quantified using a development index, calculated with the formula:

$$\text{Development Index} = \frac{\text{Value in 2020}}{\text{Value in 2018}}$$

Finally, a qualitative SWOT analysis was performed to summarize the strengths, weaknesses, opportunities, and threats related to circular economy practices in the selected countries. This analysis synthesized the findings from both the comparative and sectoral analyses to provide a broader perspective on each country's performance and areas for improvement.

3 Research results

This section presents the research results, providing an overview of the current state of the circular economy in Central European countries. Based on selected key indicators, it examines progress in areas such as waste management, material recycling, and innovation performance, offering insights into the strengths, weaknesses, and ongoing challenges in specific sectors.

3.1 Analysis of the circular economy indicators

Based on the analysis of available statistical data from the EUROSTAT platform, a table was compiled to provide an overview of indicators for individual countries. The selection of countries includes six Central European countries: Slovakia, Hungary, the Czech Republic, Austria, Poland, and Slovenia. Since all these countries are members of the European Union, their results were compared with the EU average. The analysis focuses on the development and monitoring of indicators over two time periods – the years 2018 and 2020.

Table 1 Key indicators of circular economy

Indicator	unit	Slovakia		Czech republic		Hungary		Poland		Austria		Slovenia		EU	
		2018	2020	2018	2020	2018	2020	2018	2020	2018	2020	2018	2020	2018	2020
Generation of municipal waste	kg/capita	414	478	494	543	384	406	329	356	588	834	486	487	500	520
Circular material use rate	%	4.7	10.3	10.5	11.5	6.9	5.1	10.5	7.4	11.8	11.4	10.1	9.9	11.6	11.2
Recycling rate of municipal waste	%	36.3	45.3	32.2	40.5	37.4	32.0	34.2	38.7	57.7	62.3	58.9	59.3	46.4	48.7
Recycling rate of all waste excluding major mineral waste	%	50.0	60.0	61.0	59.0	49.0	54.0	60.0	52.0	63.0	63.0	82.0	80.0	56.0	58.0
Recycling rate of plastic packaging	%	51.4	56.3	57.0	41.8	30.0	24.9	35.7	31.5	31.9	31.6	48.8	44.6	41.4	37.6
Material footprint	t/capita	14.8	12.1	17.8	16.4	15.9	14.3	17.8	16.8	24.0	22.3	17.9	16.7	14.7	14.4
GHG emissions from production activities	t/capita	6.6	5.6	10.0	8.4	5.6	5.1	9.7	8.8	6.4	6.2	6.6	6.2	7.2	6.2
Resource productivity	index	1.2	1.3	1.1	1.2	0.8	0.9	0.7	0.8	2.4	2.2	1.5	1.6	2.0	2.0
Total waste generation	t/capita	2.3	2.3	3.6	3.6	1.9	1.8	4.6	4.5	7.4	7.8	4.0	3.6	5.2	4.8
Patents related to recycling and secondary raw materials	number	1.5	0.0	4.7	7.2	2.0	0.0	22.2	17.3	13.0	6.5	0.0	1.0	316.1	206.6

Source: Own processing based on the statistical data of EUROSTAT

Austria in 2020 stands out for its advanced waste management practices, with a municipal waste recycling rate of 62.3%, up from 57.7% in 2018, reflecting a 8.0% increase. However, it also generates the highest amount of waste per capita, reaching 834 kg/person, a notable increase from 588 kg/person in 2018, representing a 41.8% rise, which far exceeds the EU average of 520 kg/person. This reflects Austria's high standard of living and consumption levels, as noted by Galdeano-Gómez et al. (2024). Additionally, Austria demonstrated strong innovation performance by patent applications in 2018 and 2020, the highest among the analyzed countries, showcasing its commitment to research and development. This focus on innovation likely supports its highly efficient recycling systems.

Slovenia demonstrated effective waste management in 2020, with a municipal waste recycling rate of 59.3% and a plastic packaging recycling rate of 44.6%, both above the EU averages of 48.7% and 37.6%, respectively. Compared to 2018, Slovenia's plastic packaging recycling rate declined by 8.6%, dropping from 48.8% in 2018. Meanwhile, its circular material use rate declined slightly, from 10.1% in 2018 to 9.9% in 2020, showing a 2.0% decrease, suggesting a need for renewed focus on material reuse. In terms of innovation, Slovenia shows a relatively moderate figure, surpassing countries like Hungary and Slovakia but falling far behind Austria.

Slovakia in 2020 excelled in plastic packaging recycling, achieving a rate of 56.3%, up from 51.4% in 2018, reflecting a 9.5% increase. Its circular material use rate showed significant progress, increasing from 4.7% in 2018 to 10.3% in 2020, representing a 119.1% increase, the highest among the analyzed countries. However, its municipal waste recycling rate improved to 45.3% in 2020, up from 36.3% in 2018, reflecting a 24.8% increase. Furthermore, the country's innovation activity was relatively low and lagging significantly behind Austria and the Czech Republic.

The Czech Republic showed progress in circular material use in 2020, reaching 11.5%, up from 10.5% in 2018, reflecting a 9.5% increase, nearing the EU average of 11.2%. However, its plastic packaging recycling rate declined sharply, from 57.0% in 2018 to 41.8% in 2020, representing a 26.7% decrease. Its municipal waste recycling rate

improved slightly, from 32.2% in 2018 to 40.5% in 2020, showing a 25.8% increase. The Czech Republic demonstrated moderate levels of innovation, ranking below Austria but outperforming Hungary, Poland, and Slovakia.

Hungary in 2020 faced challenges in waste management, recording the lowest municipal waste recycling rate (32.0%), down from 37.4% in 2018, representing a 14.4% decrease, which can largely be attributed to insufficient waste processing infrastructure and lower environmental awareness (Szczepańczyk, 2022). Plastic packaging recycling rate (24.9%), went down from 30.0% in 2018, reflecting a 17.0% decrease. Despite these setbacks, Hungary's circular material use rate fell significantly, from 6.9% in 2018 to 5.1% in 2020, a 26.1% decrease, remaining well below the EU average.

Poland in 2020 generated 356 kg/person of municipal waste, up from 329 kg/person in 2018, reflecting an 8.2% increase, the largest rise in waste generation among the analyzed countries. Despite this, it remained the country with the lowest municipal waste per capita. Poland's plastic packaging recycling rate declined slightly, from 35.7% in 2018 to 31.5% in 2020, representing a 11.8% decrease, and its circular material use rate dropped from 10.5% in 2018 to 7.4% in 2020, showing a 29.5% decrease. Innovation activity in Poland remained modest, with 17.3 patent applications in 2020, down slightly from 22.2 in 2018, ranking above all the selected countries.

To better illustrate the changes over time, a table (Table 2) was created to highlight the development between the years 2018 and 2020 for key indicators across six Central European countries. This table calculates the development index (2020/2018 ratio) for each indicator, providing a clear comparison of progress or regression.

Table 2 Development Index of key indicators between the years 2018–2020

Indicator	2020/2018						
	Slova-kia	Czech repub-lic	Hungary	Po-land	Aus-tria	Slovenia	EU
<i>Generation of municipal waste</i>	1.1546	1.0992	1.0573	1.0821	1.4184	1.0021	1.0400
<i>Circular material use rate</i>	2.1915	1.0952	0.7391	0.7048	0.9661	0.9802	0.9655
<i>Recycling rate of municipal waste</i>	1.2479	1.2578	0.8556	1.1316	1.0797	1.0068	1.0496
<i>Recycling rate of all waste excluding major mineral waste</i>	1.2000	0.9672	1.1020	0.8667	1.0000	0.9756	1.0357
<i>Recycling rate of plastic packaging</i>	1.0953	0.7333	0.8300	0.8824	0.9906	0.9139	0.9082
<i>Material footprint</i>	0.8176	0.9213	0.8994	0.9438	0.9292	0.9330	0.9796
<i>GHG emissions from production activities</i>	0.8507	0.8455	0.9228	0.9131	0.9672	0.9382	0.8587
<i>Resource productivity</i>	1.1176	1.0450	1.1235	1.0857	0.9237	1.0748	1.0000
<i>Total waste generation per capita</i>	1.0308	1.0112	0.9362	0.9719	1.0485	0.9040	0.9198
<i>Patents related to recycling and secondary raw materials</i>	0.0000	1.5332	0.0000	0.7767	0.4988	-	0.6534

Source: Own processing

Austria's municipal waste recycling rate showed a development index of 1.047, indicating a 4.7% increase between 2018 and 2020, reflecting steady improvement in recycling efficiency. However, its waste generation per capita continued to rise, with a development index of 1.033, representing a 3.3% increase, highlighting the ongoing challenge of balancing consumption levels with sustainability goals. Slovenia achieved a strong improvement in plastic packaging recycling, with a development index of 1.084, equivalent to an 8.4% increase, reflecting advancements in policy effectiveness and infrastructure. However, the circular material use rate showed a development index of 0.932, indicating a 6.8% decrease, pointing to inefficiencies in material reuse despite its generally high recycling rates. Slovakia saw the largest improvement in plastic packaging recycling, achieving a development index of 1.105, or a 10.5% increase, driven by legislative reforms and investments in waste sorting systems. Its circular material use rate, however, showed limited progress, with a development index of 1.034, reflecting only a 3.4% increase, indicating persistent challenges in material reuse. The Czech Republic showed steady progress in circular material use, with a

development index of 1.044, or a 4.4% increase, showcasing the country's commitment to circular economy strategies. In contrast, its plastic packaging recycling rate was nearly stagnant, with a development index of 1.006, indicating just a 0.6% increase, highlighting limited progress in addressing recycling gaps. Hungary made moderate gains in municipal waste recycling, with a development index of 1.075, equivalent to a 7.5% increase, and in plastic packaging recycling, achieving a development index of 1.078, or a 7.8% increase. Despite these improvements, Hungary remains among the lowest-performing countries in the region, reflecting enduring issues with waste processing infrastructure and policy. Poland showed minor changes, with its plastic packaging recycling rate improving slightly to a development index of 1.041, representing a 4.1% increase, while the circular material use rate achieved only a 1.1% increase (development index of 1.011). Notably, Poland reduced its waste generation per capita, with a development index of 0.989, representing a 1.1% decrease, making it the only country in the region to buck the trend of increasing waste production.

3.2 Selected key indicators in specific sectors

As part of a deeper analysis, selected indicators and their development across sectors during the years 2018 and 2020 were examined. The indicators Waste Generation and GHG Emissions were chosen to identify areas where gaps persist and to pinpoint sectors that present potential opportunities for improvement or further advancements.

Table 3 Generation of waste by economic activities and households in thousands of tonnes (kt) 2018–2020

Sector	Slovakia		Czech republic		Hungary		Poland		Austria		Slovenia	
	2018	2020	2018	2020	2018	2020	2018	2020	2018	2020	2018	2020
Construction	542	1 150	15 800	16 496	6 104	4 359	16 950	22 051	48 883	52 702	669	473
Mining and quarrying	206	160	130	101	130	57	62 339	63 678	41	20	9	12
Waste/water	1 523	1 140	5 293	5 963	2 115	2 068	24 423	22 832	2 440	2 434	288	284
Manufacturing	3 068	3 605	4 665	4 918	2 612	4 366	27 327	25 778	5 140	5 738	1 343	1 472
Households	2 254	2 362	5 805	6 108	2 743	4 742	9 568	13 230	4 407	4 630	643	630
Services	2 890	3 577	4 384	4 312	2 101	991	11 175	10 961	3 521	3 390	3 916	3 811
Energy	975	697	551	414	2 058	1 953	18 811	11 212	504	401	966	912
Agriculture, forestry and fishing	530	562	412	398	450	295	432	281	140	168	62	56

Source: Own processing based on the statistical data of EUROSTAT

Waste generation in the construction sector in Slovakia increased dramatically from 542 kt in 2018 to 1,150 kt in 2020, reflecting growing construction activity but also revealing deficiencies in recycling capacities for construction and demolition waste. According to Osmani et al. (2019), construction and demolition waste represents one of the largest waste streams, and its management poses significant challenges due to inadequate recycling and reuse frameworks. The study highlights the importance of proactive strategies such as designing out waste, effective on-site sorting, and innovative material recovery processes. In contrast, Austria (with an increase from 48,883 kt to 52,702 kt) mitigates the impact of rising construction waste through advanced recycling systems and industrial symbiosis, demonstrating its leadership in integrating circular principles. In the manufacturing sector, the results show varied trends. Poland recorded a slight decrease in waste from 27,327 kt to 25,778 kt, indicating improved efficiency in production processes. On the other hand, Hungary experienced a sharp increase in manufacturing waste from 2,612 kt to 4,366 kt, which reflects a lack of modernization and support for innovations. According to Konečný et al. (2020), bridging investment gaps is crucial to fostering technological progress in industries across Central and Eastern Europe. In the energy sector, Poland demonstrated a substantial reduction in waste, decreasing from 18,811 kt in 2018 to 11,212 kt in 2020, largely attributed to improvements in its energy mix and a reduced dependence on fossil fuels. These findings align with the principles discussed by Pires and Martinho (2019), who emphasize the critical role of adopting waste hierarchy practices within a circular economy framework, where renewable energy utilization plays a supportive role in achieving sustainability goals. While the positive outcomes observed across all selected countries are encouraging, they may also have been partially influenced by the COVID-19 pandemic and related restrictions, which temporarily reduced industrial and energy consumption activities. In households, the sharpest increase in waste was observed in Hungary (from 2,743 kt to 4,742 kt) and Poland (from 9,568 kt to 13,230 kt), reflecting inadequate recycling capacities and low levels of waste separation. Pires and Martinho (2019) point out that public awareness campaigns and the development of collection networks are key to reducing household waste, yet such measures remain underdeveloped in Central and Eastern Europe. Austria and Slovenia demonstrate more stable results thanks to their established systems for separated waste collection. In the services sector, Poland recorded a dramatic drop in waste from 51,690 kt to 20,843 kt, likely due to the impact of the COVID-19 pandemic and reduced commercial activities. This temporary reduction is

confirmed by Konečný et al. (2020), who caution that waste decreases driven by the pandemic are unlikely to be sustainable in the long term without systemic changes and investments.

Table 4 shows the analysis of GHG emissions across sectors in Central European countries in the years of 2018 and 2020 and reveals both progress and persistent challenges, influenced by structural factors and temporary impacts such as the COVID-19 pandemic. Comparing these findings with insights from authors such as Domenech et al. (2017), Konečný et al (2020), Mazur-Wierzbicka (2021), Szczepańczyk (2022), Castillo-Díaz et al. (2023), and Galdeano-Gómez et al. (2024) reveals areas of alignment and divergence.

Table 4 Generation of GHG emissions by economic activities in thousands of tonnes (kt) 2018-2020

Sector	Slovakia		Czech republic		Hungary		Poland		Austria		Slovenia	
	2018	2020	2018	2020	2018	2020	2018	2020	2018	2020	2018	2020
Construction	2 069	2 017	1 319	1 335	1 177	1 123	795	809	1 108	1 075	547	572
Mining and quarrying	361	303	7 101	5 070	715	662	23 341	21 574	830	758	341	330
Water supply	2 178	2 164	6 913	7 183	4 135	4 085	5 853	5 367	2 378	2 238	540	503
Manufacturing	16 639	13 435	19 034	17 469	12 580	11 802	68 292	64 108	25 946	25 696	2 882	2 725
Transportation and storage	3 064	2 124	8 964	7 876	7 129	4 736	12 921	40 024	6 999	5 822	1 067	866
Services (except transportation and storage)	2 606	2 672	3 211	2 655	6 504	5 978	51 690	20 843	3 801	3 879	1 371	1 357
Energy	6 555	5 779	49 848	39 291	12 815	12 060	150 445	126 410	7 405	6 165	4 952	4 656
Agriculture, forestry and fishing	1 915	1 974	10 103	9 579	9 421	9 624	55 086	55 948	8 274	8 116	2 016	2 033

Source: Own processing based on the statistical data of EUROSTAT

In the construction sector, emissions remained relatively stable or slightly declined in Slovakia, Hungary, and Austria. Austria continues to lead in integrating circular construction practices, supported by industrial symbiosis and material recycling, as highlighted by Domenech et al. (2017). In contrast, Poland, Slovenia and Czech republic lag behind, consistent with Szczepańczyk's (2022) assertion that low investment levels in innovation hinder the adoption of circular models. This stagnation in emissions reduction underscores the gap between policy intentions and implementation in these countries. Mazur-Wierzbicka's (2021) analysis further supports this observation, emphasizing that insufficient infrastructure and public awareness in Central and Eastern Europe slow progress in integrating circular economy practices into construction. The mining and quarrying sector experienced substantial reductions across Slovakia, Czech republic, and Poland. These trends reflect both reduced extraction activities and gradual improvements in resource efficiency. However, structural challenges persist in countries like Poland, where high emissions remain tied to heavy industry and extraction sectors, as highlighted by Castillo-Díaz et al. (2023). The manufacturing sector, while the largest contributor to emissions across the region, showed slight reductions in Poland and Austria. These trends align with findings by Galdeano-Gómez et al. (2024), who emphasize that public investments in environmental technologies and industrial innovations have driven modest improvements. However, Slovakia and Hungary's slower progress reflects Szczepańczyk's (2018) observation that insufficient collaboration between academia and industry limits advancements in technology and circular practices. The energy sector exhibited significant emissions reductions in Poland, Czech republic, Slovakia, and Austria, driven by the gradual shift to renewable energy. These findings align closely with Galdeano-Gómez et al. (2024), who stress the importance of transitioning away from coal and investing in clean energy technologies. However, Poland's continued dependence on coal underscores the challenges noted by Domenech et al. (2017) regarding slower infrastructure transitions in emerging economies. In transportation, emissions fell in Slovakia and Hungary, likely due to pandemic-related slowdowns and incremental progress in logistics efficiency. Konečný et al (2020) aligns this, emphasizing that modernization of public transport fleets, such as transitioning to electric and hybrid vehicles, is crucial for achieving emissions reductions in urban areas. Lastly, emissions from agriculture and water supply remained stable across most countries, reflecting slow adoption of sustainable practices and limited innovation in these sectors. This aligns with Szczepańczyk's (2022) critique of structural barriers and underinvestment in sectors that hold significant potential for emissions reductions.

3.3 Swot analysis

Building on the detailed analysis of the current state of the circular economy, a SWOT analysis has been conducted to assess the strengths, weaknesses, opportunities, and threats associated with the transition to a circular economy in Central European countries.

Strengths

Central European countries share several strengths in their circular economy practices, particularly in waste management and recycling. Austria stands out as a regional leader, excelling in municipal waste recycling, innovation, and the use of secondary raw materials, which sets a benchmark for other countries. Slovakia demonstrated remarkable progress in circular material use, achieving the highest increase among all analyzed countries, driven by effective legislative reforms and investments in waste sorting systems. Slovenia and the Czech Republic also performed well, with Slovenia maintaining high recycling rates and the Czech Republic showing steady progress in circular material use, nearing the EU average. Across the region, reductions in GHG emissions, particularly in the energy sector, reflect positive shifts toward renewable energy sources and improved energy efficiency.

Weaknesses

Austria struggles with rising waste generation per capita, highlighting the difficulty of balancing high consumption levels with sustainability goals. Hungary and Poland consistently underperform in waste management and recycling, with declining plastic packaging recycling rates and limited circular material use. Innovation activity remains a significant weakness for Slovakia and Hungary, limiting their ability to adopt advanced circular economy practices. Structural barriers, such as inadequate recycling infrastructure and underinvestment in critical sectors like transportation and agriculture, hinder broader progress across the region.

Opportunities

Expanding recycling infrastructure and public awareness campaigns in countries like Hungary and Poland offer significant potential to improve recycling rates and waste management outcomes. Promoting circular economy strategies in the manufacturing sector, as seen in Poland and Austria, presents an opportunity for further waste reductions through cleaner technologies and digitalization, as also suggested by Del Rio Castro et al. (2020). The transition to renewable energy offers additional opportunities for reducing waste and emissions. Poland's success in reducing waste in the energy sector illustrates the potential for broader adoption of renewables across the region. Strengthening public and private collaboration, as highlighted by Szczepańczyk (2022), could drive technological advancements and enhance the implementation of circular models, particularly in lagging sectors such as manufacturing and energy.

Threats

Economic and structural barriers, including inadequate waste processing infrastructure and low investment levels, pose significant challenges for countries like Hungary and Slovakia. These limitations hinder their progress in adopting circular economy practices and may exacerbate regional disparities. The temporary reductions in waste and emissions observed during the COVID-19 pandemic could obscure underlying inefficiencies, delaying necessary long-term reforms. Despite the implementation of circular economy policies across the region, wide gap between high-performing countries like Austria and lagging ones such as Hungary and Poland is seen. Rising waste generation in key sectors, including construction in Slovakia and Austria and household waste in Poland and Hungary, presents a growing threat to achieving circular economy goals without targeted interventions. The import of non-recyclable materials, such as composites or non-standardized plastics, poses a threat by undermining recycling efforts and increasing reliance on landfills. Without stricter regulations on product design and import standards, such materials could hinder circularity and add environmental burdens.

4 Conclusions

This article analyzes the progress of circular economy implementation in six Central European countries: Slovakia, Hungary, the Czech Republic, Austria, Poland, and Slovenia, focusing on indicators such as waste generation, recycling rates, circular material use, and GHG emissions. The findings reveal diverse performances, with Austria leading in recycling efficiency, innovation, and secondary raw materials use, while Slovakia achieved the largest improvement in circular material use. Slovenia maintained high municipal waste recycling rates, but declines in plastic recycling and circular material use highlight areas needing attention. Hungary and Poland face significant challenges, including declining recycling rates and insufficient infrastructure, particularly in managing household and manufacturing waste. Poland demonstrated some progress by reducing manufacturing waste and achieving the lowest municipal waste per capita, but overall circularity performance remains inconsistent. The Czech Republic showed moderate progress in circular material use but experienced notable declines in plastic recycling. The sectoral analysis highlights critical challenges in construction and manufacturing, where rising waste generation, particularly in Slovakia and Austria,

points to gaps in recycling systems. Energy sector improvements, especially in Poland and Austria, are attributed to shifts toward renewable energy and reduced fossil fuel reliance, aligning with broader sustainability goals. Despite this, the analysis faces several limitations. The data, primarily sourced from EUROSTAT, is constrained by availability, covering only 2018 and 2020, and focuses on a limited set of indicators and countries. Sophisticated statistical methods were not applied, limiting the depth of the findings, and the study could not fully capture the broader dimensions of circular economy dynamics, such as innovation spillovers, or policy interconnections.

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Sustainability Commitment, Early-stage Entrepreneurial Activity and Entrepreneurial Eco-system Quality: A European Perspective

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Abstract: This paper aims to explore the level of the sustainability commitment of early-stage entrepreneurs, recognizing that such commitment depends, at least in part, on supporting governmental programs and policies, cultural and social norms, perceptions of the priorities given to sustainability issues and quality of other components of the national entrepreneurial ecosystems. Datasets that feed into the k-means cluster analysis come from the adult population survey conducted by the Global Entrepreneurship Monitor in 2023. The analysis of the data from 20 European countries that participated in the survey, shows that there are significant differences between two distinctive clusters of countries depending on the extent to which sustainability aspects and value creation goals are considered among entrepreneurs engaged in the early-stage entrepreneurial activity. Furthermore, the results show significant differences between these two clusters in terms of the quality of national entrepreneurial eco-systems. The results suggest that the quality of the national support has an important, yet not expected, influence on the sustainability considerations among early-stage entrepreneurial activity. A better understanding the complexity of the entrepreneurial eco-systems and their interactions with the extent of the sustainability considerations among new entrepreneurs may help to close the gap in the sustainability entrepreneurship research and fulfil the goals of the sustainable development agenda.

Keywords: social, environmental and economic value creation, early-stage entrepreneurial activity, GEM European countries, k-mean cluster

JEL Classification: L26, M13, Q01

1 Introduction

Sustainable entrepreneurship is regarded as a form of entrepreneurial activity that involves creating a balance between the entrepreneurial venture's social, environmental, and economic benefits. Sustainable entrepreneurs are expected to discover, create and exploit entrepreneurial opportunities that create economic, social and environmental value (Roomi et al., 2021:4). As such, they are considered catalysts (Filser et al. 2019) or "game changers" (Vuorio, 2017) in the transition to sustainable development. According to the latest Global Entrepreneurship Monitor Report (GEM, 2024) a growing number of entrepreneurs are considering and prioritizing environmental and social implications of their business decisions or taking steps to minimize environmental damage and maximize social benefits. Despite this growing number of entrepreneurs committed to sustainability, their overall impact on sustainable development appears to be insufficient (Roomy et al., 2021). The importance of sustainable entrepreneurship has been repeatedly emphasized in the United Nations 2030 Agenda for Sustainable Development (UN, 2015). With only 17% of the Sustainable Development Goals (SDG) achieved and just six years left until 2030 deadline (UN, 2023) enhancing and encouraging sustainable entrepreneurial activities is considered crucial for, among others, providing decent jobs, promoting economic development, decoupling the economic growth from environmental degradation and preventing social injustice.

Previous research reported significant and relatively persistent differences in the level of entrepreneurial values, attitudes or activities across countries (Grilo and Thurik, 2006), resulting from the complex interaction of the individual, micro- or and macro conditions (Bosma and Schutjens, 2011). While the relationship on national and regional differences between entrepreneurial attitudes, entrepreneurial intentions or behavior is already empirically confirmed in the international context (Wennekers et al. 2007; Arenius and Minnity, 2005), the relation between early-stage or new entrepreneurs' commitment to sustainability across countries are still largely unexplored. Therefore, the purpose of this paper is to identify

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diversity of the European countries regarding sustainable entrepreneurship, and to reveal novel insights in the conditions for sustainable entrepreneurship across Europe.

While indicators of sustainability entrepreneurship are still debated, GEM research provides methodologically sound and harmonized cross-country data on sustainability considerations among entrepreneurs. Starting from 2021, GEM research measures sustainable consideration across new or already established entrepreneurial activity. These considerations may be interpreted as the proxy of sustainable early-stage entrepreneurial activity. Our study aims to analyze diversity between European countries for sustainable commitment of new entrepreneurs. The analysis applies k-means cluster analysis to divide 20 European countries participating in the GEM research in 2023 into distinctive clusters based on the prevalence of early-stage entrepreneurs who are committed to sustainability. In addition, the study aims to explain what differentiates these clusters and how they are characterized by the interplay between individual- or contextual factors (for example: individual entrepreneurial attitudes, perception of the social norms and perception of the quality of national entrepreneurial ecosystems).

Individual and specifically psychographic factors such as the perception on start-up opportunities, self-assessment of the capabilities to start a venture, or perception of the fear of failure are found relevant to explain prevalence rates of the nascent, new and established businesses across 17 European countries (Bosma and Schutjens, 2011). Wennekers et al. (2007) found a negative correlation between uncertainty avoidance and business ownership. Many studies related national differences in entrepreneurial activity to the values in society or national entrepreneurship formal or informal procedures and regulations (Uhlauer and Thurik (2007).

Most of the literature related to sustainability points to individual-level factors such as values, empathy and altruism as significant and important descriptors of the individual's willingness to become a social entrepreneur (Dees, 2012, Hockerts, 2015). The likelihood of recognizing sustainable entrepreneurial opportunities is found higher among individuals who are more empathetic and sympathetic (Patzelt and Shepherd, 2011). Contextual factors such as socio-economic as well as formal and informal institutions and procedures influence the formation of these values and behaviors at the individual level. Since contextual factors remain largely constant over time, they have a long-term effect on the level of sustainable commitment of entrepreneurs (Ralson et al., 2014). Muñoz and Dimov (2015) suggest that sustainable enterprises emerge either because of a supportive social environment or as a response to a non-supportive social environment. In addition, societies that attach high value on freedom, self-expression, and quality of life are conducive to higher sustainability commitment of entrepreneurs. For example, Hechavarria et al. (2017) found that individuals in countries with high postmaterialist values are more likely to prioritize social and environmental value creation goals over economic goals.

This paper aims to explore the level of the sustainability commitment of early-stage entrepreneurs, recognizing that such commitment depends, at least in part, on supporting governmental programs and policies, cultural and social norms, perceptions of the priorities given to sustainability issues and quality of other components of the national entrepreneurial ecosystems. Therefore, this study is primarily focused on answering two research questions: How diversified are European countries regarding the sustainable commitment of new entrepreneurs, and what factors play a significant role in explaining these differences?

The remainder of the paper describes data and methodology. Section 3 presents the identified cluster and discusses the differences in individual- or contextual level descriptors. The paper concludes by pointing to the contribution of this study, limitations of the current study and expectation of further research.

2 Data and methods

The data for this research was collected within the framework of the GEM project (www.gemconsortium.org) and includes 20 European countries that participated in the research in 2023. GEM collects data from 2 sources: (i) Adult population survey (APS) and (ii) National expert survey (NES). APS collects data from the representative sample of 2,000 adult residents aged 18-64, while NES data are collected from the convenient sample of experts (at least 36) based on the criterion of reputation and experience in the areas that determine the entrepreneurial environment of a country.

In line with the research on the intentions or actual entrepreneurial behavior, we assume that sustainability consideration can be used as a proxy or a latent potential of the early-stage entrepreneurs to become sustainable entrepreneurs. We also assume that such latent sustainable entrepreneurial activity is influenced by psychographic (such as networking with established entrepreneurs, seeing good opportunities to start a business, fear of failure attitudes, self-assessment of the capabilities to start a business), contextual and macro-level factors (such as quality of the entrepreneurial ecosystems, and social norms that prioritize sustainability issues). In total, 23 variables were selected for the analysis following the previous research: 13 variables were taken from NES and 11 variables from APS datasets. In addition, real GDP per capita (expressed in international dollars) sourced from the World Bank's World Development Indicator database was also used. The description of the APS and NES variables can be found in Table 1.

Table 1 APS and NES variables used in the research

APS variables	NES variables
The percentage of the population that: <ul style="list-style-type: none"> – knows someone who started a business in the past 2 years (KNOENT) – sees good conditions to start business in next 6 months (OPPORT) – has knowledge/skills to start business (SUSKIL) – would be prevented to start a business because of fear of failure (FEAR) 	The average grade of the selected component in the national entrepreneurial ecosystem: <ul style="list-style-type: none"> – Easiness to get financing for entrepreneurs (NES_FIN) – Government concrete policies, priority and support (NES_GPOL) – Government policies bureaucracy, taxes (NES_GBUR) – Government programs (NES_GPRO) – Entrepreneurial level of education at Vocational, Professional, College and University (NES_EDU) – Professional and commercial infrastructure access (NES_PCI) – Cultural, social norms and society support (NES_CUL)
The percentage of entrepreneurially active population that: <ul style="list-style-type: none"> – has the motivation to start a business - to make a difference in the world (TEA_YES) – consider social implications (TEASDGSO) – consider environmental implications (TEASDGENV) – prioritize the social and/or environmental impact above profitability (TEASDGPRI) – has taken steps to minimize the environmental impact (TEASDGST1) – has taken steps to maximize the social impact (TEASDGST2) 	The average grade of the following component of the SDG implementation system: <ul style="list-style-type: none"> – Good practices of social contribution and responsibility in new and growing firms (NES_SDGS) – Priority assigned to economic performance in new and growing firms (NES_SDGE) – Priority assigned to good environmental practices by new and growing firms (NES_SDGEN) – Priority assigned to sustainability by new and growing firms (NES_SDGC) – Priority assigned to business sustainability by governments/policy makers through new regulations/laws (NES_SDGG)
The average percentage of SDG variables <ul style="list-style-type: none"> – A composite indicator representing the extent of socially and environmentally conscious entrepreneurial activity (TEA_PROXY) 	The average grade of the national entrepreneurial ecosystem <ul style="list-style-type: none"> – A composite indicator representing the average of 13 components of the national entrepreneurial context (NECI)

Source: GEM APS and NES datasets, 2024

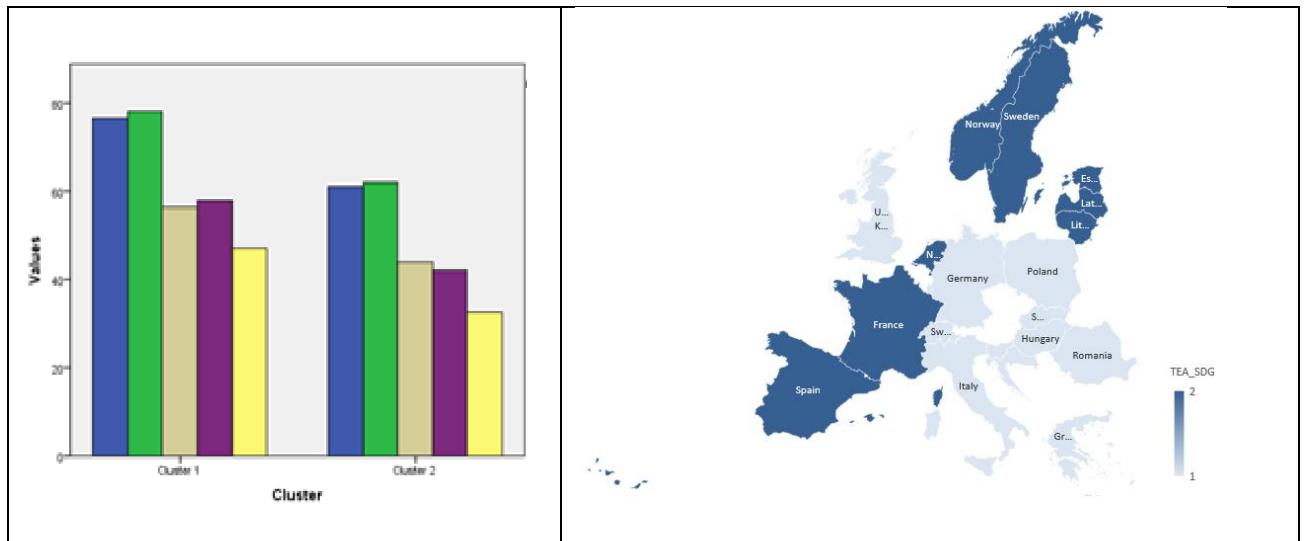
To cluster early-stage entrepreneurs, two methods were utilized: hierarchical clustering and k-means clustering. The former was employed to suggest the initial number of clusters, while the later, the most popular clustering method (Ikotun et al., 2023), was used to analyze the complex relationships between cases—in this instance, entrepreneurs in European countries). The k-means algorithm begins by selecting k cases as initial cluster centers, then calculates the distance between each cluster center and each case. Each case is assigned to the nearest cluster, and the averages of all clusters are updated. This process is repeated until the criterion function converges, meaning the updated cluster means no longer

changes significantly between successive steps. The final cluster means are then used to assign cases to their permanent clusters. Detailed information on this method can be found in Patel (2019) and Ikotun et al. (2023). One should note that this study uses squared Euclidean Distance as the measure of divergence between units. Additionally, a one-way analysis of variance (ANOVA) was conducted to determine whether the means are statistically significantly different from each other. Chi-square tests were also performed to profile and examine the statistical significance of the association between cluster membership and the variables of the entrepreneurial ecosystem and perception of the SDG system.

3 Research results

The hierarchical cluster analysis dendrogram initially suggested potential solutions with either two or three clusters. Subsequently, both configurations underwent k-means clustering. Upon evaluating the cluster centers, it was concluded that the two-cluster configuration proved to be the most statistically significant, stable, and meaningful. Figure 1 displays the final solution of the cluster analysis and illustrates the map of European countries categorized into clusters.

Figure 1 Results of clustering analysis



Source: Own processing

Note: Bars in both clusters refer to the following variables TEASDGSO, TEASDGEN, TEASDGPRI, TEASDGST1, and TEASDGST2, respectively

The first cluster is the largest, encompassing 12 European countries (Croatia, Germany, Greece, Hungary, Italy, Luxembourg, Poland, Romania, Slovakia, Slovenia, Switzerland, and the United Kingdom). In comparison to Cluster 2, entrepreneurs in this cluster exhibit a stronger commitment to a positive impact on society and the environment. They are more inclined to consider the social and environmental implications of their business activities. Moreover, they prioritize social and/or environmental impact over profitability and take proactive steps to mitigate their environmental footprint. Consequently, this cluster is aptly labeled "*sustainability enthusiasts*".

Cluster 2 comprises eight European countries (Estonia, France, Latvia, Lithuania, the Netherlands, Norway, Spain, and Sweden). On average, the values across each APS dimension used for clustering are lower compared to Cluster 1. Specifically, while less than 50% of entrepreneurs in Cluster 1 (47.1% precisely) have taken steps to maximize social impact (note that in all other APS dimensions, more than 50% of entrepreneurs exhibited pro-sustainable behavior), in Cluster 2, less than 50% of entrepreneurs prioritize social and/or environmental impact over profitability (44.01%), have taken measures to minimize environmental impact (42.1%), or have focused on maximizing social impact (32.7%). This highlights a distinct entrepreneurial profile in Cluster 2 characterized by lower engagement in socially and environmentally oriented business practices compared to Cluster 1. Therefore, this cluster is labeled "*sustainability opportunists*".

ANOVA tests produced F-values for each of the five sustainability dimensions used as clustering criteria (TEASDGSO, TEASDGEN, TEASDGPRI, TEASDGST1, TEASDGST2; 28.939, 32.051, 5.838, 18.034, 15.625; respectively, all $p < 0.001$), indicating significant contributions from all variables in the model. Notably, the dimensions of TEASDGSO and TEASDGEN were identified as particularly influential in shaping the clusters compared to the others.

To thoroughly characterize the clusters, we examined whether there exists a statistically significant relationship with the variables of the entrepreneurial ecosystem and perception of the SDG implementation. The p-values of the chi-square test statistics are presented in Table 2.

Table 2 Elementary statistics and statistical differences in means of the APS and NES variables

Variable	Cluster 1		Cluster 2		p-value
	mean	st. dev	mean	st. dev	
GDP per capita	56180	27270	56452	17525	0.9804
Knows someone who started a business (KNOENT)	49.859	10.257	53.504	9.220	0.4289
Sees good conditions to start business (OPPORT)	47.847	13.061	54.944	13.839	0.26
Has knowledge/skills to start business (SUSKIL)	51.735	9.267	50.850	4.071	0.8035
Fear of failure (FEAR)	51.140**	6.390	44.273	4.551	0.0174
To make a difference in the world (TEA_YES)	44.700	13.882	38.109	8.612	0.2485
Social implications (TEASDGSO)	76.503	5.216	61.124	7.624	<.001
Environmental implications (TEASDGENV)	78.178	4.730	62.013	8.092	<.001
Prioritization of Soc/env impact above profitability (TEASDGPRI)	56.428	13.305	44.066	6.702	0.0265
Minimize the environmental impact (TEASDGST1)	57.982	8.382	42.108	7.878	0.0005
Maximize the social impact (TEASDGST2)	47.211	8.043	32.685	8.063	0.0009
The average of SDG variables (TEA_PROXY)	63.260	4.328	48.399	3.990	<.001
Easiness to get financing (NES_FIN)	4.231	0.239	4.629	0.887	0.1527
Gov.policies, priority and support (NES_GPOL)	3.839	0.672	4.356	1.048	0.1934
Gov. policies bureaucracy, taxes (NES_GBUR)	4.508	0.573	5.201	1.107	0.0813
Government programs (NES_GPRO)	4.642	0.918	5.410	0.738	0.0639
Education: prof, college, univ (NES_EDU)	4.488	0.649	5.313	0.776	0.019
Professional/commercial infrastructure (NES_PCI)	5.383	0.511	5.784	0.600	0.1257
Cultural, social norms (NES_CUL)	4.309	0.842	5.494	1.397	0.0288
Good practices of social contribution and responsibility in new and growing firms (NES_SDGS)	5.372	0.585	5.833	0.654	0.1169
Priority assigned to economic performance in new and growing firms (NES_SDGE)	5.106	0.452	5.568	0.703	0.0894
Priority assigned to good environmental practices by new and growing firms (NES_SDGEN)	5.734	0.610	6.231	0.495	0.0714
Priority assigned to sustainability by new and growing firms (NES_SDGC)	5.563	0.818	6.373	0.868	0.0486
Priority assigned to business sustainability by governments/policy makers through new regulations/laws (NES_SDGG)	4.590	0.660	5.328	0.915	0.05
The average grade of the entrepreneurial ecosystem (NECI)	4.558	0.380	5.113	0.790	0.0491

Source: Own processing

Our results show that individual psychographic factors (except the fear of failure) are insignificant in explaining the diversity of latent national potential for sustainable entrepreneurship. However, contextual factors such as government administration and taxation, government programs, tertiary education, and prevailing cultural or social norms play an important role. Surprisingly, Cluster 1 shows a lower quality of the overall entrepreneurial ecosystem compared to Cluster 2. On the other hand, Cluster 2 shows a higher perception of SDG prioritization by new or growing firms or by policy makers and a lower prevalence of early-stage entrepreneurs committed to sustainability.

4 Conclusions

This study confirms the diversity of European countries in terms of sustainable early-stage entrepreneurial activities. The k-means cluster analysis identifies two clusters of European countries and links their differences primarily to context/macro-level factors. The quality of the entrepreneurial ecosystem and the prioritization of SDG implementation by new and growing firms or government regulations seem to play the most important role in explaining the differences between the two distinct clusters.

The findings are partly consistent with previous research on national differences in entrepreneurial intentions and behavior. They highlight that contextual conditions play a role in promoting or enhancing sustainable entrepreneurship. The findings contribute to the literature on sustainable entrepreneurship from an international perspective. However, the

interplay of the individual and contextual/macro-level factors is interwoven, so the results should be considered mainly explorative. The main limitations of our study is the focus on the European countries, and a relatively small number of variables considered. Further research could therefore include examining the differences between all GEM participating countries, using a multi-year approach that tracks the sustainability commitment of early-stage entrepreneurs longitudinally, and includes broader set of variables.

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Domestic Politics and Immigration Policy: Examining Political Drivers of Restrictive Measures in V4 Region Post-2015

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Abstract: The existing literature reveals a significant gap in understanding how domestic politics influence stance on immigration policy. This study examines the impact of key domestic political factors on immigration policy stances within the Visegrad Group (V4) region, utilizing the Chapel Hill Expert Survey databases and applying Fixed Effect (FE) and interaction term econometric methods. The findings indicate that parliamentary power, ideology, and nationalism perspective of domestic political parties significantly contribute to restrictive stance on immigration policies, especially post-2015. At the country level, nationalism and ideology are crucial in Slovakia, while security concerns and parliamentary power dominate in Poland. In the Czech Republic and Hungary, a combination of ideology, security concerns, economic issues, and nationalism shapes their restrictive stances. The study highlights the complex interplay between political forces and immigration policy in the V4 region and advocates for more balanced and inclusive policies that address labor market inequalities and foster social cohesion, tailored to each country's political and economic context. Acknowledging data constraints, the study emphasizes the need for further research on immigration policies and its labor market impacts.

Keywords: Immigration policies, domestic politics, V4, post-2015.

JEL Classification: P16, J61, D72, F22

1 Introduction

The V4, established on February 15, 1991, initially aimed to promote political, economic, and cultural cooperation among the Czech and Slovak Republic, Poland, and Hungary, with the primary goal of joining the European Union (EU) and North Atlantic Treaty Organization (NATO) (Bauerová, 2018). While the V4 successfully achieved these objectives by gaining EU membership, the group has since faced new challenges, notably the migration crisis that began in 2015. This crisis, which intensified discussions around immigration policies across Europe, forced the V4 to adopt a unified response that significantly diverged from the broader EU stance (Clarissa, 2018).

The migration crisis of 2015 exposed deep rifts within the EU regarding immigration policies, particularly between Western European nations and the V4 countries. While the EU sought collective action to manage the influx of migrants, the V4 countries opted for more restrictive policies, driven by concerns over national security, sovereignty, and cultural identity (Duina & Carson, 2020; Stojarová, 2018). This divergence highlighted the complex interplay between domestic political forces and regional cooperation, with the rise of nationalism and populism playing a crucial role in shaping the V4's approach to immigration (Lindquist, 2019; Walters & Skocpol, 2024).

Existing literature offers various explanations for the V4's restrictive stance on immigration. Three dominant narratives have emerged: the neorealist perspective, which focuses on geopolitical and security concerns; the social constructivist view, emphasizing nationalism and xenophobia; and the neoliberal explanation, which highlights the influence of radical right-wing parties and domestic politics on immigration policies (Szalai et al., 2017). While these perspectives provide valuable insights, they often lack empirical evidence to support causal links between political determinants of restrictive stance on immigration policy in the V4 countries, particularly their increasing power in the parliament (Weinar, 2011; Fleischmann & Dronkers, 2010).

Despite the growing body of literature on immigration policies within the V4 region, gaps remain. Few studies have empirically examined how domestic political parties influence the framing of immigration policies in these countries, particularly in the wake of the 2015 crisis. Moreover, there is a lack of comprehensive analysis on the factors driving the

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V4's collective opposition to the EU's immigration policies, such as the role of nationalism, political ideology, and economic concerns (Clarissa, 2018; Bauerová, 2018; Cichocki & Jabkowski, 2019).

This study aims to fill these gaps by empirically analyzing the political determinants of immigration policies in the V4 countries, focusing on factors such as the ideological positioning of political parties, their share of power, and the influence of nationalism, economic and security concerns. By doing so, it will contribute to a deeper understanding of how domestic political dynamics influence stance on immigration policies within the V4 region and offer insights into broader EU integration challenges.

The study's contributions are significant. First, it explores the relationship between the factors contributed to the restrictive stance of domestic political parties on immigration policies in the V4 region in the long-run and post 2015, providing empirical evidence on a topic that has been underexplored. Second, it focuses individually on the V4 region member countries, a critical but often overlooked context in discussions of European immigration policy. Finally, the findings will have practical implications for policymakers, offering recommendations on how to address immigration in ways that balance economic growth with social cohesion.

Specifically, this study is guided by the following research questions:

1. How do domestic political parties in the Visegrad Group (V4) countries influence the framing of immigration policies?
2. What role do ideological positioning, parliamentary power, nationalism, and security concerns play in shaping restrictive immigration stances in the V4 region post-2015?

2 Are there significant variations in immigration policy drivers across individual V4 countries (Czech Republic, Hungary, Poland, and Slovakia)?Methods

To empirically investigate the political determinants of restrictive immigration policies in the V4 region, this study tests the following hypotheses:

1. H1: The share of parliamentary power held by right-wing parties significantly correlates with a restrictive stance on immigration policies in the V4 countries.
2. H2: Nationalism and ideological extremism positively influence the likelihood of restrictive immigration policy stances in the V4 region.
3. H3: Security concerns and economic factors have varying impacts on immigration policy stances across V4 countries, reflecting their unique political and economic contexts.

To empirically test the specified research questions and hypotheses, the study employs the following econometric specification: $Y_{ipt} = \beta_0 + \beta_1 X_{ipt} + \alpha_i + \gamma_p + \delta_t + \epsilon_{ipt} \dots \dots (1)$

In model (1) Y_{it} denotes the position of political parties (p) toward immigration policies in the country (i) at time (t). Additionally, X_{ipt} are the variables which explain the factors contributing to political parties' stance toward immigration policies. These variables include the seat share of political parties in parliament, the ideological stance of political parties, their concern about economic and national security concern, and nationalism. The model (1) is further extended to capture the time-invariant country and political party specific factors with consideration of robust standard error. Moreover, to investigate the impact of each factor on the stance of political parties toward immigration policies at the V4 region and members countries, the study applies several models by including interaction term of time and countries. This will provide us with empirically tested evidence on how various factors from the domestic political perspective influence the stance of political parties toward immigration policies. Additionally, it will highlight whether the V4 countries with stronger far-right- and right-wing political parties exhibit divergence or convergence in their stance toward immigration policies compared to countries with more far-left- and left-wing political parties.

2.1 Data and Variables

The research utilizes the Chapel Hill Expert Survey as its primary data source, covering the period from 1999 to 2019. This survey examines the factors influencing the framing of immigration policies. The dataset integrates surveys conducted in 1999, 2002, 2006, 2010, 2014, and 2019. Initially, the 1999 survey included 116 experts assessing 143 political parties across the 14 largest EU member states (EU-14). Subsequent surveys expanded to evaluate more experts and parties. By 2019, the surveys encompassed all EU member states, focusing on position of domestic political parties related to European integration, immigration policy, economic policy, security, and their share in government (BAKKER et al., 2021). Based on the theoretical framework and literature review, relevant variables for this research are outlined in Table 1 for analysis.

Table 1. Description of Variables

Variables	Definition	Measurement	Source
Immigration Policy	Position and stance of party on immigration policies	0 = Strongly favors liberal 10 = Strongly favors restrictive	Chapel Hill
Power	Share of the party in the national election	Numeric	Chapel Hill
Ideology	Position of the party in terms of its overall ideological stance	0 = Extreme left 10 = Extreme right	Chapel Hill
Economic	Position of the party on Economic issues	0 = No importance 10 = Great importance	Chapel Hill
Security	Orientation of the party towards a common EU foreign and security policy	1 = Strongly opposed 7 = Strongly in favor	Chapel Hill
Nationalism	Position on integration of immigrants and asylum seekers	0 = Strongly favors multiculturalism 10 = Strongly favors assimilation	Chapel Hill

Source: Author Elaboration based on Chapel Hill Dataset

Additionally, the descriptive statistics of variables which are utilized in this study are summarized in the Table 2. This table provide the mean, standard deviation and the number of observations.

Table 2. Descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
immigrate policy	875	5.269	2.375	0	10
Economic	1196	4.856	2.157	.091	9.588
Security	1195	4.523	1.585	1	7
Ideology	1196	5.188	2.264	.143	10
Power	1127	12.304	13.631	0	64.6
Nationalism	873	5.367	2.417	.444	10

Source: Author Elaboration based on Chapel Hill Dataset

3 Research results

The main factors influencing the political parties' stance on immigration policies in the V4 region are summarized in Table 3. Specifically, a positive coefficient indicates that changes in the explanatory variables increase the likelihood of restrictive immigration policies. In column (1), there is a significant positive relationship between the V4 region and immigration policies in the long run. Furthermore, columns (2-6) explore the effects of each explanatory variable. Notably, in column (5), by adding the share of power of political parties in parliament, it positively influences immigration policies in the post-2015. Additionally, column (7) presents a pooled regression of all variables, revealing that the V4 region's ideological stance, nationalist sentiments, and increasing parliamentary power significantly contribute to

opposition to liberal immigration policies. While, the growing share of political parties in parliament is a key driver of restrictive immigration stances in the V4 region post-2015, ideology and nationalism are also the main factors.

Table 3. Regression Result for V4 Region

VARIABLES	(1) Model 1	(2) Model 1	(3) Model 1	(4) Model 1	(5) Model 1	(6) Model 1	(7) Model 1
Post-2015	0.263 (0.205)	0.231 (0.168)	-0.0355 (0.198)	0.216* (0.118)	0.239 (0.205)	0.195*** (0.0649)	0.152 (0.0933)
V4	0.447** (0.217)	0.316 (0.251)	0.409** (0.186)	0.00887 (0.189)	0.371* (0.224)	-0.0355 (0.0921)	1.183* (0.708)
V4_Post	0.408 (0.502)	0.387 (0.532)	0.504 (0.392)	0.547 (0.379)	0.855* (0.485)	0.186 (0.163)	0.685*** (0.212)
Economic		0.531*** (0.0312)					0.0164 (0.0652)
Security			-0.447*** (0.0578)				-0.0646 (0.0670)
Ideology				0.795*** (0.0232)			0.221** (0.0881)
Power					0.0283*** (0.00486)		0.00929* (0.00502)
Nationalism						0.912*** (0.0111)	0.565*** (0.0520)
Constant	5.112*** (0.101)	2.571*** (0.165)	7.230*** (0.324)	1.051*** (0.130)	4.806*** (0.133)	0.327*** (0.0734)	0.415 (0.705)
Observations	875	875	874	875	829	871	825
R-squared	0.012	0.246	0.096	0.598	0.042	0.866	0.959
FE-Country	No	No	No	No	No	No	Yes
FE-Party	No	No	No	No	No	No	Yes
FE-Year	No	No	No	No	No	No	Yes

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

able 4 investigates the factors influencing the stance of political parties on immigration policies in V4 member countries. Firstly, Column (1) shows long-term changes, revealing that the Czech Republic and Slovakia have a significant positive influence on the stance toward restrictive immigration policies, whereas Poland exhibits a negative influence, and Hungary is deemed insignificant. In addition, Columns (2-7) analyze the post-2015 impacts. Here, the Czech Republic, Hungary, and Poland demonstrate significant positive effects, while Slovakia remains insignificant. Notably, after 2015, Slovakia's stance becomes significant when ideological and nationalist factors are included, and Poland shows a similar response influenced by security and power variables. Moreover, both Czech and Hungary exhibit significant impacts across various factors, particularly political power. Lastly, Column (8) presents a pooled regression, indicating that only Slovakia has a significant long-term positive impact. While in the post-2015 context, Hungary and the Czech Republic demonstrate positive significance. However, the influence of political parties ideology, share of power in parliament and nationalism are also significant factors. Thus, V4 countries exhibit diverse stances on immigration influenced by ideology, nationalism, power, security, and economic priorities.

Table 4. Regression Result for V4 countries

VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Post-2015	0.255** (0.118)	0.126 (0.116)	0.116 (0.115)	0.0479 (0.113)	0.103 (0.108)	0.127 (0.116)	0.187** (0.0849)	0.151 (0.0935)
dummy_hung	0.297 (0.298)	-0.647 (0.585)	-1.353** (0.630)	-0.556 (0.541)	-1.641*** (0.605)	-0.426 (0.558)	-0.314 (0.603)	-0.609 (0.646)
dummy_pol	-0.746** (0.298)	-1.625** (0.667)	-1.794*** (0.688)	-1.493** (0.652)	-1.214 (0.780)	-1.457** (0.608)	-0.173 (0.812)	0.0976 (0.814)
dummy_cze	2.226*** (0.298)	0.864 (0.596)	-0.0529 (0.689)	0.852 (0.593)	-1.182 (0.754)	0.933 (0.610)	0.476 (0.543)	-0.383 (0.682)
dummy_slo	1.410*** (0.298)	0.702 (0.687)	-0.149 (0.753)	0.731 (0.675)	-1.276 (0.775)	5.635*** (0.745)	0.384 (0.592)	1.291* (0.769)
dummy_slo_post		0.808 (0.614)	0.832 (0.596)	0.814 (0.604)	0.975* (0.550)	0.922 (0.669)	0.606* (0.365)	0.578 (0.362)
dummy_pol_post		0.980* (0.592)	0.972 (0.593)	0.951* (0.576)	0.994 (0.645)	0.982* (0.521)	0.323 (0.654)	0.322 (0.621)
dummy_hung_post		1.045** (0.498)	1.067** (0.470)	1.057** (0.451)	1.100*** (0.398)	1.053** (0.452)	0.676* (0.381)	0.715** (0.315)
dummy_cze_post		1.463*** (0.512)	1.562*** (0.515)	1.433*** (0.513)	1.551*** (0.533)	1.581*** (0.521)	0.900*** (0.281)	1.025*** (0.306)
Economic			0.208*** (0.0720)					0.0245 (0.0650)
Security				-0.137* (0.0712)				-0.0661 (0.0672)
Ideology					0.545*** (0.0870)			0.217** (0.0880)
Power						0.0141** (0.00615)		0.00970* (0.00505)
Nationalism							0.592*** (0.0485)	0.565*** (0.0523)
Constant	2.602*** (0.295)	2.631*** (0.324)	2.088*** (0.403)	3.452*** (0.524)	1.195** (0.507)	2.400*** (0.349)	0.720 (0.497)	0.409 (0.709)
Observations	875	875	875	874	875	829	871	825
R-squared	0.928	0.932	0.933	0.932	0.938	0.932	0.958	0.959
FE-Country	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
FE-Party	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
FE-Year	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Robust standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

4 Conclusions

This study investigated the political factors shaping stance toward immigration policies in the V4 region and member countries, emphasizing the significant influence of domestic political parties, particularly after 2015. In this context, ideological stances, nationalism, and increasing parliamentary power drive restrictive policies, aligning with the Political Opportunity Structure Framework (POSF). Moreover, this finding supports Kitschelt et al. (1995)'s conclusions regarding the impact of extreme right-wing parties. As a result, the growing share of right-wing political parties in parliament is a key driver of restrictive immigration stances in the V4 region post-2015, ideology and nationalism are also the main factors. Additionally, in the member countries the Czech Republic and Slovakia demonstrate long-term restrictive trends, while Hungary and Poland adopt stricter stances due to security and power concerns. Specifically, in Poland, immigration

policy is largely shaped by parliamentary power and security concerns, while in Slovakia, nationalism and ideology play key roles. Thus, V4 countries exhibit diverse stances on immigration influenced mostly by ideology, nationalism, power, security, and economic priorities. Similarly, these findings align with Szalai et al. (2017), who identified conflicting narratives in the V4 countries. Moreover, Stojarová (2018) noted how xenophobic rhetoric has caused these countries to diverge from EU norms. This study emphasizes that the rise of right-wing parties and nationalist rhetoric has further driven opposition to liberal immigration policies across the region.

While the study offers valuable insights, certain limitations, such as using perceptive suvey data constraints may affect its comprehensiveness. Therefore, future research should consider real indicators, measuring the immigration policies and expanding the dataset to ensure a more accurate understanding of the factors shaping immigration policies in the V4 region and memeber countries.

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Decoding Entrepreneurial Value Creation Goals: A Comparative Analysis of Factors Influencing Early-Stage Entrepreneurs' Drives

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Abstract: Acknowledging the vital role of entrepreneurship as a driver of economic growth and a contributor to the overall health and prosperity of societies, this study examines the motivations and value creation goals of entrepreneurs during their early stages. Previous research indicated a mix of motivations that drive or spurs entrepreneurial activity. Entrepreneurs may have numerous motivational triggers, starting from the desire for autonomy, self-expression and the desire to make their own decisions as the most common, to more advanced motivational orientations such as to accumulate the great financial or economic wealth, or affect the pressing social issues and provide new innovative solutions for social or environmental challenges. Entrepreneurs may also be driven by the desire to continue a family tradition, or simply to provide employment for themselves, because of the scarcity of the available jobs around them. The aim of this study is to explore which factors influence early-stage entrepreneurs and how these factors affect each of the motivations. These influencing factors include socio-demographic aspects as well as attitudes towards business opportunities, entrepreneurship, media, growth aspirations, and sustainable development. Data were collected within the GEM research for Croatia in 2023. A representative sample of 256 individuals who were engaged in owning or managing early-stage entrepreneurial activity is analyzed applying multivariate multiple linear regression is used (MMR). The results show that although there are similarities in attitudes about social status and long-term planning, significant differences stem from age, focus on social and economic impact, fear of failure. Those who want to make a difference in the world and those who want to create wealth have different priorities, while entrepreneurs motivated by continuation of the family business or necessity may make decisions that have less to do with business opportunities and more to do with available resources and experiences.

Keywords: entrepreneurial motivation, opportunity driven entrepreneurs, necessity driven entrepreneurs, early-stage entrepreneurial activity, GEM

JEL Classification: L21, L26, M13

1 Introduction

Entrepreneurship associations with innovation, employment and overall economic growth and welfare (Wennekers and Thurik, 1999; Audretsch an Thurik, 2004; Shane, 2009, Acs et al., 2012; Neumann, 2021) attract all sorts of interest among academics and policy makers in an attempt to increase the level and quality of the entrepreneurship. Decoding the relationship between individual factors that drive the entrepreneurial activity has proved to be far from simple. Literature offer numerous explanations of what makes the entrepreneurial activity more impactful and how to foster value creation of entrepreneurial activity. Apparently, not every entrepreneurial activity contributes equally to the economic welfare. Accordingly, opportunity driven entrepreneurial activity are more innovative and characterized with higher growth aspirations and ambitions, and therefore has the key role in economic development. However, along with the economic value creation goals, entrepreneurial activity has a profound contribution to the environmental and social value creation. Recently, reflecting on the ascend of the sustainable development agenda (UN, 2022), entrepreneurship is called to play the role of the key agent in addressing pressing social injustice (for example: poverty and inequality in access to education, decent jobs, good employment opportunities), or environmental deterioration (such as: climate change, carbon emissions, pollution, etc.).

Sustainable entrepreneurship emerged as novel approach to entrepreneurship research in line with the SDGs Agenda (UN, 2015) and the „tripple bottom line“ framework (Elkington, 2006) for assuring balanced or blended impact of entrepreneurial activity on profit, people and planet. Sustainable entrepreneurs are in „the pursuit of perceived

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opportunities to bring into existence future products, processes, and services for gain, where the gain is broadly construed to include economic and non-economic gains to individuals, the economy and society“ (Shepherd and Patzelt, 2011:142). More broadly, sustainable entrepreneurs are referred as those focused on „discovering, creating, and exploiting entrepreneurial opportunities that contribute to sustainability by generating social and environmental gains for other in society“ (Roomi et al, 2021:4). Apparently, entrepreneurs who effectively balance economic, social and environmental value creation are still marginally represented among the entrepreneurs. Although the number of entrepreneurs who are aware of the need to adopt sustainable goals is growing, there is still insufficient number of those among them who are opportunity driven (or aspire to make a change in the world) and to make more significant contribution to the sustainable development (Roomi et al, 2021; Cervelló-Royo et al., 2020; Huđek & Bradač Hojnik, 2020).

Researchers attempting to explain sustainable entrepreneurial behaviour explicitly acknowledge the role of motivations (Reuther et al., 2023; Kummitha and Kummitha, 2021) in entrepreneurial success and impact. Motivational orientation seems to be influenced by personal factors such as gender, age, education, prior knowledge and experience, values, goals, and others (Fischer et al. 2017). For example, Muñoz and Dimov, (2015) explicitly emphasized the role of the motivations (such as the aspiration to make a change in the world) and values (i.e. prioritisation of the environmental or social goals) in starting or running sustainability-oriented ventures. In addition, motivational orientation or entrepreneurial reactions to sustainability may vary between nascent or early-stage ventures and established ventures or large corporations (Roomi et al., 2021). Despite the increased awareness of the importance of the sustainability commitment, awareness or values only a little is known about how these values are related to the entrepreneur's motivation or goals. Therefore, this study aims to explore which individual factors influence early-stage entrepreneurs and how are their consideration of the sustainability issues aligned with their motivations. These influencing factors include socio-demographic aspects as well as attitudes towards business opportunities, entrepreneurship as the career choice, perception of the status of entrepreneurs in media, their growth aspirations, and their consideration of the sustainability prioritization. Using archival data of the Global Entrepreneurship Monitor (GEM) observatory (GEM, 2023) and deploying multivariate multiple linear regression, this study focuses on examination of how changes in multiple independent variables (motivational drivers such as “to make a difference in the world”, or “to make a great wealth or a very high income”) relate to changes in multiple dependent variables (individual sociodemographic factors).

Researching the motivations of early-stage entrepreneurs is of utmost importance as it provides deeper insight into what drives individuals to start a business venture, even under conditions of uncertainty and risk. Understanding these motivations can help not only in shaping policies that support entrepreneurship but also in creating an encouraging environment for innovation and sustainable growth. Such knowledge is crucial for countries seeking to improve their entrepreneurial ecosystem, as it allows for the identification of specific needs and barriers faced by entrepreneurs, enabling more effective responses to these challenges. The results can be useful for policymakers, business advisors, educators, and the entrepreneurs themselves to better understand the factors that shape their motivation and success. In addition, multivariate multiple linear regression provides insights into the interrelationships between motivations, as well as potential joint effects of independent variables on different aspects of entrepreneurial motivations. This ensures a more comprehensive analysis, allows for a more precise identification of key influencing factors on entrepreneurial motivations, and creates a significant advancement over conducting individual multiple regressions for each motivational model.

2 Methods

GEM observatory (GEM, 2023) annually provides large amount of data allowing tracking the level and quality of the entrepreneurial activity across the large number of participating countries. Our study is based on the data from Adult Population Survey (APS) collected within the GEM research for Croatia in 2023. A representative sample of 2,000 adults in Croatia included 256 individuals who were engaged in owning or managing early-stage entrepreneurial activity (TEA). This study is focused on exploring four types of motivational triggers for early stage entrepreneurial activity. These variables used as multiple dependent variables were as follows: „to make a difference in the world“, „to build great wealth or a very high income“, „to continue a family tradition“, and „to earn for a living“. Participants indicate their interest in each of these motivational triggers on a scale from 1 (strongly disagree) to 5 (strongly agree). Independent variables included in this study, were also taken from the APS Croatia 2023 dataset, are described in Table 1.

Table 1. Description of variables used in the research

Variable label	Variable description
AGE	Age of the respondents
EDUC	Education of the respondents (secondary, post-secondary, graduate)
OPPORT*	In the next six months, there will be good opportunities for starting a business in the area where you live
SUSKILL*	You personally have the knowledge, skill and experience required to start a new business
FEARFAIL*	You would not start a business for fear it might fail.
EASY*	In your country, it is easy to start a business
OPPISM*	You rarely see business opportunities, even if you are very knowledgeable in the area
PROACT*	Even when you spot a profitable opportunity, you rarely act on it
CREAT*	Other people think you are highly innovative
VISION*	Every decision you make is part of your long-term career plan
EQUAL*	In my country, most people would prefer that everyone had a similar standard of living
NBGOOD*	In my country, most people consider starting a new business a desirable career choice
NBSTATUS*	In my country, those successful at starting a new business have a high level of status and respect
NBMEDIA*	In my country, you will often see stories in the public media and/or internet about successful new businesses
JOBS	Expected job growth (persons) in 5 years
SOC_HI	When making decisions about the future of your business, you always consider social implications (yes / no)
SOC_ENV	When making decisions about the future of your business, you always consider environmental implications (yes / no)
SOC_PRI	You prioritize the social and/or environmental impact of your business above profitability or growth (yes / no)
SDG_STEPS1	Have you taken any steps to minimize the environmental impact of your business over the past year? (yes / no)
SDG_STEPS2	Have you taken any steps to maximize the social impact of your business over the past year? (yes / no)
SDG_AWARE1	Are you aware of the 17 United Nations Sustainable Development Goals? (yes / no)
SDG_AWARE2	Have you identified any of the goals which are a priority for your business and defined a set of clear objectives, actions and Key Performance Indicators? (yes / no)

* measured by the Likert scale (1: strongly disagree to 5: strongly agree)

Source: Global Entrepreneurship Monitor, Adult Population Survey Questionnaire

In data analysis multivariate multiple linear regression is used (MMR). This method extends simple linear regression, which deals with only one dependent variable, by enabling simultaneous modeling of multiple dependent variables that are associated with a set of independent variables (Hair et al., 2010; Tabacnick, Fidell, 2013). The formula for MMR can be represented as:

$$Y = X\beta + \varepsilon$$

where:

Y represents the matrix of dependent variables (dimension $n \times p$, where n is the number of observations and p is the number of dependent variables).

X is the matrix of independent variables (dimension $n \times k$, where k is the number of independent variables).

β is the matrix of coefficients (dimension $k \times p$).

ε represents the matrix of errors (dimension $n \times p$).

MMR is employed when there is a need to understand the impact of multiple predictors on multiple outcome variables, which allows for the exploration of complex relationships within the data. This is particularly useful in fields like entrepreneurship research, where multiple aspects of motivation and their interactions need to be examined.

3 Research results

Results of multivariate multiple regression are presented in table 2. Only those variables that have an influence on any of the motivations are presented in the table results.

Table 2. Results of multivariate multiple regression

Variable	To make a difference in the world			To build great wealth or a very high income			To continue a family tradition			To earn a living		
	B (SE)	β	p-value	B (SE)	β	p-value	B (SE)	β	p-value	B (SE)	β	p-value
Age				-0.036 (0.006)	-0.319	<.0001				-0.017 (0.006)	-0.147	.0164
EDUC (post-sec.)										-0.469 (0.175)	-0.163	.0081
EDUC (graduate)										-0.335 (0.232)	-0.878	.1500
SKILLS										0.160 (0.085)	0.117	.0690
FEARFAIL							0.143 (0.067)	0.136	.0354	0.169 (0.057)	0.178	.0036
EASY	-0.114 (0.063)	-0.110	.0717							-0.101 (0.057)	-0.104	.0801
OPPISM				0.152 (0.063)	0.147	.0170	0.139 (0.075)	0.119	.0654	0.173 (0.064)	0.163	.0078
PROACT	-0.160 (0.066)	-0.150	.0160									
VISION	0.222 (0.077)	0.183	.0045				0.194 (0.082)	0.155	.0201			
NBSTATUS	0.166 (0.072)	0.139	.0221	0.242 (0.064)	0.222	.0002						
SOC_HI (yes)										0.601 (0.213)	0.184	.0052
SOC_PRI (yes)				-0.387 (0.174)	-0.141	.0275						
SDG_STEPS2 (yes)	0.558 (0.182)	0.193	.0023							0.364 (0.165)	0.134	.0290

The factors that significantly impact the motivation '**to make a difference in the world**' are: (i) easiness to start a business; (ii) reaction to profitable opportunities; (iii) focusing on long-term career plans; (iv) attitudes about the high level of status of entrepreneurs; (v) steps taken to maximize the social impact of the business. Regression analysis results show that motivation for this goal is high among early-stage entrepreneurs who perceive it as difficult to start a business in Croatia, but who quickly react to profitable opportunities when they arise. High motivation is also observed among those who consider long-term career plans in every decision they make. Additionally, they believe that those successful at starting a new business have a high level of status and respect, and they have also taken steps to maximize the social impact of their business over the past year. Entrepreneurs with high motivation for this goal are driven to succeed despite finding it difficult to start a business. They are committed to their career and have a clear vision of what they want to achieve. Interestingly, this motivation is pronounced among entrepreneurs who have already taken steps to maximize the social impact of their business over the past year, indicating that they value contributing and making a social impact.

The factors that significantly impact the motivation '**to build great wealth or a very high income**' are: (i) age; (ii) seeing business opportunities; (iii) attitudes about the high level of status of entrepreneurs; (iv) prioritization of social/environmental impact versus profitability/growth. Regression analysis results show that motivation for this goal is high among early-stage entrepreneurs who are younger and, although they see business opportunities less frequently, are highly focused on wealth and prioritize profitability or growth over social or environmental impact. Younger entrepreneurs often have higher ambitions for acquiring wealth, are more willing to take risks associated with entrepreneurship due to having more time to recover from failure, and may have fewer financial resources and stability, which can motivate them to start a business with the aim of quicker wealth accumulation. Entrepreneurs with high motivation for this goal place significant importance on having high status in society. It has been shown that no factor related to social or environmental impact is important for this goal. Therefore, it seems they are exclusively focused on profit and wealth accumulation.

Three factors significantly impact the motivation '**to continue family tradition**': (i) fear of failure; (ii) seeing business opportunities; (iii) focusing on long-term career plans. Regression analysis results show that motivation for this goal is

high among early-stage entrepreneurs who have a low fear of failure, see business opportunities less frequently, and are dedicated to a long-term career. They have a lower fear of failure because they already have the support and experience of previous generations; the family business often comes with an existing client base, reputation, and resources, which reduces the perception of risk. Family support can decrease fear of failure and increase motivation, as entrepreneurs know they are not alone in facing challenges. They are determined to continue the family business and are focused on this career path regardless of the level of business opportunities.

For the motivation '**to earn a living**', the largest number of influencing factors has been identified, totaling eight: (i) age; (ii) education; (iii) fear of failure; (iv) having skills and experience to start a business; (v) easiness to start a business; (vi) seeing business opportunities; (vii) steps taken to maximize the social impact of the business; (viii) decisions about the future of the business consider social implications. Regression analysis results show that motivation for this goal is high among early-stage entrepreneurs who are younger and have lower education. Starting a business out of necessity may be more common among younger entrepreneurs because they are less established in the labor market and may face greater difficulties in finding employment, in an uncertain economic environment, and due to a lack of other income or stable employment opportunities. Regarding education, they may not see other opportunities due to their lower level of education and therefore rely on their own capacities. Although they see business opportunities less frequently, they do not have a pronounced fear of failure and have confidence in their skills and experience to start a successful business. Interestingly, these entrepreneurs, motivated by necessity, have a pronounced social component. Specifically, when making decisions about the future of their businesses, they always consider social implications and have already taken steps to maximize the social impact of their business. This may be because they are in a socially sensitive situation and thus think about these issues more. They may be more aware of how their decisions impact employment, the local economy, and social relations. Considering social implications may be crucial for the sustainability of their business. For other motivations, such as wealth accumulation or continuing a family business, social implications may not be as critical since these motivations are more focused on individual goals or preserving tradition.

4 Conclusions

Our analysis results show that younger entrepreneurs are more inclined towards the motivations 'to build great wealth or a very high income' and 'to earn a living'. On the other hand, motivations such as 'to make a difference in the world' and 'to continue family tradition' do not show a significant association with age, suggesting that both younger and older entrepreneurs equally prefer these motives. Education has proven to be important only for the motivation 'to earn a living', with less educated entrepreneurs being more motivated by this goal. For other motives, such as 'to make a difference in the world' and 'to build great wealth', education is not a significant predictor, indicating that education level does not have a decisive impact on these specific entrepreneurial motivations. Possessing the necessary knowledge and skills to start a business is significant only for the motivation 'to earn a living', suggesting that entrepreneurs with greater confidence in their skills are more inclined to start a business with the goal of earning a living. Conversely, for motivations like 'to make a difference in the world' or 'to build great wealth', self-perception of knowledge and skills is not a crucial factor, which may imply that these motivations are driven by other factors. Fear of failure is an important predictor for 'to continue family tradition' and 'to earn a living', showing that necessity-driven entrepreneurs are less worried about failure because they may have no other alternative, while those continuing a family tradition already have an established business. Conversely, for motivations like 'to make a difference in the world' and 'to build great wealth', fear of failure is not significant, suggesting that entrepreneurs driven by these motives are less sensitive to the risk of failure or do not perceive it as a barrier to achieving their goals. Interestingly, for all motivations except 'to make a difference in the world', seeing fewer business opportunities increases motivation. This might indicate that entrepreneurs who less frequently notice business opportunities are more aware of the need to capitalize on the opportunities they do see, and their motivation drives them to act out of necessity or a sense of urgency. In other words, these entrepreneurs may be driven by internal pressures or constraints that encourage them to take action when they see an opportunity, knowing they might not encounter similar chances often. On the other hand, for the motivation 'to make a difference in the world', entrepreneurs may be more guided by personal beliefs and goals, regardless of the frequency of opportunity recognition. Social status is an important factor only for the motivations 'to make a difference in the world' and 'to build great wealth'. This means that entrepreneurs driven by these motivations may view social status as crucial in achieving their goals. For instance, those who want to make a difference in the world or create great wealth might see social status as a means to achieve these goals or as an indicator of success in these areas. Steps taken to maximize social impact have been undertaken only by entrepreneurs with motivations 'to make a difference in the world' and 'to earn a living'. This suggests that entrepreneurs aiming to create a positive social impact actively seek ways to improve their influence on society. On

the other hand, entrepreneurs focused on earning a living may see social impact as a means to stabilize and ensure the long-term sustainability of their business. Interestingly, only for the motivation 'to earn a living' is it important to consider social implications when making decisions about the future of the business. This may suggest that only entrepreneurs motivated by earning a living actively consider the social consequences of their decisions.

Factors that are not significant for any motivation are: (i) attitudes about good opportunities for starting a business in the next six months; (ii) innovativeness perceived by others; (iii) attitudes about a similar standard of living; (iv) attitudes about entrepreneurship as a desirable career choice; (v) attitudes about stories in the media about successful new businesses; (vi) expected job growth in 5 years; (vii) considering environmental implications when making decisions about the future of the business. These findings suggest that early-stage entrepreneurs are primarily motivated by personal goals, long-term career plans, and immediate business opportunities, while external factors such as social perception, media attention, or environmental implications are less important. This may indicate that early-stage entrepreneurs are more focused on establishing and stabilizing their businesses rather than broader economic or social aspects. It may also suggest that policies and incentives should focus on providing concrete support rather than promoting entrepreneurship as a socially desirable or innovative venture. Attitudes about good opportunities for starting a business in the next six months are not significant, suggesting that entrepreneurs, regardless of their motivation, do not base their business decisions on short-term business opportunities. Instead, they may rely on longer-term or more stable factors, such as personal ambitions, life goals, or current opportunities, which do not depend on short-term market conditions. Attitudes about entrepreneurship as a desirable career choice do not affect motivation, implying that entrepreneurs are not necessarily driven by the social perception of entrepreneurship as a desirable career choice. This may indicate that their decision to engage in entrepreneurship comes from personal motives and aspirations, rather than external pressure or social norms. Attitudes about stories in the media about successful new businesses are not significant, meaning that media coverage of the successes of other entrepreneurs does not play a role in motivating early-stage entrepreneurs. This finding may suggest that entrepreneurs are guided by their own experiences and goals, rather than how the successes of others are portrayed in the media. Expected job growth in 5 years is not significant, indicating that entrepreneurs do not base their motivations on predictions of future employment growth. This finding may suggest that they are focused on personal goals or immediate needs rather than broader economic forecasts that could impact employment. Considering environmental implications when making decisions about the future of the business is not a significant factor for any motivation, indicating that environmental aspects are not considered crucial when making decisions about the future of the business. This result may point to a lack of awareness about sustainable business practices or that economic and practical factors currently take precedence.

These results highlight the need for a differentiated approach in analyzing and supporting entrepreneurs. Understanding the specific factors influencing different motivations can help in shaping targeted policies and programs that are better aligned with the actual needs and ambitions of entrepreneurs. Ultimately, this understanding can enhance the effectiveness of support and contribute to greater success in entrepreneurial initiatives.

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Session:

Towards Sustainability in Retail, Marketing and Tourism

Service Quality of the Wellness and Spa Centers in the Czech Republic: Application of SERQUAL Model

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Abstract: While much literary work is increasing in the tourism business, little attention is given to the service quality of wellness and spa centers. Therefore, the present work aims to assess the service quality of the wellness and spa centers in Luhačovice, the Czech Republic using the SERVQUAL scale model. The study, which is cross-sectional, and quantitative, consists of 90 randomly selected participants visiting Wellness and Spa centers during 2 months of the data collection period. Data were analyzed using confirmatory factor analysis indices to establish the modified SERVQUAL scale's reliability, underlying dimensionality, and convergent, discriminant validity. Results show a moderate negative quality gap for overall wellness and spa center service quality. It also indicates a moderate negative quality gap on each service quality scale dimension, especially in the 'Tangibility dimension'. The scope of the present work is limited to the Luhačovice wellness and spa centers due to time and other resource constraints. However, the study's major contribution is that it offers a general framework to assess the service qualities of the wellness and spa centers.

Keywords: Tourism, Wellness and Spa, Service Quality, SERVQUAL, Czech Republic.

JEL Classification: G32, G33, C35

1 Introduction

The tourism industry of the Czech Republic has seen a perpetual growth in the number of tourists over the previous decade. In 2019, it generated 2.9% of the country's GDP and employed 239,506 people, or 4.4% of all jobs (<https://www.oecd.org>. 2022). Even though the COVID-19 pandemic had an undeniable impact, the GDP contribution of tourism nearly halved (to CZK 82 billion) in 2020, accounting for 1.5% of the whole GDP. Employment in the tourism industry decreased by 17,494 people, or 7.3%, with less impact. Spas in the Czech Republic which are traditionally considered impossible to separate from European cultural heritage have consistently stood to be an attractive tourism center with notable economic benefits for the Czech Republic. The economic benefit was majorly due to the long-term stays of spa guests who spent an average stay of about 15 days (Vystoupil, J., Šauer, M., & Bobková, M. (2017). From 1989 onwards, the Czech Republic's Spa sector has changed and is privatized. This change, which took place in 1992, has resulted in more than 50 new spa organizations from 12 originally state spa organizations. Though this change at first caused the extinction of smaller spas, it has increased the standard range of treatment stays for new forms of relaxation and regeneration stays which is mainly health tourism. Spa tourism then became a popular way of spending leisure time (Smolová & Szczyrba, 2005). As privatization increases, competition in business also does. As the Competitive landscape sharpens and the external environment becomes more challenging, concern for service quality grows. According to Zeithaml et al. 1988, service quality is defined as "an assessment of customers from the overall excellence of services". or simply, "How well a particular service meets customers' needs or expectations". according to Asubonteng et al., (1996). Parasuraman et al., (1985) also put service quality as "The gap between consumers' perceptions of services given by a particular service center and their expectations about firms giving such services". If service quality is to become the hotspot of marketing strategy, the marketer must have the tools to evaluate it. Service quality, however, is difficult to measure. The reason is unlike products service businesses have a few characteristics like intangibility, heterogeneity, and inseparability from utilization that make them more troublesome to be assessed. Service quality measurement metrics help managers to be able to spot problems and enhance both the efficiency and effectiveness of services, to attain customer satisfaction, Parasuraman, A., Zeithaml, V. A., & Berry, L. L. (1988). Defining a service from the customer's perspective comes beside a few expressions like confidence, encounter, security, and feeling which are hard to pin down because of the intangibility nature of services (Gronroos, 1988). Although researchers have general agreement on the significant role of service quality in customers' satisfaction and the performance of firms, there is no unanimous consensus on the model

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of service quality measurement. Service quality is multidimensional (Brady & Cronin, 2001a; Parasuraman et al., 1988) and dimensions can vary according to the different service industries (Pollack, 2009). There are several well-known service quality models used across different service sectors, and a few of the most typical ones are the GAP model, SERVQUAL model, SERVPERF Model, RATER model, Grönroos Model, and Importance-Performance Analysis (IPA), Seth, N., Deshmukh, S. G., & Vrat, P. (2005). In Academic papers, numerous studies have adopted SERVQUAL as a benchmark model for effectively measuring and analyzing service quality. Park, J., & Jeong, E. (2019). The SERVQUAL model is an instrument developed by Parasuraman et al. (1985; 1988). It is a tool used to measure the customer's perception of service quality. Using data from interviews conducted in focus groups, Parasuraman et al. (1985). SERVQUAL is a tool widely regarded as a significant deviation from the conventional strategy of utilizing perception-based measures as a predictor of customer satisfaction. It proposes the use of expectation/perception, or the service quality gap, as a persistent perception that forecasts client satisfaction with a service provider in place of perception. (Babakus and Mangold, 1992; Parasuraman et al., 1991a).

The present work aims to assess the service quality of the Czech Republic's wellness and spa centers, specifically Luhačovice, using the SERVQUAL model to spot strengths and areas for improvement in customer satisfaction.

This paper contributes to a structured approach, using the SERVQUAL model, to assess the service quality of the wellness and spa centers in the Czech Republic. It can also be applied by similar businesses to measure customer satisfaction and in turn to set a strategic plan to enhance customer loyalty.

This paper is organized as follows: Section 2 reviews the literature on the fundamental concepts of service quality and the SERVQUAL model. Section 3 outlines the methodology used to evaluate service quality. Section 4 presents the key results and discussion. Finally, Section 5 concludes the paper by summarizing the main insights and providing recommendations for further studies, along with references for additional citations.

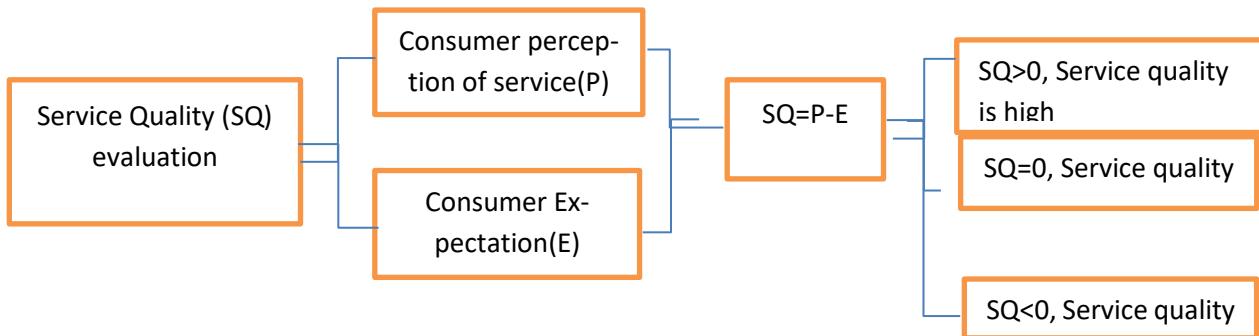
2 Literature Review

SERVICE QUALITY and SERVQUAL

Insight into service quality concepts can profoundly affect service providers' activities in competing to acquire and retain customers. The definition of service quality has been evolving. Quality according to Juran, 1974 is "Fitness for use" while (Crosby, 1979) took the strictest approach with a "Zero defect". Even though Juran's definition can be taken as a broad one, both can be applied to the manufacturing and service industries indiscriminately. However, service, unlike products, has an intangible characteristic that will make it difficult to measure like a product. As the services are intangible, determining their quality might be more difficult. The quality of service is measured by how much it meets the customer's expectations. The degree to which a service lives up to client expectations is measured by its quality. Researchers typically use the term perceived service quality to quantify the quality of intangible services. (Yarimoglu, E. K. (2014). Arguably, one of the groundbreaking definitions of service quality is indicated by Parasuraman et al, (1988) which refers to 'the difference between what customers believe they received and what they expected from the service.'" Parasuraman et al. have put a critical emphasis on the satisfaction of the customer relating to the customer's loyalty.

The SERVQUAL model's authors recommend evaluating service quality by subtracting customer expectations from their perception scores ($Q = P - E$). (Parasuraman et al., 1985). The result is elaborated in the figure below. The intangible nature of services has led many researchers to disregard expectations when measuring service quality, concluding that service performance should be the sole driver of customer satisfaction (Patterson et al., 1997; Sharma and Ojha, 2004). Though subject to ongoing criticism in service quality research, the SERVQUAL model continues to be widely used for measuring service quality in various industries.

Fig. 1. Service quality assessment process (Shi, Z., & Shang, H. (2020).



3 Method

The SERVQUAL scale, developed by Parasuraman et al. (1988), is a versatile tool that has been used to assess various dimensions of service quality—Tangibles, Reliability, Responsiveness, Assurance, and Empathy—and can be modified to measure service quality across different sectors. Accordingly, we have adopted and prepared our initial questionnaire based on the recommendations of the previous studies. However, we have modified the questionnaire by consulting experts such as local spa center professionals and academics. In total, 22 items were selected to capture these five service quality dimensions. This alteration in the questionnaire can effectively measure customer expectations and other customer perceptions. The measurement of expectation and perception is valid in line with the earlier studies (Parasuraman et al., 1988). We used a five-point Likert scale, from 1 (strongly disagree) to 5 (strongly agree). The questionnaire also included questions regarding respondent demographics. The survey is limited to the wellness and spa centers visitors to Luhačovice. The study was descriptive and cross-sectional in nature. Questionnaires were randomly distributed to those visiting the Luhačovice wellness and spa centers in July and August of 2024. A total of 90 questionnaires were distributed to eligible respondents and were usable for further analysis. Data were analyzed using the SMART PLS software to calculate the confirmatory factor analysis.

The data were subjected to the confirmatory factor analysis (CFA) and assessed using multiple fit measures such as Chi-square, Goodness of Fit Index (GFI), and Normal Fit Index (NFI). The GFI demonstrates the degree to which the model accurately represents the data. This battery included absolute fit measures like the chi-square statistic, demonstrating that predicted and actual matrix differences are nonsignificant for a model to be acceptable. The GFI is a commonly used absolute fit index, with a result of 0.9 or above indicating an acceptable model fit (Meyers et al., 2006). The other fit indices include relative fit measures like CFI and NFI. These are measures of fit relative to the independent model (Meyers et al., 2006). A researcher must use a range of fit indices to determine how well the data aligns with the proposed model.

4 Data Analysis and Results:

Aligned with previous research, five expectation and perception dimensions were employed as reflective indicators (Parasuraman et al., 1988). Each indicator variable was calculated as a composite score from its corresponding subscale. Reflective indicators imply that changes in measured indicators are driven by the underlying latent construct, directing the model paths from latent to observed variables (Jarvis et al., 2003). These reflective indicators were used to create new correlation matrices. The results demonstrate that each construct's correlations were consistently stronger than those between other constructs, meeting the requirements for measurement scale discriminant validity (Bagozzi, 1981). (See Tables 3 and 4). The first-order confirmatory analysis was carried out using SMART PLS. The model examines how well service perception and expectation indicators benefit the data. The model was assessed using a maximum likelihood procedure and evaluated using chi-square, GFI, and CFI. The first-order model retains all its original variables (see Table XI and Figure 1). The Chi-square was significant at 170.6 and the p-value was 0.0001.

Table 1. SERVQUAL attribute's internal reliability

Dimension	Items	Expectation	Perception
Tangibles	4	0.885	0.945
Reliability	5	0.901	0.882
Responsiveness	4	0.881	0.953
Assurance	4	0.865	0.862
Empathy	5	0.945	0.903

Source: Author's processing

Table 2 Respondents Profile

Variable	Frequency	Percent
Gender		
Male	23	25.56
Female	67	74.44
Age		
15-25	0	
26-35	0	
36-45	18	20
46-65	41	45.55
66 and above	31	34.44
Education Level		
Primary Education	0	
Secondary Education	68	75.55
Vocational Training/Certificate	22	24.45
Bachelor's degree	0	
Master's Degree	0	
PhD	0	
Occupational Status		
Student	0	
Private Employed	22	24.44
Government Employed	1	1.11
Own Business	0	
Retired	77	85.55
Category of the Respondents		
Local/Domestic Visitors	88	97.77
Foreign Tourists	2	2.23
Marital Status		
Single	0	
In a Relationship	0	
Married	12	13.33
Divorced	36	40
Widower/widow	42	46.66

Source: Author's Own processing

Table 3 Correlation matrix: composite service quality indicators formed from expectation dimensions

	E1	E2	E3	E4	E
Tangi-bles(E1)					5
Reliabil-ity(E2)	0.99 6				
Respon-sive-ness(E3)	0.99 7	1.03 6			
Assur-ance(E4)	0.93 8	0.95 5	0.94 8		
Empa-thy(E5)	0.78 1	0.82 1	0.79 7	0.96 0	

Source: Author's Own processing

Table. 4 Correlation matrix: composite service quality indicators formed from perception dimensions

	P1	P2	P3	P4	P
Tangi-bles(P1)					
Reliabil-ity(P2)	0.86 3				
Respon-sive-ness(P3)	0.87 4	0.94 3			
Assur-ance(P4)	0.84 6	0.89 5	1.00 0		
Empa-thy(P5)	0.81 3	0.84 9	0.81 6	0.87 2	

Source: Author's processing

Table 5. Model fit index:

Model fit indi-ces	Chi	p-value	CFI	GFI	NFI
First order CFA	170.9	0.0001	0.836	0.74	0.806

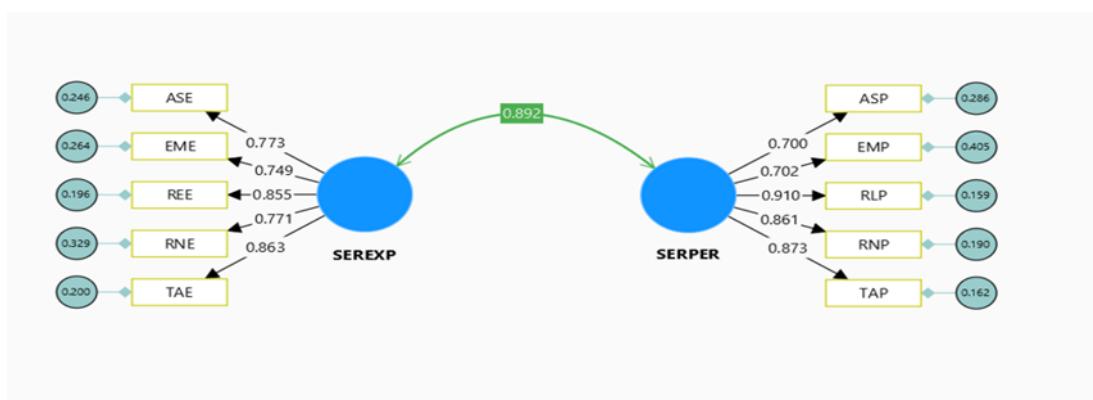
Source: Author's processing

The first-order model retains all its original variables. Chi-square was significant =170.9 and P<0.05. Other indices also indicate that both CFI (0.836) and NFI (0.806) are excellent fits (Hu and Bentler, 1999).

Note: GFI– Goodness of Fit Index, between 0 and 1, where 1 indicates a perfect fit; CFI– Comparative Fit Index, where values close to 1 indicate a very good fit.

Figure 2. First-order confirmatory factor model for Wellness and Spa Center's service quality: The first-order model retains all its original variables (see Figure 2 below) with a 0.892 difference which could reflect an overall gap across all measured attributes in the service quality construct.

Figure 2. First-order confirmatory factor model for wellness and spa service quality



Source: Author's processing

5 Discussion

In wellness and spa facilities, it is crucial to comprehend service user experiences from the customer's viewpoint. If expectations and perceptions are clarified and appropriately addressed, providers can build a partnership with their clients instead of taking a one-way approach (Crosby, 1979). Spas can obtain a competitive edge in the market by providing high-quality services. For the employees of the organization offering these services, it is crucial. Any business cannot afford to fall short of or surpass the quality expectations of its clients; doing so could spell disaster. Therefore, creating a metric that consistently assesses the quality of spa services could greatly aid in service enhancement. A tool that gauges consumer expectations and perceptions aids in opportunity identification, and general and targeted service quality improvement.

To help service providers systematically analyse service delivery processes and allocate resources where the greatest benefit can be obtained, SERVQUAL measures both global and individual service quality dimensions in each setting. However, this does not imply that service providers can disregard the dimensions that show smaller gaps in quality.

According to our research, SERVQUAL is a reliable tool for assessing the level of service provided by wellness and spa facilities in the Czech Republic. The expectation and perception dimensions of the scale were found to be a unidimensional construct with high validity and reliability. As a result, the scale is a great way to measure spa service expectations and perceptions objectively. Our findings also showed a strong correlation between spa services perception and expectation indicators on their respective dimensions. Therefore, if any one of the indicators is not met, it may result in a general negative opinion of the service provider.

By measuring service quality gaps and regularly implementing corrective actions, private spa service providers can begin addressing quality issues with the help of existing research. According to our findings, Luhačovice wellness and spa service expectations are higher than what clients believe is provided in practice. Although the gaps are small for each service dimension and the entire scale, they are all in negative territory, which suggests a significant issue.

The negative gap on the overall scale, subscale, and individual items indicates that these quality gaps require an answer. The greatest negative scores were given to service tangibility, indicating that customers were not sufficiently satisfied with the physical facilities. Service users, particularly those with back pain and allergies, reported experiencing issues with beds, baths, and the physical surroundings in general. The Czech Republic's private spas must prioritize modern physical amenities and an aesthetically pleasing setting to remain competitive in the rapidly growing private spa sector.

6 Conclusions

Using the SERVQUAL model, our study sought to evaluate the level of service provided by Luhačovice wellness and spa facilities. To efficiently identify the gaps in the service quality of businesses aiming for ongoing expansion, we employed the SERVQUAL model. To ensure long-term business survival, it is necessary to continuously monitor and measure customer expectations and perceptions due to shifting demographics, preferences, and competition. The issue of excellent service in wellness and spa facilities is highly demanding. Apart from its financial benefit, a high level of service quality can also improve the general health condition of the guests. Customer satisfaction and loyalty, a competitive advantage, and long-term success can thus be guaranteed by improving service quality in wellness and spa facilities.

through ongoing SERVQUAL assessment. By estimating quality gaps, the SERVQUAL approach makes it evident where service employees are falling far short of customer expectations. Any effort made by businesses to bridge these gaps will inevitably improve the perception of service quality, which will ultimately result in more satisfied customers. For instance, a low tangibility score suggests there should be an increase in overall infrastructure setup improvements.

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Leveraging Social Media Engagement Data for Predicting Consumer Buying Behaviour: A Systematic Literature Review

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Abstract: This study presents a systematic literature review to consolidate research on the link between consumers' social media engagement and buying behavior. The research from 2018-2024 focuses on key engagement metrics and their correlation with consumer purchase intention and buying behavior. Considering the increasing volume of available social media data, it has become increasingly essential for firms to understand how these interactions can shed light on consumer buying habits. In this paper, the research presents evidence that firms can harness information in consumers' social media interactions to derive valuable insights about their buying behavior. In the review, the paper proposes ways in which data resulting from social media engagement can be used to predict consumer-specific and less-specific buying behavior. The research also provides future research directions.

Keywords: Social Media Engagement, Consumer Buying Behavior, Social Media Metrics, Digital Consumer Behavior, Social Media Platforms, Online Marketing, Purchase Intention

1. Introduction

Social media's impact on customers is becoming increasingly apparent in the digital age. As a result, e-commerce and digital marketing are receiving an increasing portion of global investment (Steenkamp, 2020; Shankar et al., 2022). The most common way consumers alter their purchases is through digital platforms, enabling businesses to use top-notch content to maximize return on investment (Lopes & Casais, 2022; Makrides et al., 2020). Businesses use interaction data based on the timeliness and relevance of social interactions to stand out in today's environment (Appel et al., 2020; Ye et al., 2022; Cartwright et al., 2022). These encounters' usefulness as digital word-of-mouth sparked this research (Nisar et al., 2020). Studies show that social media involvement favors consumer decision-making, brand equity, and brand position, while there is significant variation in its practical uses (Wies et al., 2023). However, the fundamental causes of this association have yet to be well studied (Collado-Mateo et al., 2023; Karim et al., 2020).

The flow of information between consumers is a good predictor of their purchasing decisions (Petcharat & Leelasantitham., 2021; Palalic et al., 2021). Thus, establishing a relationship between social media interactions and a customer's net promoter level can reveal how interactivity data corresponds to consumer spending (Rachmad., 2022; Agag et al., 2024). However, no previous review has examined the predictive value of social media-derived interactivity data (Abbasi et al., 2023; Li et al., 2020; Shahbaznezhad et al., 2021). By investigating the phenomenon of the predictive nature of social media engagement data, this study addresses this gap and comprehensively summarises previous literature in this study area. Finally, this systematic literature review provides implications for future research and practice.

1.1. Background and Rationale

Understanding social media data, consumer behavior, social networks, and their effects has piqued the curiosity of academics worldwide for several decades (Vrontis et al., 2021). Newer viewpoints are required because traditional corporate communication channels and interactions between companies and their customers are currently deemed insufficient (Shankar et al., 2022; Fraccastoro et al., 2021; Guerola-Navarro et al., 2024). Connecting social network user engagement measures to purchasing behavior is a significant difficulty (Saura et al., 2021; Bag et al., 2022; Kleinberg et al., 2024). Comprehensive artificial intelligence-based systems may also record and report human behavior, and further technological improvements are being made in this area (Sarker, 2022; Aggarwal et al., 2023; Nazar et al., 2021). Because consumers spend much time on social media, businesses can use AI systems or ERP software to learn about their preferences and routines (Dwivedi et al., 2021; Haleem et al., 2022). Descriptive statistics, normality tests, and regression approaches for sales and customer acquisition models are only a few of the statistical operations that social media platforms may do with sufficient and faultless performance (Garg et al., 2020; Zachlod et al., 2022; Choi et al., 2020). A

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succinct, methodical literature evaluation of the subject from a commercial standpoint is still lacking (Di et al., 2020; Giuggioli & Pellegrini, 2023).

This review will close the scholarly gap and address the managerial ramifications of social networking website use for organizations (Choi et al., 2020; Zhao et al., 2022; Gupta & Srivastava, 2024). In addition to becoming increasingly important, gathering data about customers and their preferences has become crucial for companies hoping to thrive and stay in business (Du et al., 2021; Varadarajan, 2020; Guerola-Navarro et al., 2024). To make forward-thinking judgments and keep a competitive edge, businesses should be aware of the trends currently dominating the sector (Smith & Ashby, 2020). For years, numerous studies and publications from marketing and other fields have tried to model the connection between social network involvement levels and customer purchasing behavior (Nadeem et al., 2021; Zheng et al., 2022). Determining state-of-the-art research and reviewing the entire corpus of scientific literature published on this topic is why we are interested in this study (Denche-Zamorano et al., 2024). This study thoroughly reviews the literature and addresses the methods or processes, study stages, scientific methods, potential research gaps, and potential clients. (Paul and others, 2021; Antons and others, 2023)

1.2. Research Objectives

The study aims to investigate the trajectory and researchers' understanding of the association between social media engagement behavior and its potential to predict consumer buying behavior by conducting a systematic literature review. This research intends to outline content analysis in broad lines and, therefore, show how social media engagement-related sales are predicted through written textual data and how this characteristic has changed over time. This literature review constitutes a starting point and roadmap for researchers with varied views who want to delve deeper into these matters. The following research objectives help readers understand where this literature review research is situated and to which side it leads.

The study aims to accomplish two objectives in line with these research questions.

1. To examine the impact of different social media engagement metrics (e.g., likes, comments, shares, and retweets) on consumer purchase intention and buying behavior.
2. To assess the predictive power of social media engagement data in forecasting consumer purchase decisions.

2 Methodology

A systematic literature review (SLR) methodology was followed by the guidelines to present an accurate, comprehensive, objective, and fair representation of the phenomenon under study (Shaffril et al., 2021; Hiebl., 2023; Linnenluecke et al., 2020).

The table below shows the selection criteria and the article selection process employed by the researcher.

Table 1 Selection criteria and article selection

Table 1: Selection Criteria and article selection		
Filtering Criteria	Reject	Accept
Search Criteria		
Search engine: Scopus		
Search date: 18 th October 2024		
Search term: (“Social Media Engagement” OR “Online Marketing” OR “Social Media Platforms” OR “Social Media Metrics” AND (“Consumer Behaviour” OR “Purchase Intention” OR Digital Consumer Behaviour))		305
Subject Area: Business, Marketing, Management & Accounting		145
Document Type: Article		106
Content Screening: Full Record and Cited Reference		
Format: CSV		

Source: Author's research, 2024

The first phase consisted of the data set. The first step of the data collection concerns the adoption of the Scopus database as the data source of this study because it is the most extensive database, which includes several types of papers and analysis tools, and Elsevier introduced it in November 2004. Thus, systematic research on Scopus was conducted and collected in October 2024.

For our search to select appropriate keywords, we reviewed previous bibliometric and literature reviews on key engagement metrics and their relationship with consumer purchase intention and buying patterns. We identified and selected the following keywords: “Social Media Engagement,” “Online Marketing,” Social Media Platforms, “Social Media Metrics,” “Consumer Behaviour,” “Purchase Intention,” and “Digital Consumer Behaviour.” The query yielded 305 documents, including articles, conference papers, book chapters, and conference reviews. In the next step, we identified the exclusion criteria; we filtered the research area considering articles published in the Scopus subject area of business, management, and accounting. Further, we considered only papers written in the English language. After retrieving the raw data, we continued with preliminary data analysis, removing duplicates and manually refining the data set. Finally, this phase of the data set results in 106 relevant scientific products consistent with prior samples in bibliometric studies. The researcher further finalized 25 articles for the review. The analysis covers the period from 2018 to 2024 because the number of publications related to the subject has been growing continuously and provides a comprehensive and up-to-date understanding of the research landscape (Halibas et al., 2023; Han et al., 2018).

The study employed bibliometric analysis techniques to analyze the structure of key engagement metrics and their relationship with consumer purchase intention and buying behavior. The study used the Scopus database since it is impartial and helpful (Merigó et al., 2015). Data obtained from Scopus or any other search engine is prone to erroneous bibliometric and bibliographic information from reporting the original manuscript in later manuscripts. Therefore, direct data processing without data screening risks inappropriate assessment (Goodell et al., 2021).

Table 2 Reviewed Articles

No	Common Themes	Authors	Findings	Possible different Results
1	Social Media Engagement Metrics and Consumer Buying Behavior	- Aw et al., 2021; Ratchford et al., 2022; Naeem., 2019; Paredes et al., 2021; Reviglio & Agosti., 2020; Gigerenzer., 2022 Sharma et al., 2023; Shahbaznezhad et al., 2021; Rachmad., 2022; Matharu et al., 2020;	<ul style="list-style-type: none"> - Consumers' online actions are valuable predictors of offline or future behavior - Social networking websites help foster responsiveness, awareness, assurance, reliability, and empathy. - The study highlights the importance of understanding consumer behavior and channel-related factors to effectively address webromoming behavior and improve business strategies - The findings reveal that e-commerce has significantly changed consumers' shopping habits and the retail industry's future. - The results showed the effects of knowledge engineering tasks and the quality of the machine learning classifier in predicting consumer behavior. - The study highlights the gap between favorable consumer attitudes and actual purchase behavior. - Different content formats and platforms impact passive and active engagement behavior. - The findings highlight that social commerce positively affects customer switching behavior, indicating that consumers are increasingly inclined to make purchases through social media channels. - Social media marketing significantly impacts both social commerce and customer switching behavior, demonstrating its pivotal role in influencing consumer decisions. 	<ul style="list-style-type: none"> - The study highlights increasing concerns regarding algorithms' ability to overtly persuade and covertly manipulate users for the sake of engagement
2	Industries and Social Media Engagement Indicators	Moran et al., 2020; Aydin., 2020; Garg et al., 2020; Majeed et al., 2022; Ho et al., 2022;	<ul style="list-style-type: none"> - The results show positive relationships between interactivity cues and media richness content components on increasing consumer-brand engagement outcomes. - Calls to action (CTAs) enhance all four engagement behaviors (clicking, liking, commenting, and sharing). - Media richness, particularly visual imagery (photos and videos), strongly influences all engagement behaviors. - The findings highlight that social commerce positively affects customer switching behavior, indicating that consumers are increasingly inclined to make purchases through social media channels. - Social media marketing significantly impacts both social commerce and customer switching behavior, demonstrating its pivotal role in influencing consumer decisions. - The study provides valuable insights for e-commerce companies on leveraging social media marketing to enhance customer engagement, loyalty, and conversion rates. - By understanding these dynamics, businesses can better navigate the evolving digital marketplace and maintain a competitive edge in attracting and retaining customers. - The study highlights the importance of social media analytics in enhancing customer engagement and improving business performance. - The three dimensions of customer engagement significantly influence repurchase intention. 	
3	Social Media Engagement Metrics	Sharma et al., 2023; Vander et al., 2020; Valsesia et al., 2020; Shawky et al., 2022; Bag et al., 2022; Panadero & Lipnevich., 2022; Naeem & Ozuem., 2021; Agarwal., 2020; Vrontis et al., 2021; Haenlein et al., 2020; Lee et al., 2022; Zhang et al., 2021; Kim & Song., 2020; Nusairat et al., 2021; Tyrväinen et al., 2023	<ul style="list-style-type: none"> - Social media platforms furnish users with abundant information that is profitable for marketers - A set of metrics is essential in measuring social media user data to predict consumer purchasing behavior - Greater perceived influence impacts engagement with shared content, resulting in more favorable attitudes (likes) and a greater propensity to spread it (retweets). - The study found that social media can effectively increase informational and emotional support. - It identified social media measurement tools that assist social marketing practitioners in understanding different actors' interactions with social media content. - The findings highlight the importance of maintaining actors' levels of engagement and advancing their engagement to a higher level. 	

3. Key Results

This section is divided into three themes:

- A. How do the differing social media engagement indicators influence consumer buying behavior?
- B. How do different industries experience differing social media engagement indicators?
- C. What general trends in consumer behavior regarding social media indicators can be identified?

A. Social Media Engagement Metrics and Consumer Buying Behavior

Consumers' online actions are valuable predictors of offline or future behavior (Aw et al., 2021; Ratchford et al., 2022; Naeem., 2019). Using data from social media platforms to uncover insights makes logical sense, as these are highly popular sites that capture real-world individuals' behavior in real-time. (Paredes et al., 2021; Reviglio & Agosti., 2020; Gigerenzer., 2022). The findings in this systematic literature review provide an in-depth understanding of user interaction on social media to predict consumer buying behavior (Abdelsalam et al., 2020; Mariani et al., 2022; Sharma et al., 2023). Of all the social media engagement indicators, comments are closely related to purchasing behavior and revenue; likes and shares also positively correlate with consumer behavior (Shahbaznezhad et al., 2021; Rachmad., 2022). Only a limited number of the studies reviewed explored the practical implications of these insights; like and share indicators were similarly associated with purchasing behavior in crisis and non-crisis stages for the travel and financial industries on social media platforms (Matharu et al., 2020; Anitha and Patil., 2022; Fadillah and Kusumawati., 2021).

B. Industries and Social Media Engagement Indicators

Different industries have different social media engagement indicators (Moran et al., 2020; Aydin., 2020; Garg et al., 2020). Studies have revealed that social media shares influence the travel and education industries, while the restaurant industry is influenced by comments that drive consumer behavior (Majeed et al., 2022; Obembe et al., 2021; Kengpol et al., 2022). The results from the financial industry were mixed, with some studies adopting comments as an engagement indicator and others using shares to gauge future consumer behavior (Vander et al., 2020; Eslami et al., 2022; Ho et al., 2022). Industries with more realistic product portrayals, such as restaurants, are more influenced by comments than likes, possibly because seeing positive comments about products helps to reduce consumers' perceived risk, which in turn increases the likelihood of purchase (Moran et al., 2020; Kim et al., 2021; Selensky & Carels., 2021). The financial industry, however, found multiple conflicting results across the different studies reviewed (Ali et al., 2020; Akomea-Frimpong et al., 2022; Ozili., 2021).

3.1. Social Media Engagement Metrics

Social media platforms furnish users with abundant information that is profitable for marketers (Sharma et al., 2023). A set of metrics is essential in measuring social media user data to predict consumer purchasing behavior (Vander et al., 2020; Valsesia et al., 2020). These metrics can be considered quantitative and qualitative, explaining user behavior more specifically (Hase & Bansal, 2020).

3.1.1. Quantitative Metrics. These metrics provide quantifiable data that marketers can utilize to evaluate and predict a user's purchasing decision.

Engagement Rates. Engagement rates are quantitative, referring to the trade-off between the number of people exposed to the posts and those who connect with them (Rossi et al., 2021). Additionally, engagement can be assessed by comparing each post's number of likes, comments, and reposts to the numerical value of a page's audience (Shawky et al., 2022). Marketers should pay attention to the most crucial index: the engagement rate (Argyris et al., 2020; Bag et al., 2022). They suggest that this focus should be divided into three indices. Comments are a valuable way for a person to give feedback, report any problems they encounter, or share their positive and negative experiences (Carless & Winstone, 2023; Panadero & Lipnevich., 2022)—sentiment Analysis. Using sentiment analysis, it can be determined whether a social media user tends to purchase a product or avail themselves of a service (Jain et al., 2021; Wankhade et al., 2022). In addition, opinions can be positive or negative, including organic reach for a brand, such as posts, videos, and photos.

3.1.2. Qualitative Metrics. Engagement metrics that are qualitative in nature include Consumer Commentary. Consumer commentary denotes consumers' favorable or adverse remarks about a product or service (Vander et al., 2020; Munaro et al., 2021). User-generated content (UGC) refers to shared social media content created by unpaid fans, loyalists, and followers. UGC can be crucial in consumer behavior, including brand recall, credibility perception, and familiarity (Naeem & Ozuem., 2021; Agarwal., 2020). Over the years, it has been seen as an influencer and brand positioning tool, with an emphasis on the growing significance of social media, particularly platforms like Instagram (Vrontis et al., 2021; Haenlein et al., 2020; Lee et al., 2022). Marketers have incorporated UGC into their advertising strategies, particularly in measurement and implementation (Zhang et al., 2021; Kim & Song., 2020). Generally, UGC can be characterized as relevant, useful, educational, entertaining, vibrant, and recent content, referred to at fortnightly, monthly, or annual intervals.

Relevance of Quantitative and Qualitative Metrics. Social media data-based market segmentation studies based on consumer behavior are being published. Social media reveals various types of consumer behavior. These behaviors also influence a consumer's purchasing decision. Marketers and business entities must differentiate the behaviors related to different consumer groups. This has necessitated more precise measures with definite samples for predicting social media impacts. Likewise, using preferred engagement metrics contributes to the influence of targeting. These numbers matter to the audiences businesses intend to influence with an effective marketing strategy. (Nusairat et al., 2021; Tyrväinen et al., 2023)

4. Implications and Future Research

4.1. Businesses can develop their marketing strategy by using the implications. Through engagement strategies, it may be possible to convince a customer to buy a product if they believe it to be low risk. Businesses must comprehend social media dynamics and how the consumer's role varies across platforms. Businesses can develop brand loyalty that eventually results in word-of-mouth by successfully interacting with customers. Knowing the customer is essential to forming this interaction and gives marketers the tools to gain sway. Marketers must be nimble and adaptable to the ever-evolving social media landscape.

4.2. The findings further indicate consumer behavior differences across platforms and how social media practices influence them. The study suggests that further investigation is necessary to verify and investigate the accuracy of the information presented. Future research should delve into consumer attitudes during an era of tech-savvy engagement. New consumer-led phenomena have become significant in marketing on their respective platforms. There is also the need for a deeper understanding to uncover consumers' attitudes and actions when purchasing limited tokens or special access to online services, using new payment methods, and allowing marketers more access to analyze and predict consumer behaviors.

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A Literature Review of Residents' Empowerment, Sustainable Tourism Development, and Quality of Life

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Abstract: Tourism is a well-known services industry with multidimensional impacts on different stakeholders. Residents as one important stakeholder play important role in the sustainability of tourism. In this regard, residents' empowerment is a critical factor in fostering sustainable tourism development with resulting impacts on their quality of life (QOL). This research carries out a literature review to explain how residents' empowerment plays role in the sustainable tourism development and quality of life. The study's analysis focuses on the articles available in the web of science database to highlight the current status of the knowledge and explore the potential areas for further research. The explored knowledge gaps will provide guidelines for future research. The study concludes by highlighting key findings and offering recommendations for future research in the field.

Keywords: Residents' empowerment, Sustainable tourism development, Quality of life, literature review.

JEL Classification: Z32, R11, Q01, I31

1 Introduction

Tourism serves as a cornerstone of economic development globally, significantly impacting local communities by fostering cultural exchange and generating substantial revenue. This sector is not only a vital source of income but also a catalyst for infrastructure development and job creation. As one of the fastest-growing industries, tourism's economic significance is underscored by its ability to attract foreign investment and stimulate local businesses, thereby enhancing the overall quality of life for residents. However, to maximize these benefits while minimizing adverse effects, sustainable tourism practices must be prioritized.

Residents' empowerment is becoming a critical area in the advancement of sustainable tourism. According to Scheyvens's (1999), if residents feel empowered, they will support measures that resonate with their ideals and promote the wellbeing of the community. Such empowerment may take economic, social, psychological, and environmental forms, all of which will determine how residents react to and participate in tourism activities.

Studies also show that tourism development aims to incorporate them in decision-making processes when the residents are empowered. To define these facets of citizens' participation in tourism, a measure known as the Resident Empowerment via Tourism Scale (RETS 2.0) has been developed. The scale presents a whole picture of how locals see their participation in tourism (dos Santos et al., 2024) combining psychological and social elements with economic and environmental empowerment. RETS 2.0 claims that predictability of support for sustainable development is much influenced by psychological, economic, and environmental empowerment as well as by other aspects.

The sustainability of tourism development rests on empowering local people. Empowered citizens are more likely to support initiatives that coincide with their ideals and advance the society (Scheyvens, 1999). Empowerment can show up in environmental, psychological, social, and financial spheres, therefore impacting how locals participate in the tourism sector.

Involving in the process of decision making of tourism development makes residents feel empowered. The Resident Empowerment through Tourism Scale (RETS 2.0) has been developed to measure these dimensions of empowerment effectively. It was pointed out that this scale demonstrates that psychological, economic, and environmental empowerment significantly predict support for sustainable tourism initiatives.

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In the literature, many findings suggest a robust link between residents' empowerment within tourism contexts and improvements in quality of life (Aghazamani & Hunt, 2017; Ramos & Prideaux, 2014). It was reported that higher satisfaction levels regarding their community's development trajectory were achieved when residents actively participated in shaping tourism policies. Such satisfaction, most of the time, boosts social bonding, service delivery for the locality, and cultural integrity. Empowered communities can claim ownership over their financial resources and create means for long-term economic stability (Scheyvens, 1999). Economic empowerment ensures that the wealth generated from tourism is equitably distributed among community members rather than concentrated in the hands of external entities (Nguyen et al., 2021). Additionally, environmental empowerment enables residents to engage actively in conserving their natural resources, fostering a sense of responsibility toward their environment (Ramos & Prideaux, 2014).

In this literature review study, our aim is to explore these dynamics by examining existing research on resident empowerment within the context of sustainable tourism development. The results of this research can help enhance our comprehension of the important role that residents serve as stakeholders in the tourism sector and the wider impact on sustainable development strategies worldwide.

2 Research Objectives

The main goal of this literature review is to comprehensively examine the connection between residents' empowerment, sustainable tourism development (STD), and quality of life (QoL). Specifically, this study intends to examine how various aspects of empowerment, including psychological, social, economic, and environmental empowerment, influence residents' participation in decision-making concerning tourism and their support for sustainable tourism development initiatives. By means of an analysis of current literature, this study will highlight areas with knowledge gaps and possible future avenues for research, therefore providing recommendations for legislators and tourist developers to support empowered, sustainable communities.

3 Research Methodology

The research approach employed in this study is qualitative, utilizing a systematic literature review to investigate the existing research on the interplay between residents' empowerment, sustainable tourism development (STD), and quality of life (QoL). Academic articles and studies primarily from the Web of Science database will be the main focus of the review. A structured search strategy will be implemented, using key terms such as "residents' empowerment," "sustainable tourism," "quality of life," and "tourism development." The selection criteria will consist of peer-reviewed articles published within the past 9 years (2015-2024) that specifically address the role of empowerment in tourism contexts. The publication year has been chosen based on the first emergence of relevant peer-reviewed articles starting from 2015. This approach would shed light on the current state of knowledge, identify gaps in the literature, and propose avenues for future research on the role of empowerment in sustainable tourism.

4 Reviewed Literature and Discussions

Using the search function on web of science database the terms "residents' empowerment" and, "sustainable tourism", and "quality of life" we identified a limited number of research papers. Although this number of studies provides some insight into the relationship between residents' empowerment, sustainable tourism development, and quality of life, the limited results highlight a clear research gap. Further research is needed to deepen the understanding of these connections and their implications for sustainable tourism.

To comprehensively examine the literature, this section will concentrate on three primary aspects of sustainable development: economic, social, and environmental sustainability, commonly known as the three spheres of sustainability. These spheres are essential for understanding how residents' empowerment contributes to tourism development while improving their overall quality of life

4.1 The Three Spheres of Sustainability in Tourism

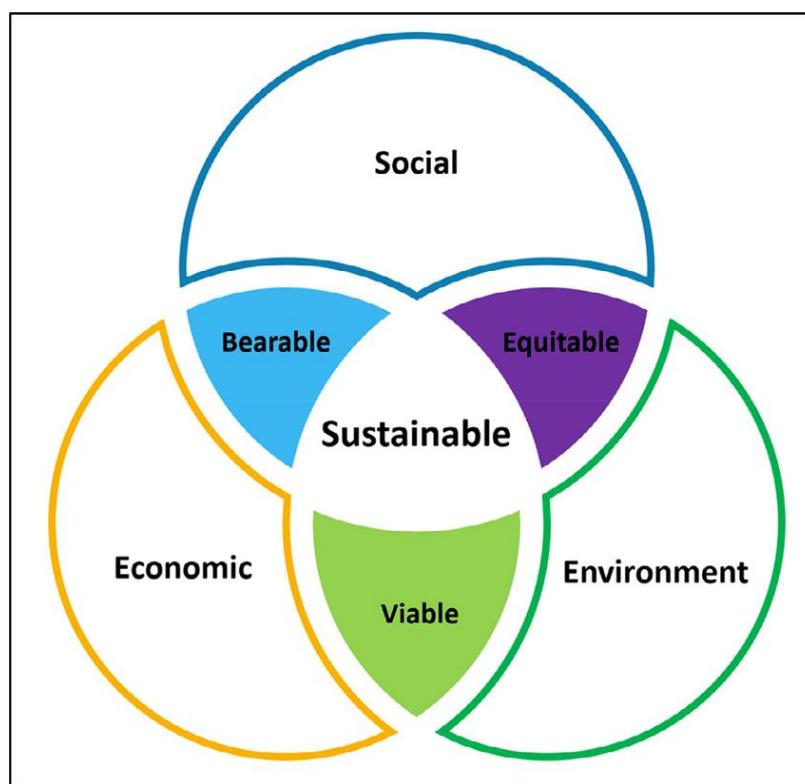
Sustainability in the tourism sector is commonly seen through the lens of three interconnected areas: economic, social, and environmental sustainability. Achieving sustainable development in tourism depends on these basic elements, which also have to be in harmony to guarantee long-term success. Table 1 lists the main tourism-related sustainability categories together with their particular goals.

Table 1 Key areas of sustainability in the tourism

Sustainability area	Key objectives
Economic sustainability	Fair profit distribution, job creation, support for local enterprises
Social sustainability	Welfare of residents, preservation of culture, social equality
Welfare of residents, preservation of culture, social equality	Preservation of natural resources, minimizing environmental impact

Understanding the function of empowering citizens in the sustainable tourism development depends on the three sectors' interaction. Figure 1 shows the three areas of sustainability and their junction in the framework of tourism.

Figure 1 The three spheres of sustainability



Source: Blaauw, 2021

4.2 Review of Literature on Residents' Empowerment and Sustainable Tourism Development

Long-term success and sustainability of tourism development depend on empowering local people. Empowerment in the context of tourism refers to enabling citizens to actively participate in making travel decisions, get equitable benefits from tourist activities, and handle travel-related resources (Berbekova et al., 2023). In addition to improving the social structure of their neighborhoods, empowered citizens help to further goals of sustainable tourist development (STD). With an eye toward the basic elements of empowerment, psychological, social, political, economic, and environmental—this section reviews the body of current research on resident empowerment.

4.2.1 Psychological Empowerment

Psychological empowerment involves enhancing residents' self-esteem, pride, and sense of identity through their involvement in tourism. Literature shows that when residents feel that tourism positively reflects their culture, environment, and heritage, they experience an increased sense of pride and belonging (Scheyvens, 1999). Tourists' appreciation of local traditions can elevate residents' perception of their community's cultural significance, leading to

higher levels of psychological well-being (Boley & McGehee, 2014). This sense of pride also fosters stronger support for sustainable tourism, as residents feel personally invested in maintaining their cultural and natural resources for future generations (Ramos & Prideaux, 2014).

Psychological empowerment is improving residents' self-esteem, pride, and feeling of identity by means of their tourism involvement. Studies of literature reveal that people feel more pride and belonging when they believe that travel reflects their culture, surroundings, and legacy (Scheyvens, 1999). The appreciation of local customs by tourists might improve the view of the cultural value of their neighborhood, so promoting greater psychological well-being among the people (Boley & McGehee, 2014).

However, psychological empowerment is not automatic; it requires that tourism be developed in a way that genuinely involves and benefits the local population. If tourism is perceived as exploitative or if it commodifies local culture in ways that are inauthentic, residents may experience psychological disempowerment, leading to negative attitudes towards tourism (Li et al., 2022).

4.2.2 Social Empowerment

Social empowerment refers to the strengthening of community ties and social cohesion through tourism activities. Socially empowered communities are more likely to engage collectively in tourism planning and decision-making, which enhances their ability to address common challenges and share in the benefits of tourism (Boley & McGehee, 2014). Tourism, when managed sustainably, can create opportunities for community members to interact with each other and with tourists in meaningful ways. This fosters mutual respect and understanding, both within the community and with visitors (Strzelecka et al., 2017). Research on local citizens' satisfaction of sustainable tourism development revealed different degrees of satisfaction with environmental, socio-cultural, and economic elements of tourism. The results showed a considerable positive association between these elements, therefore underlining their major influence on the development of sustainable tourism (Tiwari et al., 2021).

Since social empowerment develops resilience in communities, the literature strongly supports that it is a necessary component of sustainable tourism. Those who feel socially empowered are more suited to handle challenges posed by tourism including controlling tourist influxes, safeguarding of cultural legacy, and guaranteeing fair distribution of benefits (Nguyen et al., 2021). On the other hand, tourism that promotes some groups or individuals at the expense of others, hence creating social divisions, can result in social disempowerment and disappointment inside the society.

4.2.3 Political Empowerment

Political empowerment pertains to the voice that residents have in tourism governance and decision-making. Literature emphasizes that local community involvement in tourist planning is crucial to guarantee that the development of a destination aligns with the needs and expectations of its citizens (Timothy, 2007). Tourism policies and initiatives that consider community needs are more successful when approached from a politically empowered perspective, as this directly influences tourism outcomes (Ramos & Prideaux). A study on Cyprus' tourism policy suggests that an 'inside-out' planning approach, focused on the kind of development locals desire, can enhance residents' quality of life and foster socio-cultural revitalization. Shifting from 'top-down' bureaucratic processes to 'bottom-up' decision-making can empower residents to take an active role in tourism planning, promoting local prosperity (Boukas & Ziakas, 2016).

As pointed out by Scheyvens (1999), political empowerment enables residents to influence how tourism is managed in their communities including decisions related to land use, infrastructure development, and environmental conservation. Exclusion of residents from these processes might result in political disempowerment, therefore influencing community resistance against tourism initiatives. Thus, political empowerment is absolutely essential to guarantee that tourism is grown in a fair, inclusive, and in line with long-term objectives of the community.

4.2.4 Economic Empowerment

Economic empowerment is one of the most frequently discussed dimensions of residents' empowerment in tourism literature. It refers to the ability of residents to benefit financially from tourism, whether through employment opportunities, entrepreneurship, or revenue-sharing schemes (Scheyvens, 1999). When tourism is economically empowering, it leads to higher household incomes, improved living standards, and reduced economic inequality within communities (Nguyen et al., 2021).

The literature also highlights the uneven distribution of economic empowerment in the tourism sector. The economic benefits of tourists are often felt by foreign investors or elites, while locals don't see much of an impact. This lack of economic power can make people angry and resistant to tourists (Ramos & Prideaux, 2014). Local people should be able to fully participate in the tourism value chain and have a lot of economic possibilities thanks to sustainable tourism. An importance-performance analysis (IPA) study of how residents felt about sustainable tourism initiatives (STIs) found that while residents in different regions gave these initiatives high marks, their opinions on how well they worked changed depending on how much emphasis was put on sustainable tourism in strategic plans (Boley et al., 2017). This shows how important strategic planning is for changing how locals think about and participate in sustainable tourism.

4.2.5 Environmental Empowerment

Environmental empowerment is the ability of residents to help to preserve and manage their own natural resources. Since local communities are often the main protectors of the natural and cultural heritage that tourism depends on, effective sustainable tourism development calls for active participation of these local communities in preserving their environment (Ramos & Prideaux, 2014; Falatoonitoosi et al., 2022). Environmentally empowered communities are more likely to adopt sustainable practices including ecotourism, which aims to strike a balance between environmental preservation and economic development (Scheyvens & Van der Watt, 2021). A conceptual model by Boley (2015) advocates balancing tourism's positive contributions (handprint) with its environmental impacts (footprint) alongside rising concerns about the greenhouse gas (GHG) emissions of the industry and their effect on climate change. This approach underlines that while reducing GHG emissions, sustainable tourism should maximize benefits for residents' quality of life, cultural legacy, and economics (Boley, 2015).

Studies show that environmental empowerment is especially important in delicate areas like coastal or island communities where tourism can have a significant impact on the surroundings. By means of sustainable tourism management, people may guarantee that the growth of tourism does not compromise the natural resources sustaining their livelihoods (Strzelecka et al., 2017).

4.2.6 Integration of Empowerment Dimensions in Sustainable Tourism Development

Empowerment in the tourism industry encompasses numerous aspects, including psychological, social, political, economic, environmental, and psychological ones, all of which have functions in advancing sustainable development of travel. According past studies, empowerment guarantees fair distribution of tourism benefits, increases community involvement, and promotes resilience. People who feel empowered in these areas are more likely to support sustainable tourism projects and actively engage in tourist management (Boley & McGehee, 2014).

5 Results and Discussion

The studies conducted by dos Santos et al. (2024) and Gautam & Bhalla (2024) taken together offer a comprehensive knowledge of the links between tourist involvement, resident empowerment, quality of life (QoL), and support of sustainable tourism development (STD). Both research assessed several facets of empowerment - psychological, social, and political - and their effects on people's views toward tourism using the Resident Empowerment through Tourism Scale (REts 2.0). Hu et al. (2022) highlighted the unique challenges faced by community empowerment in government-controlled heritage sites, such as disempowerment in political and economic aspects. The study proposed a comprehensive framework incorporating systemic, informational, and educational empowerment to address these challenges, offering valuable insights for sustainable tourism development in similar contexts.

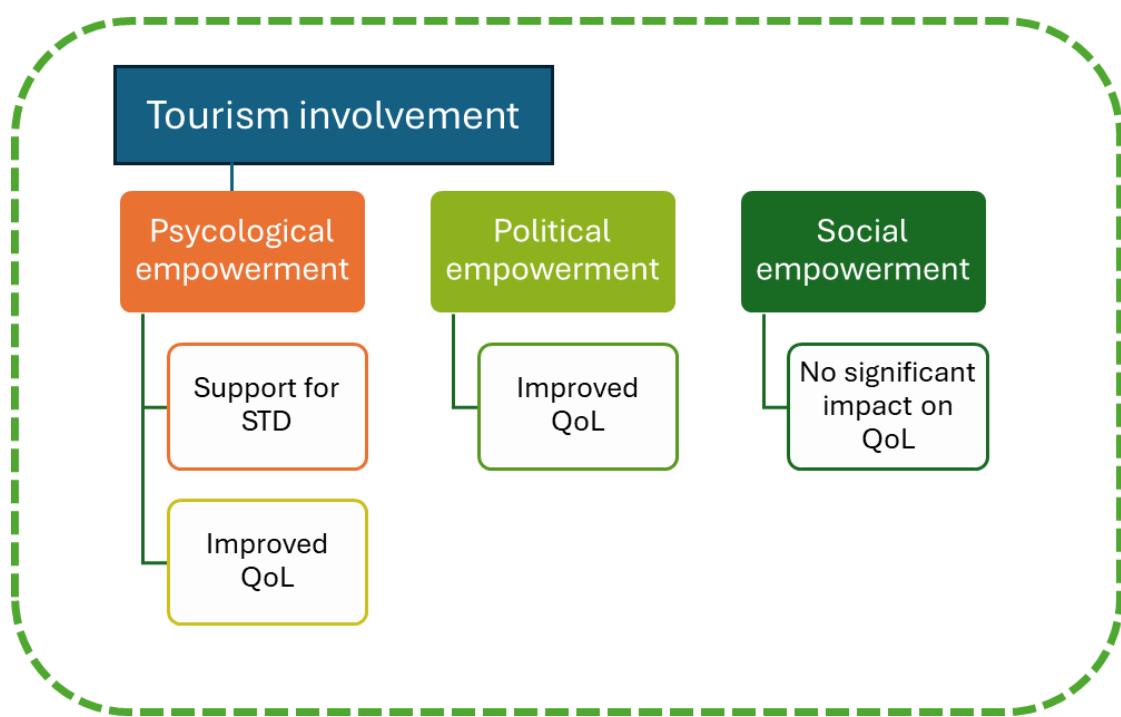
Gautam and Bhalla's study revealed that residents' psychological and political empowerment significantly increases through active engagement in tourism. Psychological empowerment emerged as the primary factor influencing the endorsement of sustainable tourism initiatives. The study also indicated that political empowerment strongly affects residents' quality of life, suggesting that feeling represented and having a voice in decision-making processes leads to enhanced overall satisfaction. However, no statistically significant relationship was found between social empowerment and quality of life outcomes.

Similarly, dos Santos and colleagues stressed that residents' involvement in tourism positively affects their psychological, social, and political empowerment. Their findings supported the idea that psychological empowerment is crucial for garnering support for sustainable tourism practices. The research overall emphasizes that empowered residents are more likely to advocate for sustainable tourism growth, which positively contributes to their communities and enhances their overall quality of life.

Khalid et al. (2019) demonstrated that community empowerment significantly influences sustainable tourism development through the mediating role of community support for tourism. Their findings underscore the importance of fostering positive attitudes and active participation among residents to ensure the success of tourism initiatives. The significance of destination management organizations focusing on empowering residents, particularly in psychological and political aspects, is highlighted in both studies, with the aim of gaining increased support for sustainable tourism practices. These findings indicate that empowering local communities is essential for realizing sustainable tourism objectives and ensuring equitable distribution of tourism benefits among residents. In summary, these results underscore the importance of understanding the impact of tourism participation on resident empowerment and how this empowerment can contribute to improved quality of life and greater support for sustainable tourism efforts.

In Figure 2, one can observe the impact of tourism involvement on residents' empowerment, quality of life (QoL), and support for sustainable tourism development (STD), as evidenced in the research conducted by dos Santos et al. (2024) and Gautam & Bhalla (2024).

Figure 2 Influence of tourism involvement on residents' empowerment, quality of life (QoL), and support for sustainable tourism development (STD)



6 Future Implications and Conclusion

6.1 Future Implications

The exploration of existing research on the empowerment of residents, the development of sustainable tourism, and the quality of life has revealed numerous areas that require additional investigation. Understanding these dimensions is vital for both academic research and policy formulation. The following implications provide a roadmap for future research and practical applications:

Most studies on residents' empowerment and sustainable tourism have focused on developed countries or specific regions. Future research should prioritize exploring empowerment in developing countries, particularly in tourism-dependent regions where residents' livelihoods are closely tied to tourism. This will help address how cultural, economic, and political contexts affect the empowerment process and the success of sustainable tourism initiatives. Additionally, comparative studies across different regions and cultural contexts will provide a more nuanced understanding of how empowerment manifests and its impacts on tourism development.

While there is a robust link between empowerment and improved QoL, longitudinal studies are needed to assess whether the benefits of empowerment are sustained over time. Such studies could investigate whether the positive effects of empowerment persist, or if they diminish once initial tourism projects mature. Longitudinal research would provide insights into how the long-term involvement of residents in tourism decision-making continues to impact their QoL and support for sustainable tourism.

The literature suggests that political and environmental empowerment are critical, yet often underexplored, dimensions of residents' involvement in tourism. Future research should focus on how political empowerment through inclusive governance and decision-making processes affects residents' support for tourism projects. Similarly, environmental empowerment, which involves residents actively participating in the preservation and management of natural resources, deserves more attention in relation to its role in fostering sustainable tourism.

Policymakers should use the insights gained from empowerment studies to create more inclusive tourism frameworks. Policies that focus on equitable benefit-sharing, capacity-building, and community engagement will enhance residents' roles in tourism development. Empowerment should be integrated into national and regional tourism policies, emphasizing the importance of involving local communities at every stage of the tourism planning process. Governments and tourism developers should prioritize community-based tourism models, which ensure that tourism benefits are distributed fairly and residents have control over how tourism impacts their lives and environment.

6.2 Conclusion

The concept of residents' empowerment has emerged as a cornerstone of sustainable tourism development (STD). This literature review has demonstrated that empowerment is a multi-dimensional process encompassing psychological, social, political, economic, and environmental factors. Each of these dimensions plays a crucial role in determining how residents perceive, engage with, and benefit from tourism activities.

Empowered residents are more likely to support tourism initiatives that align with their values and contribute to the sustainability of their communities. Psychological and social empowerment lead to greater community pride and cohesion, while economic and environmental empowerment ensure that residents benefit financially and have a stake in the conservation of their natural resources. Political empowerment allows residents to have a voice in decision-making processes, fostering a sense of ownership and control over tourism development.

The literature consistently demonstrates that residents' empowerment not only enhances their quality of life but also contributes to the long-term success of sustainable tourism initiatives. However, achieving empowerment requires careful planning, inclusive policies, and active community engagement. Empowerment cannot be a passive outcome of tourism; rather, it must be intentionally cultivated through collaborative, community-centered approaches.

Future research and policy must continue to explore ways to deepen residents' empowerment, particularly in developing regions, where tourism often has the potential to drive significant economic and social change. By focusing on the empowerment of local communities, tourism can become a powerful tool for sustainable development, benefiting both residents and the broader environment in which they live.

In conclusion, the empowerment of residents is not only a moral imperative but also a strategic necessity for ensuring the sustainability of tourism. As we move toward more responsible and equitable forms of tourism, empowering local communities will be at the heart of creating resilient, inclusive, and environmentally conscious tourism systems.

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Facereader as a Tool to Evaluate Music Preferences of Slovak Consumers

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Abstract: The sales environment is a space that needs the interplay of several elements to create a pleasant atmosphere. The space must create a shopping experience, only then will customers remember it better. One of the components of a good sales environment is music. It can positively influence consumers' mood, memory, attitude towards brands and purchase intentions. To properly approach the creation of a quality music backdrop, in this study we will focus on the analysis of Slovak consumers' music preferences using the FaceReader tool. The latter allows measuring and analysing emotional reactions to specific music stimuli. The aim is to investigate the impact of selected audio stimuli on consumers' emotional responses, recording and analysing expressions such as facial expressions and changes in emotional state. This implicit data is then compared with explicit feedback provided by consumers through Computer Assisted Web Interviewing (CAWI) questionnaire. The research results correlate the implicit feedback with stated preferences, offering a more comprehensive view of music perceptions and preferences in the Slovak context.

Keywords: Store atmosphere, Music preferences, FaceReader, Consumer emotions

JEL Classification: M30, M31, M37

1 Introduction

Environmental factors such as music and sound, lighting, colour and smell help to create sensory impressions that are essential to creating a shopping experience. Therefore, finding a unique synergy of factors can mean a competitive advantage for retailers and better customer retention (Pine & Joseph, 1998). Music is defined as one of the fundamental factors that significantly contributes to the creation of a shopping atmosphere. Music is a powerful sound that can influence consumers' conscious and unconscious decisions. Pleasant music played in the store significantly influences consumer's purchase intentions (Hussain & Ali, 2015). Zhou and Wong (2004) write that store atmosphere represents a conscious effort to create a retail environment that elicits specific emotional effects on consumers and increases the likelihood of purchase, suggesting that retailers may actively manipulate these stimuli (Vieira, 2013). Oakes (2000) adds that the emotional reactions triggered by the store environment influence the time and money spent by the consumer in the store. Background music can positively contribute to improving the shopper's mood at the point of purchase, which also has an impact on behavioural change. Music has a strong influence on causing psychological reactions in shoppers (Jain & Bagdare, 2011). Milliman (1986) found in his research that slower music was associated with slower purchase rates and higher sales. In another study he tested the effect of fast and slow music in an "upscale" restaurant. The results of the study showed that the guests consumed their meals faster when fast music was playing. However, in the evening when slow music was played, customers spent significantly more time in the restaurant and spent more money on alcoholic beverages. Oakes and North (2008) found that music variables (genre, tempo, loudness and pleasantness) can be used to achieve desired effects in terms of service environment ratings, perceptions of waiting time, length of stay, speed of movement, etc. According to the findings of Milliman (1986), loud music, if it is the preferred genre, will contribute positively to the emotional states of the shoppers in the target group of this study, young fashion shoppers. Customer behaviour and emotions influenced by stimuli like a music can be analysed also by neuromarketing tools. Neuromarketing or neuroscience focuses on the subconscious responses of customers because according to previous studies, consumer behaviour and their cognitive responses of consumers are inconsistent (Renvoise & Morin, 2016).

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Mansor & Isa (2020) are classifying neuromarketing research methods as physiological tools that include face-reading technology. Human emotions provide a wealth of knowledge that can be discerned through facial expression measurements. Based on Wahab et al. (2021), Ekman and Friesen categorized six universal facial expressions: happiness, fear, surprise, disgust, sadness, and anger. Areni (2003) compared academic theories with industry-based observations and found that atmospheric music plays a crucial role in shaping customer experiences. It helps create a suitable brand image, encourages customers to stay longer, attracts or repels them, manages their perception of time, influences social behaviour, and masks unwanted background noise.

2 Methods

The initial experiment on music preferences has been proceed in the beginning of September 2024 via online questionnaire while using a Computer-Assisted Web Interview (CAWI) survey on N=200 participants. CAWI is a quantitative method with a programmed questionnaire that is distributed online through email, mobile applications, online advertisement and SMS (Elliot, 2021). Our survey link has been distributed via university email to university colleagues, students, and friends. This study gave us better understanding of music preferences and perception such as genres, type of music and others specification related to audio stimulation in retail. The research sample consisted of 97 females and 103 males represented by generations – Boomers (1946-1965) 34, Generation X (1965-1980) 39, Millennials (1981-1996) 55, Generation Z (1997-2012) 69 and Generation Alpha (after 2012) only 3 participants, which were kids of university employees. Quantitative research sample was not representative based on the age of participants, as large number of participants were university employees and students.

Based on insight from quantitative research we have set up qualitative research on emotional perception of the same audio stimuli reproduced in instrumental and vocal. Research has been conducted on the beginning of October 2024 in The Laboratory of Consumer Studies at the Faculty of Economics and Management of the Slovak University of Agriculture in Nitra. The study was carried out in accordance with the Code of Ethics of the „Laboratory of Consumer Studies,. The qualitative research sample was N=50, where most of the participants were students and employees of the Faculty of Economics and Management.

The main objective of this study was to investigate how different versions of the same genre of selected audio stimuli affect consumers' emotionality. The same music sample was played to 50 respondents in instrumental and vocal version. During stimuli playback, we monitored facial biometrics to obtain information about participants micro-emotions. For a more detailed view of emotion, we have chosen two micro emotions. Valence and arousal. However, some of the authors might not consider valence and arousal as an emotion. Rusell (1980) specifies that valence and arousal are fundamental dimensions used to describe and measure emotions in psychology and neuroscience. These concepts are often included in emotional response models, such as the circumplex model of affect. Further Russel specifies Valence as a dimension, that refers to the positivity or negativity of an emotional experience. It indicates whether an emotion is pleasant or unpleasant, but it does not represent a specific emotion. Following Russel's explanation of arousal, it refers to the level of activation or energy in an emotional response. It can range from calm to excited states, but it is a dimension rather than a specific emotion.

Music sample that has been played to participants we have chosen based on inputs from qualitative part of this study. To choose the audio stimuli we have used Artificial Intelligence (AI). Our music parameters given to AI were: up-to-date song, modern, dynamic dance music, covering genres such as pop, disco and house. According to these preference parameters, the AI suggested a few current contemporary pop songs. From the selection of options we have chosen a song called: „The Sound of Silence,“ by the original composer Disturbed - while the selected song was an edited remix version performed by DJ CYRIL. The music was reproduced to participants through headphones JBL Tune 720BT wireless headphones, at 65 dB loudness and the tempo of the songs was 126 BPM.

Link to vocal music sample: <https://www.youtube.com/watch?v=Y-e7ij7aW8c>

Link to instrumental music sample: <https://www.youtube.com/watch?v=UNviwyVczw0>

We have used software from Noldus' FaceReader 7 to analyse respondents' micro emotions while listening to the same stimulus for 30 seconds. The emotionality analysis represents the average valence and arousal values for all respondents during the first 30 seconds of the music sample. The method of playing the demos was in the form of an A/B test. The order of the music samples varied from test to test like A/B, B/A, etc.

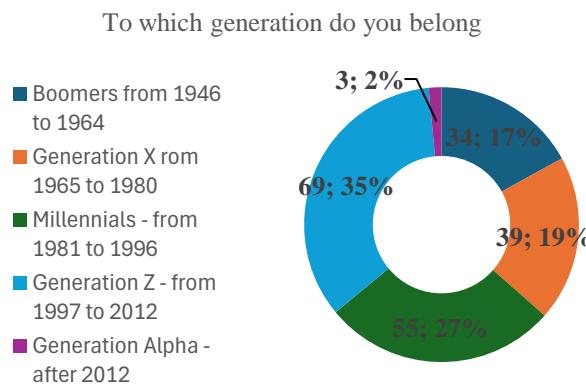
3 Research results

Through the results of the quantitative data collection that preceded the testing of the music preference evaluation, we obtained insights needed to conduct the qualitative study. The characteristics of the research sample that formed the basis for making decisions about music genre choice comprised a total of 200 respondents, with a mixture of 103 males and 97 females in diverse sample of each age category (Fig. 1). The obtained data on music preferences (Fig. 2) shows that most of the respondents up to 73% (146) prefer pop music in a retail environment. Other popular music genres include Hip-hop with a 6% preference of 12 respondents, followed by disco 5% (10) and electronic music 5% (9). The preferences of other music genres are represented by less than 5% of the research sample. Least preferred genres such, classical or country music no one from the research sample preferred.

Another question from qualitative survey regarding preferred type of the music (Fig. 3) has shown that 110 respondents (55%) would like to listen to instrumental music while shopping. Vocal music has chosen 45 participants (45%).

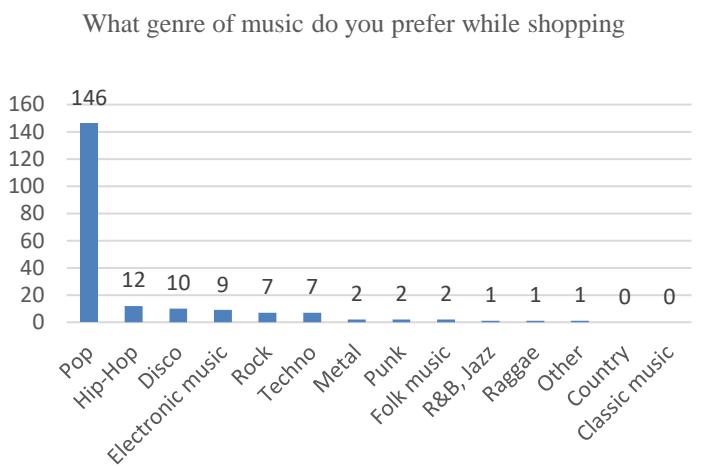
Age groups that participated in qualitative research of tested audio-stimuli in Laboratory of consumer studies can be seen in (Fig. 4). Research sample was made of 18 people (36%) belonging to Generation Z, 15 which is (30%) were Millennials, 10 were from Generation X (20%), and the least represented age groups were Boomers 4 (8%), and Gen Alfa 3 (6%).

Figure 1 Graph presents mix of generations in the quantitative research sample N=200



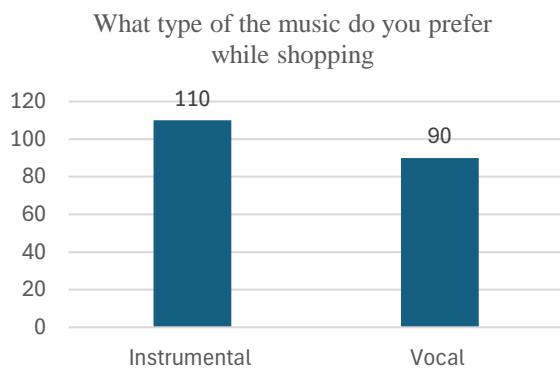
Source: Own data processing

Figure 2 Preference of music genres



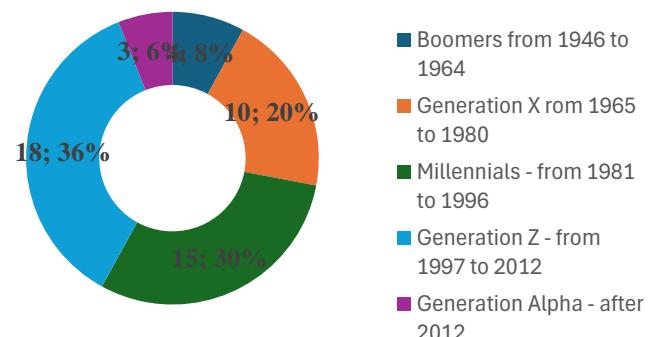
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Figure 3 Preferences in music type N=200



Source: Own data processing

Figure 4 Age categories of qualitative study N=50

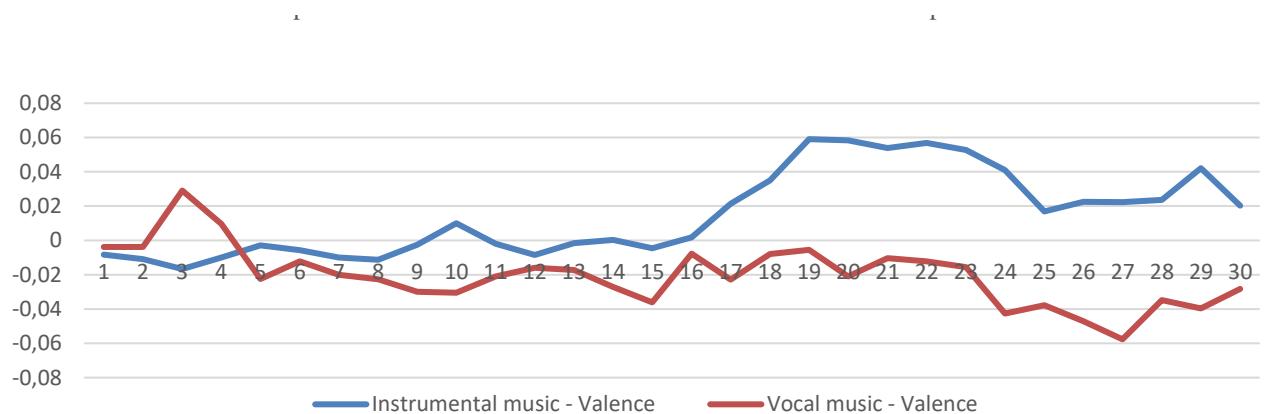


Source: Own data processing

3.1 Analysis of emotionality - valence when listening to musical stimuli

Based on the analysis of the respondents' facial micro-emotions (valence and arousal) while listening to the selected music samples, we found that higher average valence values were achieved for the instrumental version of the music sample. The average value of instrumental music reaches 0.014 whereas for the vocal it is - 0.020. The difference in emotional perception - valence is 0.035 between the perception of vocal and instrumental samples. In the graph (Fig. 5), we can see that the vocal sample starts with a higher average but only to about 4th second of the song. After that, we can observe a reverse in data analysis, when the valence of vocal music starts decreasing. We have also recorded a similar perception between the 5th and 16th second, both stimuli are perceived very similarly. A change can be seen from the 17th second onwards where the difference in valence of the musical samples starts to widen. When we are speaking about valence, it's important to mention that valence values range between -1 and 1. So if our emotional responses have recorded differences in audio stimuli perception around 0.035 it is a small emotional change. But we must take into consideration that even such a small difference in emotional perception can make a change

Figure 5 Graph of valence when vocal and instrumental music was played.

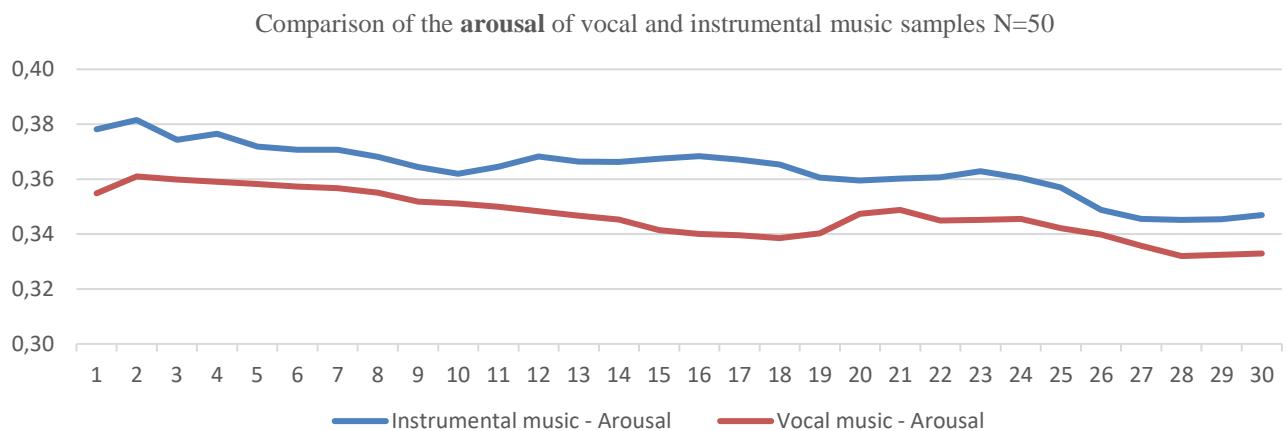


Source: Own data processing

3.2 Analysis of emotionality - arousal when listening to musical stimuli

When analysing arousal during instrumental and vocal music playback, we equally revealed differences in emotional perception, as demonstrated by the arousal values. The average arousal value during the entire listening time of the instrumental sample was 0.363. The mean arousal value for the vocal music was at 0.346, and the difference in arousal measures between the instrumental and vocal music was only 0.016. In the graph of Fig. 6, we can see slightly better arousal values for the respondents who listened to instrumental music. The arousal when listening to vocal music caused on average lower values in the respondents, but from the graph we can see the decreasing tendency of both curves at the same time. Arousal values can be from 0 to 1. By our analysis we have recorded values around 0.3 what can be considered as significant emotional status. If we look closer at average differences between instrumental and vocal music perception, we can clearly see that value of 0.016 as less significant, but although important insight.

Figure 6 Graph of arousal when vocal and instrumental music was played.



Source: Own data processing

4 Conclusions

The presented study provides an initial insight into the impact of the same audio stimulus on the emotionality of respondents and reveals the importance of addressing this issue in more detail. The study presents a pilot testing the impact of genres on consumer emotions which are analyzed by a combination of implicit and explicit feedback. This study is a start for further investigations. As we already know, the right choice of music genre, tempo, and loudness can contribute significantly to the creation of a more pleasant shopping environment and also to a better mood for the shopper (Petrizzellis et al. 2015). Michel et al. (2017) adds that the positive emotionality caused by music can contribute to longer time spent in the store, more money spent, etc.

The main findings of quantitative part of this study present that up to 73% of the research sample N=200 prefer the Pop music genre when shopping. Other preferred music genres are Hip-Hop by 12 respondents (6%) and disco by 10 respondents which represents (5%). Music genres such as Metal, Punk, and Folk music are preferred by only 1% of the research sample. We can conclude that the results of music genre preferences are strongly influenced by the music played in mass media, which is largely represented by the Pop genre. Instrumental music is preferred by 110 participants (55%), and vocal by 90 (45%).

The qualitative part of the research has been carried out on 50 participants and brought interesting insights into music perception through emotionality. The research sample was represented by a mixture of generations not equally represented. The most represented generation was Generation Z with 18 participants (36%), followed by Millennials with 15 participants (30%), Generation X with 10 participants (20%), and the least represented age groups were Boomers with 4 participants (8%) and Generation Alfa with 3 participants (6%).

Qualitative finding from FaceReader on respondents' emotionality have found that, there is significantly better emotional perception of instrumental pop music over vocal music. This is evidenced by the average valence values, which reach 0.014 for instrumental music whereas for vocal music the valence is at -0.020. The difference in emotional perception is significant at the level of 0.035.

The arousal values when listening to instrumental and vocal music samples show noticeable differences. For instrumental music, arousal values were more positive, at 0.363, while those for vocal music were 0.346. Although the difference in arousal is only 0.016, it can still be considered significant.

The differences in emotional perception of vocal and instrumental music can be considered as the negative impact of vocal music on the respondent in case he listens to audio stimuli that contain lyrics (also in a foreign language) that the customer does not understand. This fundamentally affects the cognitive load which can cause a more negative perception of the music, and this also affects emotions.

As we report, this study is pilot testing research that precedes further quantitative but also qualitative data collection. We see the limitations of this study in the small research sample of respondents. A better representation of the different

age categories may contribute to more specific results. Bias in the testing results may also have been influenced by the length of the musical stimulus tested. In the future, we suggest testing longer musical segments or even entire musical pieces. To obtain better data, analysing also other emotions e.g. Happy, Surprised, or even more negative emotions e.g. Sad would be helpful. In future research to take into consideration also personal profile of participants, as e.g. introverts vs extroverts might have a different music. Improving the respondent's focus on the music sample during testing may also contribute to better results in the future.

Acknowledgement

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Customer Engagement at a Chosen Business Entity Focused on Sport

Klára Keclíková¹, Petra Martíšková², Roman Švec³

Abstract: Nowadays, a strong competitive environment prevails, and businesses are forced to do their best to retain customers. Therefore, engagement marketing focuses not only on products or services offered but is characterized by building customer relationships via customer engagement. The research aims of this paper are to (1.) describe specific methods and tools used for customer engagement at a chosen sports club and (2.) find out customers' preferences in the context of customer engagement. A mixed research approach was applied to obtain data: a mix of qualitative content analysis and a quantitative online survey. As for research results, the following activities boosting customer engagement were detected firstly: (i.) sports club's profiles on social networks and its websites, (ii.) workshops, seminars, lectures, and courses, (iii.) special offers, promotions, and discounts, and (iv.) charity events and support towards the local community. Secondly, customers of the chosen sports club feel mostly engaged and appreciate activities organized by the sports club.

Keywords: engagement marketing, customer relationships, customer engagement, sports club, fitness club.

JEL Classification: M31, M37

1 Introduction

Nowadays, a strong competitive environment prevails, and businesses are forced to do their best to retain customers. Therefore, engagement marketing focuses not only on products or services offered but is characterized by building customer relationships via customer engagement which is based on relationship marketing. These two terms, i.e., "relationship marketing" and "customer engagement" are described in this section in detail.

1.1 Relationship marketing

Relationship marketing typically strives to retain customers rather than attract new ones, which it seeks to do by offering customer benefits. A long-term time horizon is pursued, and a strong emphasis is placed on customer service. Customer contact is frequent. Relationship marketing is usually contrasted with transactional marketing. Although it may seem that relationship marketing is a necessity nowadays, this is not always the case. (Šonková & Grabowska, 2015) Relationship marketing is mostly beneficial for such businesses entities that are service-oriented, i.e. where face-to-face interactions take place. On the other hand, consumer packaged goods retailers will focus and strategize based on transactional marketing, i.e. they will not place as much emphasis on customer retention. The reason for this is that mass contact, not proximate and unique contact with end customers, usually prevails there. (Grönroos, 1991) However, many retailers run loyalty programs these days. Thus, it may seem that they apply relationship marketing, nevertheless Wallström et al. (2024) point out that loyalty programs encourage more rational buying behavior, which means that loyalty programs may cause less customer loyalty, i.e. rather support the idea of transactional marketing. In general, transactional marketing can be used where customers are price sensitive, whereas relationship marketing is appropriate where customers are less price sensitive. (Grönroos, 1991)

1.2 Customer engagement

Customer engagement is seen as a part of relationship marketing. If business entities apply customer engagement activities, they can position themselves ahead of competitors. (van Tonder & Petzer, 2018)

Customer engagement theory describes the following five basic elements (van Tonder & Petzer, 2018):

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- Identification (how connected the customer is to a particular business entity and how intimate the relationship is),
- Enthusiasm (it is the degree to which customers are enthusiastic about their engagement),
- Attention (measures the level to which customers focus on the object of interest),
- Absorption (it is considered a progressive state of attention – customers are carried away by the business entity, they do not want to detach themselves from the business entity, as they feel a deep connection),
- Interaction (how consumers engage in online or offline activities that are not related to purchase).

The idea behind the concept of customer engagement is not focused on customer value as an equivalent of transactional value (e.g. monetary value of a purchase). Rather, customer engagement emphasizes that the value that customers deliver to the business entities is beyond the purchase. It draws on many other behaviors, which include word of mouth (customers refer a product or service to their friends, family), collaboration with other customers (assistance in buying a product or service), after-sales service (assistance in using it), co-creation (development of a new product or service). (Verhagen et al., 2015) Palmatier et al. (2018) state some examples of customer engagement activities, e.g., customer recommendations, customer conversations on social media about the brand (business entity), or customer feedback.

Customer engagement implies a process of using one's own resources and competencies for the benefit of another entity. For instance, customers may participate in spontaneous conversations. They are then judged to be highly engaged in the co-creation and experience. It means there is a transformation of customer roles. The customer is not perceived as a mere recipient of a product, but as a member of a voluntary community who participates in the activities of the business entity. (Verhagen et al., 2015)

With customer activity on social media, where it is also possible to connect with other existing or potential customers, the reach can be increased beyond what a business entity can generate (Harmeling et al., 2017). Customers use online social media platforms to offer and share various content, such as their opinions, experiences or videos. The most used and well-known social media include online social networks, blogs, discussion forums and other online communities. (Karlíček, 2016)

The research aims of this paper are to (1.) describe specific methods and tools used for customer engagement at a chosen business entity and (2.) find out customers' preferences in the context of customer engagement. The chosen business entity is a sports/fitness club "Harmony Sport & Relax Club" (hereafter simplified as a sports club), located in Písek, a South Bohemian city in the Czech Republic.

With respect to the research aims, the following research questions have been formulated:

1. What methods and tools of customer engagement are used at this sports club? (This is the sports club's point of view.)
2. What are customers' preferences in the context of customer engagement? (This is the customers' point of view.)

2 Methods

To reach both research aims, a mixed research approach was applied. Firstly, for description of specific methods and tools used for customer engagement, qualitative research in the form of content analysis was conducted: websites and profiles on social networks of the chosen sports club were analyzed. Secondly, for finding out customers' preferences, quantitative research in the form a survey, based on an online questionnaire, was carried out ($n = 201$; 71% women and 29% men; all the respondents were customers of the chosen sports club; data collection took place in February 2024). Data, collected via quantitative research, was analyzed statistically, when applicable. This paper presents only a part of the obtained results due to page limitation.

3 Research results

This chapter is structured to provide clear answers to the above formulated research questions.

3.1 Specific methods and tools used for customer engagement at the sports club

A range of methods and tools is applied at the sports club nowadays. These activities can be divided into four groups: (i.) sports club's profiles on social networks and its websites, (ii.) workshops, seminars, lectures and courses, (iii.) special offers, promotions and discounts, and (iv.) charity events and support towards the local community.

Ad (i.) Sports club's profiles on social networks and its websites – tips, pieces of advice (incl. recipes), contests, challenges, behind the scenes moments

There are countless activities within social networks that the sports club uses to engage customers. Specifically, the sports club is active on Facebook and Instagram. Very often used ways for stimulating customer engagement include discussions, polls, reactions or tagging customers. Customers can contribute through comments, likes, questions and discuss a particular post with others. The sports club usually submits questions like, "Are you coming to try it?", "Will you do it with us?", "Would you like to try it, too?" Customers can then respond and answer in any way they like.

In Instagram stories, it is possible to add some kind of a poll, quiz, response in the form of a scale, tagging, etc. In the case of a poll, customers can choose one of the options they identify with, in the case of a quiz, they guess the answer the sports club is asking or they express their level of enthusiasm through a scale. Customers are thus engaged, and the sports club sees customer activity, preferences or satisfaction on the post. For example, a quiz focusing on a new gym item looked like customers were choosing from a range of offered options about what should be new in the gym – they could choose a tank, a new carpet or a motorless treadmill.

The sports club also often involves customers through tagging. If they attend or participate in a workout or group class and the sports club team knows its customers, it can tag them specifically in a post. Subsequently, customers can also share that post or story on their profile, and they feel very engaged and appreciated.

There are also contests organized for customers. Engaged customers can try to compete under certain conditions and if they are lucky, they can win interesting prizes. The prizes are either in the form of an experience of some kind or prizes of monthly memberships, free entries, season passes or gift packages. For instance, there was a contest with the chance to win a new BMW X1 for the weekend. The only condition was to become a member by a certain date.

Nowadays, short videos from various events are a trend. If the sports club organizes an event, thematic lessons or other important or unusual events, it creates short video clips from these activities. Customers are included and can be tagged. These short video clips are also used for attracting potential customers to see what is happening at the sports club and the various events that can be attended at this sports club.

Various challenges were also run on the sports club's social media profiles. Their aim was to engage customers to take part in the challenges and share in completing them. For instance, there were cooking challenges. Here, customers were invited to share their favorite dish using a particular ingredient. Another challenge was to show the customers' fitness outfits. In this activity, customers were invited to post and show their favorite workout outfits.

Another way of customer engaging is bringing them advice, tips, recipes or interesting articles. Customers are engaged so that they can apply and take to heart any tips and advice, e.g., a tip on how to correctly execute an exercise technique such as a squat, push-up or plank variation. Or they can read an interesting article on a topic, such as why to have breakfast and exercise in the morning or how to stay motivated all year round. They can also try out different recipes at home for themselves that the sports club shares with its customers, e.g., till now published recipes described preparation of pumpkin salad, banana-nut cake or fit fruit dumplings.

The sports club also tries to engage customers through showcasing the club's background in the form of videos, posts and stories on its social media profiles. The emphasis is on drawing customers into the environment and background of the sports club. It brings all the latest news and previews of what changes are coming, the progress of classes, introductions of all the teachers and coaches – who is running what classes and when. In general, it focuses on letting customers see the current events in the sports club, what new things are coming up, how the new construction of the space is going on, what new things customers can find here, etc.

Ad (ii.) Workshops, seminars, lectures and courses, meeting with a selected company, thematic and extended lessons (not online)

Another tool for enhancing customer engagement is organizing workshops, seminars, lectures or courses. These activities are created and prepared by the sports club. Duration of these events depends on a particular topic. Some take one hour, other several hours or even several days. As for participation fees, workshops, seminars and lectures are usually free to club members – it is a part of their membership. Non-members have the option to attend for a fee only. So far, the following events have been held at the sports club: the Wim Hof Method workshop, focusing on deep fascial tissue relaxation, the Jumping know-how seminar explaining how to perform the jumping technique correctly, the Yoga Minimum seminar series (basic information on yoga practice), lectures on the topics of effective relaxation, defence against sub-winter fatigue, gaining muscle, fat burning, optimizing the working environment, myths and excesses in diet and exercise, etc. In addition, first aid and self-defense courses for women were prepared. Usually the topics are focused on healthy lifestyle, sports, muscularity, regeneration and health in general.

Furthermore, the sports club made it possible for its customers to meet with selected companies, e.g., with the Nutrend company. This is a company that focuses on sports nutrition. At the reception desk in the sports club, several products just from Nutrend can be purchased and therefore an opportunity was provided for customers to meet the Nutrend team. This meeting included product tasting, customer questions&answers and a reward for those attending in the form of a bar and a protein drink.

Other frequently used tools include thematic and extended lessons. These are usually themed around a holiday, a season, or a farewell to lecturers. Customers can participate by bringing some refreshments for the lesson, having a themed dress code, choosing their own songs, etc. Some lessons have also ended with a raffle for everyone involved. For instance, there have been organized Valentine's, May, St. Nicholas, Christmas or farewell lessons.

Ad (iii.) Special offers, promotions and discounts – focused on customers' wallets

Although customer engagement is focused on relationships going beyond pure transactions, still the financial issues need to be kept in mind – without them, enhancing and deepening customer relationships would be economical impossible. Therefore, there are activities focused on customers' wallets.

There are special offers, promotions and discounts for customers. These include, for example, promotions for group classes and wellness, discounted season passes, discounts on other services when purchasing a season pass, discounts during a holiday or month (e.g. discount for women on International Women's Day, discounts only in January), promotions in the form of purchasing a registration in a month and a subsequent bonus of one free personal training session, pre-Christmas promotions, Christmas discounts on products such as protein supplements, bars, vitamins, etc. These offers are seen as a step towards deepening customer relationships, with the sports club providing certain monetary benefits to its customers.

Ad (iv). Charity events and support towards the local community

The sports club is also dedicated to voluntary charity events and support. Charity events consisted of organized events such as full day program to raise a sum of money and donate it to charitable, philanthropic purposes. There is usually a large turnout at these charity-oriented activities. It shows that customers of this sports club are not indifferent and are happy to get involved for a good cause. Conducting such charity fundraisers is certainly attractive to both current and potential customers. They see activity, interest, empathy and concern for others. An example of a charity was, for example, the bicycle cinema "North of the Sun". This was a group spinning lesson, where customers were shown an adventure documentary about two surfers who set out to catch waves further beyond the Arctic Circle, living off what they found. Money raised through this event was then donated to charity. In addition to standard admission, customers could add a voluntary admission fee.

Another charity event was a charity marathon for a girl whose name was Anna, who suffered from the rare Phelan-McDermid syndrome (damage to chromosome 22). For one whole month, a cash box was available at the reception, to which customers could make any financial donation. Then, on the last day of the month, the charity marathon for Anna was held. This event included a program of group classes throughout the day, a program in the gym and a program on the squash courts. Customers could choose from any activity: either attend selected group lessons, or go to the gym, where there was an accompanying program, or enjoy the program on the squash courts, where it was possible to play squash or badminton with a licensed instructor. For all customers, there was an additional voluntary entrance fee. The whole day was exclusively directed to charitable purposes. At the end of this marathon, there was also a ceremony of handing over the cash box.

3.2 Customers' preferences in the context of customer engagement at the sports club

Customer preferences were collected through an online questionnaire as described above in Section 2. The questionnaire itself contained a set of questions that found out details on customers' preferences; however, page limitation of this paper does not allow to present all the results obtained. For simplicity and better understanding by respondents, the term "being engaged" was replaced with "being involved" in the question formulations.

Respondents were asked if they felt involved in the sports club activities: 20 respondents (i.e. 10%) definitely felt involved, and 132 respondents (66%) rather felt involved. Therefore, it can be inferred that 152 respondents (76%) in total felt involved. On the other hand, there were also respondents who rather or definitely did not feel involved (49 respondents in total; 24%). In the context of customer satisfaction, the following hypothesis was statistically tested: "More than 50% of respondents who are satisfied with the company's services feel involved." This hypothesis was confirmed ($\chi^2 = 56.1798$; p-value < 0.001). In fact, 78% of satisfied respondents also felt to be involved.

Furthermore, respondents were asked whether they participated in a variety of sports club' activities, and were also asked to rate these activities on a scale of 1 to 5 (where 1 = the worst, 5 = the best rating). On the basis of the average values of the rated activities, it was found that thematic and extended group lessons come out with the best average, followed by demonstrations of what happens in the sports club, further special offers, promotions and discounts are appreciated, and social media profiles are highly interesting for respondents. Details are presented in Table 1.

Table 1 The sports club's activities supporting customer engagement and their rating

Activities	Mean
Thematic and extended lessons	4.37
News and demonstrations of what happens in the sports club, behind the scenes moments	4.07
Special offers, promotions and discounts	4.01
The sports club's social media profiles (discussions, polls, reactions, tagging, etc.)	4.00
Contests	3.81
Challenges, pieces of advice (incl. recipes), tips, articles	3.63
Workshops, seminars, courses, lectures	3.62
Charity events and support	3.54
Events organized by the sports club	3.52
Meeting with companies	3.38

Source: Own processing / Note: Means were calculated from the ratings given from 1 to 5, where 1 = the worst and 5 = the best rating.

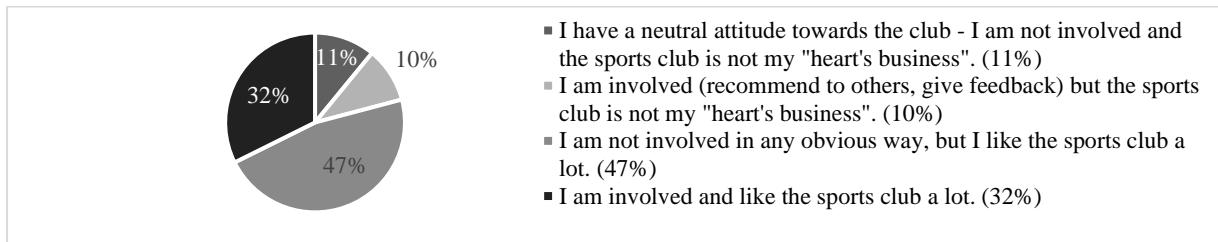
Subsequently, respondents were also asked how they would like to be more engaged. It was found that 63 respondents (31%) wanted more prize contests, while 61 respondents (30%) wanted training camps organized by the club, and 60 respondents (30%) wanted more member benefits. Additionally, 50 respondents (25%) would like to be involved in creating items with the sports club logo (e.g., t-shirts), and 44 respondents (22%) would like to be involved in selecting new machines in the gym. Besides this, respondents were directly asked if they would be interested in, for example, some multi-day activities organized by the club. The results show that 119 respondents (59%) were interested. In the context of membership type (i.e., annual membership vs. monthly membership vs. season tickets vs. one-time entrance fee for non-members vs. use of the MultiSport card for admission, which is one of the frequent employee benefits), the following hypothesis was statistically tested: "There is a connection between type of membership and interest in multi-day activities." This hypothesis was confirmed ($\chi^2 = 20.3040$; df = 4; p-value < 0.001). Namely, club members are more interested in multi-day activities.

In terms of the social media environment, 81% of respondents (163 respondents) follow the sports club on social media. Specifically, the activities and various information that are posted by the sports club are followed by the respondents on the social platform Instagram (75%), followed by the sports club's website (46%), and finally on the social platform Facebook (21%). It was revealed that the most frequent customer engagement is on the social platform Instagram, which is explained by its popularity by the analyzed sports club's customers. The most common ways customers engage on social media are: 'liking' posts shared by the sports club, reacting to stories, answering questions, completing polls or tagging the club. On the other hand, respondents have the fewest interactions with the club on the

Facebook platform. There are still many respondents who do not engage in any visible way and are purely in an observer position.

Respondents were also asked to self-evaluate their level of engagement towards the sports club. There were the following four statements from which respondents were asked to choose the only one that best described them: 'I have a neutral attitude towards the club – I am not involved and the sports club is not my "heart's business"' / 'I am involved (recommend to others, give feedback) but the sports club is not my "heart's business"' / 'I am not involved in any obvious way but I like the sports club a lot' / 'I am involved and I like the sports club a lot'. Obtained results are presented in Figure 1. It is worth noting that 79% of respondents like the sports club a lot, regardless they are involved or not.

Figure 1 Respondents' self-evaluation of their level of engagement towards the sports club



Source: Own processing / Note: For simplicity and better understanding by respondents, the term "being engaged" has been replaced with "being involved" in all the presented statements.

Based on these findings, it is possible to apply theories by Chen et al. (2019) and Sashi (2012) and deduce the following conclusions:

- The sports club is attended by 32% of emotionally engaged customers who are both fully committed and deeply connected to the club,
- 11% of customers are non-engaged, due to their neutral attitude – they are neither emotionally attached to the sports club nor show strong signs of involvement, hence, they are referred to as indifferent customers,
- 10% of customers show a low emotional attachment but they engage,
- 47% of customers have a strong relationship with the sports club, but at the same time they do not engage in any distinct way and at a higher level – such customers are perceived as enthusiastic and satisfied customers and may emerge in the future as fans of the sports club.

4 Conclusions

The research aims of this paper were to (1.) describe specific methods and tools used for customer engagement at a chosen sports/fitness club "Harmony Sport & Relax Club", located in Písek, a South Bohemian city in the Czech Republic, (2.) find out customers' preferences in the context of customer engagement.

As for the first research aim, the following activities boosting customer engagement were detected: (i.) sports club's profiles on social networks and its websites – discussions, polls, tagging customers, quizzes, videos, tips, pieces of advice (incl. recipes), contests, challenges, behind the scenes moments, (ii.) workshops, seminars, lectures, and courses, meeting with a selected company, thematic and extended lessons, (iii.) special offers, promotions, and discounts – it is because still the financial issues need to be kept in mind; otherwise it would be economically impossible to enhance and deepen customer relationships, and (iv.) charity events and support towards the local community.

As for the second research aim, customers of the chosen sports club felt mostly engaged and appreciated activities organized by the sports club. In fact, 78% of satisfied respondents also felt to be engaged (resp. to be involved – this term has been used in the questionnaire for simplicity and better understanding of respondents). Respondents also expressed their interest in being more engaged – specifically, they prefer prize contests, training camps organized by the club, member benefits, creating items with the sports club logo, and selecting new machines in the gym. Furthermore, 81% of respondents follow the sports club on social media – they like posts shared by the sports club, react to stories, answer questions, complete polls, or tag the club.

Acknowledgement

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The Behavior Aspects of Slovak Consumers in the Context of Sustainable Consumption

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Abstract: The Covid 19 pandemic had an impact on the behavior of individuals and households. The article first presents the general characteristics of the course of the Covid 19 pandemic in Slovakia, then explains the concept of sustainable consumption and its transfer to the sphere of behavior and practical activity of consumers during the Covid 19 pandemic. The starting point of the investigation is formulated research questions. The analysis of knowledge from empirical research is based on mathematical and statistical methods in order to answer research questions. From the data from the survey of various cities in Slovakia at the level of individuals and households, we identify four different clusters of consumers based on five groups of factors influencing their attitudes, which made it possible to define the main characteristics of consumers who have similar behavioral changes. Next, we illustrate which selected practices of sustainable consumption are most used by households and how the practices are related to the psychological and sociodemographic characteristics of consumers. The overall analysis shows that the structure of changes and actions of consumers, as well as the application of sustainable practices, differs in different social groups and also according to psychological and sociodemographic characteristics.

Keywords: sustainable consumption, consumer behavior, sustainable consumption practices, psychological characteristics, sociodemographic characteristics

JEL Classification: M31

1 Introduction

Understanding consumer behaviour is the essence of successful marketing orientation in the marketplace. The Covid 19 pandemic has affected several aspects of individual and household consumption. There is an urgent need to uncover which sustainable consumption values manifested themselves in consumers' consumption and practices during the Covid 19 pandemic. Different consumption practices are coming to the forefront in comparison to the pre-pandemic period, and the daily practices of each individual during the Covid 19 pandemic were confronted by multiple externalities (Sun, Liu, Zhao, 2019; Maciewski et al., 2020) that influence their sustainable consumption behaviours and attitudes during the Covid 19 crisis (Hroncová, 2011). According to the National Bank of Slovakia (Mráziková, 2020), the considerable uncertainty about the future development of the pandemic and its impact on the labour market and, consequently, on household incomes, forced them to be cautious in their spending and oriented them towards behaviour that was often contrary to normal (for example, the excessive growth in food purchases at the beginning of the Covid-19 pandemic, on the beginning of February in 2020 etc.) or to tendencies corelating to the fear of the corona virus (purchasing healthy food to strengthen the immune system, hand sanitisation, wearing of masks and observance of the prescribed two-metre distance between shoppers in the shop). At the same time, consumer dissatisfaction with the implementation of the state of emergency and lockdown has been growing as they reflect on what the current crisis means for them personally, but more importantly, what it means for their family, friends and society in general. There was a prevailing sense of worry regarding the economical scope of Covid-19 (Fetzer, T. et. Al., 2020, pp. 1-36) rather than the worry about one's health. In this sense, the crisis has had a significant real impact on consumer spending, especially if economic activity is threatened as a result of the quarantine measures.

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Consumers gradually learned to cope with and adapt to the "new normal" by taking into account the above-mentioned pandemic-related factors in their decision-making process and by introducing specific measures into their daily lives in their households to help reverse the negative trends triggered by the pandemic. We are therefore interested in identifying changes in consumption and applying everyday practices in terms of sustainable consumption. In terms of consumption changes we propose the following research question:

RQ1: What are the main characteristics of respondents who have similar behavioral patterns in the aftermath of the pandemic?

By addressing these research questions, this study provides insights into how different individual behaviours (Steg, Vlek, 2009 , p. 312) of consumers within the specific context of Covid 19 are influenced by the personal characteristics of consumers. Based on this framework, we provide insights on selected sustainable practices to which consumers are willing to devote their resources to the desired course of environmental change by answering the following research question.

RQ2: What are the psychological characteristics of people who use selected practices of sustainable consumption?

A fundamental challenge to achieving sustainable development is to change consumer behaviour as part of the fight against the current unsustainable consumption that has contributed to resource depletion, environmental pollution and climate change problems. As of today, the increased interest in environmental issues and the promotion of respect for the natural environment, especially by the media, weakens the influence of consumerism. Pro-environmental behaviour of consumers motivates manufacturing and commercial enterprises to offer products that, in accordance with the principles of sustainable development, limit the waste of raw materials, reduce global consumption by reducing the overuse of natural resources (Kita et al., 2017), motivates consumers to purchase socially responsible products (Dhandra, 2019), and contributes to increasing well-being (Sheth et al., 2011).Sustainability is, in general, not an easy choice for consumers. To select and identify the right product requires effort, and so does changing purchasing behaviour. Not to mention more money. These obstacles need to be gradually overcome in order to make sustainable consumption an easy choice for consumers.

2 Methods

The theoretical part of the paper was based on the reservoir of knowledge from scientific and professional literature, respectively specialized internet resources. The research part is focused on the identification of behavioural changes and maintenance practices and was based on the following methods: document study and content analysis and questionnaire survey.

The questionnaire survey was carried out at the peak of the second wave of the pandemic of Covid 19 from February to mid-March 2021. During this period, Slovakia was the world leader in the number of victims dying from Covid-19. This means that Slovakia had the highest number of deaths in relation to the size of the country (Oxford Martin school GSDL, 26.2.2021). At this time, on 3 June 2021, one year has passed since the first coronavirus infection in Slovakia. At the same time, this period is characterised by events such as the state of emergency, the lockdown, the full-screen testing, the introduction of the Covid automat and the political crisis, which can also affect the more intense behaviour and habits of consumers. Covid-19 has influenced data collection in many ways. It was not possible to carry out data collection on the basis of individual personal interviews. For this reason, the empirical research was conducted in the form of a pre-arranged Structured Online Interview with each respondent. Furthermore, it was necessary to capture the changes in consumer behaviour and to try to maintain the data collection period in 534 households.

Table 1. Age composition of the base set

Age group	Number of respondents (in percent)
18 - 24 years	23.60
25 - 39 years	26.77
40 - 59 years	31.09
60 and over	18.54

Source: Own processing

The most numerous groups were respondents living in cities (see Table 2) with a population of up to 50,000.

Table 2 Distribution of respondents by residence

Size of residence	Number of respondents (in percent)
A village with up to 5,000 inhabitants	27.15
City with up to 50 000 inhabitants	30.72
The city of 50 000 to 200 000 inhabitants	18.35
A city with over 200 000 inhabitants	23.78

Source: Own processing

In order to highlight the practices of sustaining consumption, the results of the empirical research were processed by using the following methods: factor analysis, non-parametric Friedman test, post hoc analysis, non-parametric Mann-Whitney test, Kruskal-Wallis and Kruskal-Wallis tests, Spearman's correlation coefficient, decision trees, CRT algorithm, sunfish's graph (Scree plot), the Varimax method, the Two Step clustering method, etc.

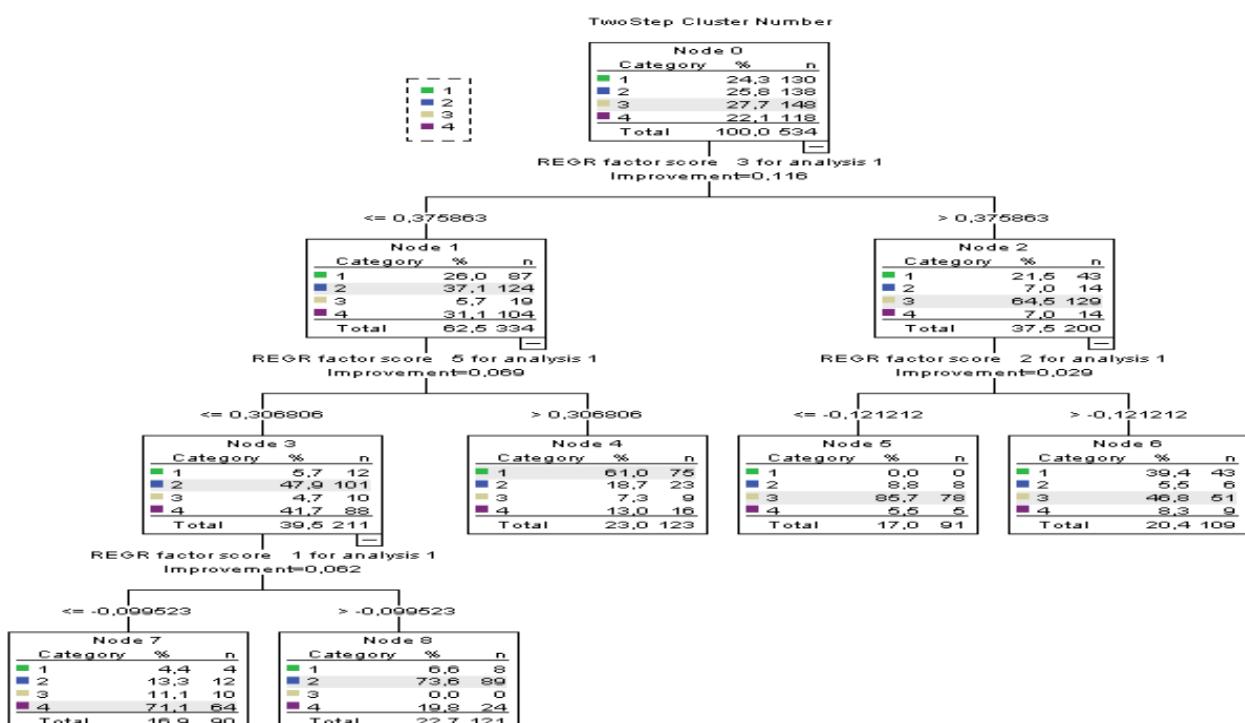
3 Research results

To identify changes of consumption and apply everyday practices correlating to sustainable consumption and to them relating topics, we shall proceed using study questions.

Segmentation was used to evaluate the research question. Due to the strong correlation between the individual factors, factor analysis was first used to reduce the dimension of the task.

KMO and Bartlett's Test (p-value <0.01) showed that the correlation matrix is not really an identity matrix and thus it is appropriate to use factor analysis. Based on the debris chart (the Scree plot) five factors had been selected. The first factor contains items that could be summarized as "sustaining life", the second factor refers to "financial management", the third one to "public activities", the fourth one to "use of modern technological means" and the fifth one to "subjective feelings" (Figure 1). From the decision tree (Figure 1) structure can be seen that the third factor is the most significant (i.e., public activities), then fifth factor (i.e., subjective feelings), first factor (i.e., sustainable life) and the least significant is second factor (i.e., financial management).

Figure 1. Decision tree



Source: Kita, P., & Žambochová, M., & Maciejewski, G., & Čvirík, M., & Mazalánová, V.K. (2023). Changes in the Culture of

Each of the measures may be written as a linear combination of the newly emerged factors. This gives rise to five new values for each measurement (each respondent) corresponding to the membership of the newly emerged variables, which, unlike the original $u \geq$, are minimally correlated. These newly emerged variables were used as input variables for segmentation using cluster analysis. The Two Step clustering method was specifically used. This method showed as optimal the partitioning into four clusters. Subsequently, classification of object membership (i.e. individual respondents) to the relevant clusters was performed using decision trees, namely from the four clusters. Firstly, from the opinion point of view, in two ways, i.e., firstly, on the basis of the artificial factor variables generated in the factor analysis, and secondly, the explanatory variables entering the classification were the original variables entering the factor analysis, i.e., the answers to the individual questions about the extent to which the respondents' families had changed their behaviour due to the pandemic. The second level was the observed demographic information about the respondents. The third level was the respondent's moral characteristics, represented by subjective opinions about their person in terms of the levels observed.

From the structure of the tree, it shall be known, that statistically, the most important factor for inclusion in the cluster is the factor "willingness to give up personal freedoms", followed by "conservatism", then "functionality before appearance", and as the last important factor was found to be "compliance with deadlines".

From the structure of these Styrian decision trees, the characteristics of the representatives of the individual clusters emerge, from all Styrian points of view.

The 1st cluster is formed by:

- Respondents older than 60 years, or people aged up to 59 years, who feel their financial situation badly;
- respondents who are willing to give up some of their freedoms for the good of society and for whom appearance is more important than functionality and what happens here and now is also important to them; and respondents who, although not willing to give up their freedoms, like news and terms are taken very seriously
- the respondents who are not willing to give up their freedoms, but do not like novelty and do not take the term very seriously
- respondents who are less supportive of charities and cut back on big spending. clustering:

The second cluster is formed by:

- respondents younger than 24 years of age, who do not perceive their financial situation as bad, or men in aged 24-59, who do not perceive their financial situation as bad;
- respondents who are not willing to give up their freedoms, like news and deadlines do not take it very seriously;
- respondents who support charities less and do not reduce large expenditures, do not shop less often and care more about the environment.

- The third cluster is formed by:

- Women aged 25-59 years Living in municipalities with a population of up to 200 000 inhabitants who do not consider their financial situation to be bad;
- respondents who are willing to give up some of their freedoms for the good of society and for whom functionality is more important than appearance;
- respondents who do not support less charitable organisations, shop less often and do not think too much about the environment; & and similar respondents who do not shop less often but feel less deprived.

The fourth cluster is formed by:

- Women aged 25-59 Living in municipalities with a population of over 200,000 who do not feel their financial situation is bad;

-Respondents who are willing to give up some of their freedoms for the good of society and for whom it is more important to look after the future than functionality and to focus their thinking on the future; or respondents who, although they are not willing to give up their freedoms, do not like novelties and take deadlines very seriously;

-respondents who do not support less charitable organisations, do not shop less often and do not think too much about the environment and feel less hopeless.

It should be noted that the initial consumer behaviour in the identified clusters has been as follows:

a) pensioners and people of working age who feel their financial situation is bad have reduced their support for charities and cut back on large donations because of the pandemic. For the majority of these people, they are willing to give up some of their freedoms for the good of society and for whom it is more important to look than to function and to live for the present. They also distinguish themselves in terms of meeting deadlines and prioritising novelty;

b) respondents who see their financial situation as good, especially young people under 24, but also men of working age, have reduced their support for charities because of the pandemic. But they have not cut back on big expenditures, they have not cut back on purchases, but they have increased their concern for the environment. A characteristic feature of these respondents is the reluctance to give up their freedoms, a preference for novelty and a reluctance to meet strict deadlines;

c) women of working age living in municipalities of up to 200,000 inhabitants, who do not consider their financial situation to be bad, have reduced their purchases because of the pandemic, but not their support for charitable organisations, and have not increased their concern for the environment. If these changes have not been reflected in some countries, there has been a heightened fear of hopelessness. It is characteristic of these women that they are willing to give up some of their freedoms and that function is more important to them than appearance:

d) Women of working age Living in large cities of over 200,000 inhabitants who do not feel bad about their financial situation, have not restricted their behaviour too much because of the pandemic, do not support less charitable organisations, do not shop less often and do not think too much about the environment and do not feel less safe. These Women are willing to give up their freedoms for the good of society and are more concerned with appearance than function and are future focused in their thinking. If some of these women are not willing to give up their freedoms, they do not like novelty and they take deadlines very seriously.

RQ2: What are the psychological characteristics of people who adhere to selected practices of consumption maintenance?

To evaluate the research question, a non-parametric Mann-Whitney test was used to compare two independent samples.

People who like more likely to participate in a social aid campaign are the individuals, who prefer to be the centre of attention, who like to spend their free time actively, who like what is new, for whom appearance/style is important, for whom civil liberties are the most important and for whom they are not going to give them up in any situation

People who volunteer and help others are the ones who like to be the centre of attention, who like to spend their free time actively, who like what is new, for whom what they think is most important, for whom civil liberties are most important and for whom they are not going to give them up in any situation

In the interest of protecting the natural environment, people who like to be the centre of attention, who like to spend their free time actively, who like what is new, for whom it is most important, for whom they themselves think what is most important, for whom civil liberties are most important and for whom they are not going to give them up in any situation, who focus their thinking on the future, who believe that there are exceptions to the rules, are more likely to take action.

In organisations promoting the objectives of sustainable development, there are people who like to be the centre of attention, who like to spend their days away from home, who like to spend their free time actively, who like what is new, who like what they think is most important, for whom civil liberties are the most important and who are not going to give them up in any situation, who focus on the future in their thinking.

In their homes, people who install more ecological elements prefer to be the centre of attention, they prefer to spend their free time being active, they like innovations, think the most important is the look/style, the people for whom

civil liberties are most important and in no situation will they accept giving them up, in their mindset, they focus on the future.

The products and services of companies, which put a lot of emphasis on the environment, who prefer to spend their time away from their home, who spend their free time staying active, who like new innovations, who prefer the appearance/style, people, for whom the civil liberties are of utmost importance are not willing to give them up under any circumstances and people who believe that there always shall be exceptions to rules.

Thrifted clothes and other goods are more likely to be purchased by people who prefer to spend time away from their home, who spend their free time being active, who like new innovations and believe there always shall be exceptions from the rules.

Broken things are more likely to be fixed or left to be fixed by people who believe that there are always exceptions to the rules.

Good and unnecessary things are given to charities more by people who like to be the centre of attention, who like to spend their free time actively, for whom appearance/style is most important, for whom civil liberties are most important and who are not going to give them up in any situation.

Electricity and gas are more likely to be saved by people who prefer to spend their free time actively, for whom civil liberties are the most important, and for whom they are not going to give them up in any situation.

Water is more likely to be saved by people who prefer to spend their free time actively, for whom civil liberties are the most important and for whom they are not going to give them up in any situation.

People who are likely to behave so as not to pollute the environment, are the people who the centre of attention, who prefer to spend their free time actively, who try to meet all the deadlines.

In their home, a more healthy lifestyle is promoted by people who spend more often than not spend their time outside of their home, who spend their free time actively, they like innovations, they like what they think is most important, civil liberties are most important to them and they are not going to give them up in any situation, they focus on the future in their thinking, they believe that there are always exceptions to the rules.

Waste is more sorted and recycled by people who like to be the centre of attention, who like to spend their free time actively, who try to meet all the deadlines.

Not wasting food is more sought after by people who like to be the centre of attention, who prefer to spend their free time actively, for whom appearance/style is the most important thing, who believe that there are exceptions to the rules, who try to meet all the deadlines.

Limiting consumption through the premeditated purchase of goods and services that are really needed is more easily done by people who like to be the centre of attention, who prefer to spend their leisure time actively, who try to meet all deadlines.

In elections, people who vote more for candidates who declare their support for the weaker and poorer social groups and their concern for the natural environment, are people who prefer to spend their days actively, for whom civil liberties are the most important and who do not intend to lead them in any situation, who try to meet all the deadlines.

With the help of monetary donations, different types of humanitarian organisations are more supported by of people who like to be the centre of attention, who like to spend their free time actively, who like to be new, for whom appearance/style is the most important, for whom civil liberties are the most important and for whom they are not going to give them up in any situation.

The formulated research questions with the use of literary sources and research methods have strengthened the development of the framework of sustainable consumption in the context of the Covid 19 crisis and have significantly enriched and expanded the knowledge about the behaviour of Slovak consumers. The segmentation carried out in this volume offers two areas of opportunity to:

1. a better understanding of consumer behaviour during the Covid-19 crisis and the characteristics of consumers for targeting consumer practices that were strengthened by the pandemic and that were already in use before the emergence of Covid-19, in particular in food consumption, but also in the areas of saving electricity and gas, water, environmental protection and waste sorting.

2. the development of sustainable consumption practices that require urgent attention, such as involvement in organisations promoting sustainable development goals, but also in social aid campaigns in which consumer activity is lower.

The differences within the clusters also indicate important differences between consumers that can be useful for sustainable marketing communication and defining the offer by business managers. Knowledge of the characteristics of customers and the context in which they evolve makes it easier to influence their behaviour and decision-making.

The practical application of these results is important in targeting different consumer groups and promoting sustainable practices. This is particularly important as targeted solutions are sought to help consumers make more sustainable consumption choices in the context of the European Union's call for a European Green Deal, which will improve the quality and health of citizens and future generations by promoting more sustainable food consumption and healthy eating.⁴

4 Conclusions

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Healthy Food Marketing Strategy on Online Platforms: Key Insight into Slovak Customers

Lea Rubínová¹, Elena Horská², Eva Oláhová³

Abstract: Online marketing is crucial for companies in the healthy eating sector, where increasing competition demands effective communication and strong brand building. This study highlights the importance of marketing strategies on online platforms and evaluates their impact on consumer behavior. It analyzes both rational and emotional factors that influence consumer preferences when choosing healthy food products and explores how businesses can leverage these factors to optimize their online marketing strategies. To confirm the research hypothesis, the study employed methods that analyze digital marketing strategies, including the use of advanced analytics, personalized content, and engagement through social media to better understand consumer needs. The results show that businesses can improve their online presence by creating visually appealing, authentic content, engaging influencers, and utilizing consumer feedback. These findings offer a guide to effectively applying digital tools in the competitive healthy food industry.

Keywords: digital marketing, marketing communication, marketing strategies, online communication channels, online marketing activities.

JEL Classification: M31, M37

1 Introduction

The aim of this paper is to highlight the importance of marketing strategies for healthy food on online platforms, focusing on current trends in digital marketing communication, and to evaluate their impact on consumer behavior. In recent years, healthy nutrition has become one of the most important aspects of modern lifestyle, with consumers increasingly seeking products that support their health and well-being. The significance of marketing in this area is growing due to increasing competition and the rising interest in healthy foods. However, despite the current high interest in healthy nutrition, marketing strategies targeting this sector still face challenges in effectively communicating with consumers, who are influenced by various emotional and rational factors in their decision-making. This paper focuses on analyzing these factors and explores how businesses can leverage digital tools such as personalized ads and social media to optimize their online marketing strategies. The research also addresses the gaps in the current understanding of the mechanisms influencing consumer behavior, particularly in the field of healthy food marketing. Such an approach is essential for businesses to adapt to current trends and meet the growing demands of consumers for healthy and sustainable products.

Studies have shown that digital marketing on social media mainly targets ultra-processed foods and contributes to increased consumption of unhealthy items. This marketing influences product recognition, consumer opinions and preferences, purchase intentions, food choices and overall eating habits. Botelho (2022) Nutrition is a factor of the external environment that significantly affects the quality of life of a person. Proper nutrition is an essential prerequisite for healthy human development. The way of nutrition and its trends have changed in the past under the influence of social, societal changes (Rovný I., 2004).

Consumers tend to believe that healthy food choices help them to achieve long-term health goals. Manufacturers have noticed this trend and see healthy food as a growing consumer market and have expanded investment in healthy food production. However, marketing performance shows that healthy food does not sell as well (Xiaofei, 2024). Marketing communication is constantly evolving and finding new ways to capture consumers' attention and generate their interest in products. In marketing, visual elements play a key role in creating emotional reactions and motivations in consumers. These visuals have a strong potential to influence how consumers perceive a product,

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decide to buy it and form an emotional attachment to it (Ripinka, 2024). People around the world are increasingly active and connected through web technologies and social media. At the same time, companies are beginning to see these innovations as powerful tools to improve communication with their customers (Alalwan, A. A., 2017). As a result of this growth companies in all sectors of the economy are forced to use social media to keep up with customer behaviour and stay connected (Matikiti, R. K., 2016). The online industry has been very proactive in the way it develops new markets and cultivates consumer eating habits (Li, 2020). During the COVID-19 pandemic, digital marketing communication, i.e. communication between businesses and consumers through digital or electronic media, has seen significant growth. This phenomenon has been analysed in detail in the study by Shankar et al. (2022) who highlight that the global health crisis has accelerated the transition to digital platforms, with many businesses having to quickly adapt their marketing strategies to the new conditions. The limitations of physical contact and the increase in online purchases have created new challenges and opportunities in digital communication, leading to a significant increase in the use of digital tools and platforms. This trend reflects not only the adaptation of the business environment to the crisis, but also a permanent change in consumer behaviour, who increasingly prefer digital channels for interacting with businesses. Sheremetyeva et al. (2021) suggest that the internet has become a key marketing tool for firms, with the digitisation of marketing enabling customers to access products and brands at the very moments they need them. Food marketing strongly influences the dietary preferences of both children and adults, with the promotion of unhealthy foods being a major contributing factor to rising obesity. Nevertheless, there are gaps in knowledge about the impact of marketing strategies aimed at promoting healthier food. As Folkvord (2020) notes, although junk food marketing has been extensively researched, less is known about the effectiveness and mechanism by which healthy food marketing operates. This study focuses on research over the past five years, with an emphasis on the impact of healthy food marketing on eating behaviour and an exploration of the psychological and behavioural mechanism through which it operates. This review study focuses on research over the past five years, with an emphasis on the impact of healthy food marketing on eating behaviour and an exploration of the psychological and behavioural mechanisms through which it operates. Understanding these dynamics is key to designing effective interventions aimed at improving public health through marketing strategies.

According to the research, 61.16% of respondents are aware of what constitutes 'innovative or functional' food. They perceive these foods as healthier and of higher quality, though they are often seen as more expensive. Consumers have also noticed an increasing presence of organic food in stores. The largest group of consumers in Slovakia (48.77%) consists of those who consume all types of food without engaging in rational eating. A significant portion, however, (43.5%) consists of individuals who prefer a balanced diet Horská et.al(2021).

2 Methods

In this study, we explore the importance of digital marketing, particularly the latest trends in marketing communications, and their impact on consumer behaviour. By analyzing both rational and irrational factors that drive consumer preferences, it seeks to understand how businesses can effectively promote their products on online platforms. The insights gained will help marketers craft strategies that resonate with consumers, leveraging digital tools to enhance engagement and conversion rates. Ultimately, this research aims to provide a comprehensive guide for businesses looking to succeed in the competitive online marketplace.

For the processing and evaluation of the questionnaire survey we defined and then verified the following research assumptions:

Research assumption 1: We assume the existence of a relationship between the media campaign and the respondents' decision to consume healthy products.

Primary and secondary sources of information were collected and used to achieve the stated objective. Secondary data were obtained from studies and articles by domestic and foreign authors, WoS and SCOPUS databases and available internet sources.

The questionnaire was processed through Google Forms and distributed through the Facebook account. The questionnaire survey was conducted on a sample of 301 respondents. Of this number of respondents, 60% were female and 40% were male (Figure 1). This may be due to the fact that women are more interested in healthy eating compared to men.

Period of data collecting

In order to verify the importance of marketing activities, with a particular emphasis on the area of healthy nutrition, we conducted a questionnaire survey, which served as the main tool for data collection. The questionnaire was distributed among 301 respondents, which represented a relevant sample for our study.

Data collection took place between 8 November 2023 and 31 December 2023. During this period, respondents were contacted electronically, ensuring anonymity and voluntary participation in the survey. Questions on healthy eating explored respondents' awareness of the importance of good nutrition, their attitudes towards marketing campaigns promoting healthy eating, and the impact of these campaigns on their purchasing behaviour.

We further processed data from the questionnaire survey into tables and graphs and interpreted the results. The first step was to verify the representativeness of the sample according to the gender of the respondents using the Chi-square test of good agreement.

- Chi X2 squared contingency was used to test for the existence of statistical dependence between variables at the significance level $\alpha = 0.05$. In chi x2 square contingency test method, it is necessary to calculate the test criterion as:

$$\chi^2 = \sum_{i=1}^k \frac{(E_i - T_i)^2}{T_i} \quad (1)$$

Where:

χ^2 – test statistic,

E_i – empirical frequencies,

T_i – theoretical frequencies.

In Microsoft Office Excel, using the CHIINV function at a significance level of $\alpha = 0.05$, we calculate the critical value and compare it with the test statistic. If the test statistic is greater than the critical value, we reject the assumption. If the test statistic is less than or equal to the critical value, accept the assumption. (Matejkova et al. 2018)

We chose the Friedman test because it is an appropriate statistical method for comparing several baseline sets based on dependent samples. It is a nonparametric analogue of the two-factor analysis of variance. The calculation of the test characteristic as follows :

$$F = \left(\frac{12}{n \cdot k \cdot (k + 1)} \cdot \sum_{j=1}^k R_j^2 \right) - 3 \cdot n \cdot (k + 1) \quad (2)$$

Where :

- n - sample size
- k - number of variants

- R_j - sum of the ranks in the column

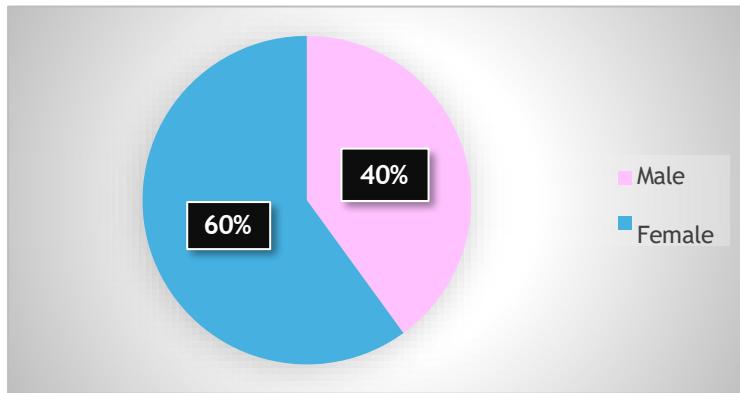
Test evaluation : if $F \geq x^2_{\alpha, k-1}$) comes out, hypothesis H_0 is rejected.

- We used Nemenyi's method as an addition to Friedman's test to detect statistically significant differences.

3 Research results

In the realm of digital marketing, effectively promoting on online platforms has become essential for businesses, especially in the healthy food sector. This section explores the findings related to digital marketing strategies and their impact on consumer behavior.

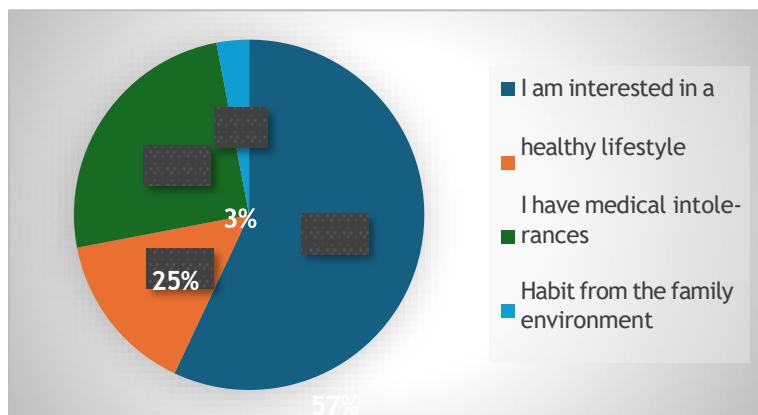
Figure 1 Gender of respondents



Source: Own processing

Next, we asked why respondents chose to consume healthy products. Respondents could add their own answer to the predetermined answers. Most respondents - 57% (172 people) - said that they were interested in a healthy lifestyle. 74 respondents, which is 25%, mentioned healthy eating as a habit from their family background. Due to health intolerances, 46 persons had to start consuming healthy products, which is 15%. The remaining respondents took the opportunity to express themselves, where the answers were: weight loss after children, exercise, personal decision, influence of an influencer who started eating healthy, more varied diet, overweight, improvements in health and appearance, autoimmune disease, working as a fitness trainer, healthy eating, or trend, trying something new, balanced diet. 3% of the respondents did not address their diet, which was 9 people.²

Figure 2 Consumption decision for healthy products

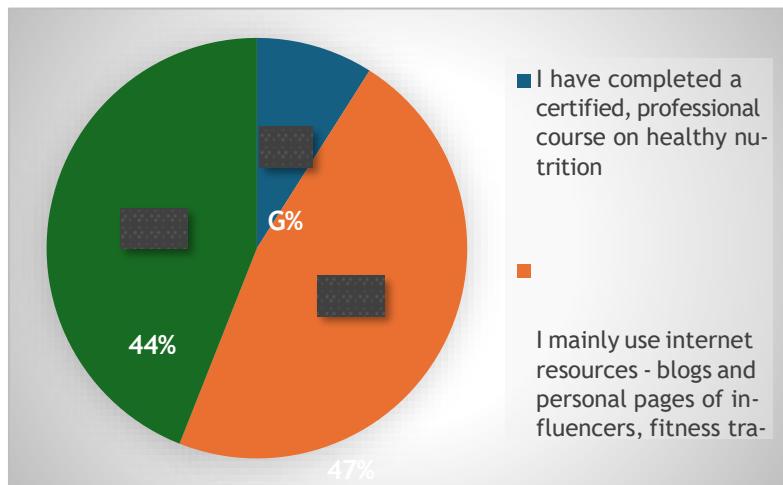


Source: Own processing

²Data collected through the questionnaire applied to prepare this text.

We asked respondents how they try to change their eating habits and lifestyle (in case of their own dissatisfaction). The most frequent answer was the use of internet resources: blogs, personal influencer sites or fitness coaches. 47% of respondents (101 respondents in total) answered this way. This may be due to the fact that they engage in transformations with nutrition counsellors with precisely set "diets" or seek inspiration for healthy foods on blogs. The second most frequent answer was consultation with a doctor, nutrition advisor trainer (goal, change of diet, physical activity, body weight), which was indicated by 44%, which is 96 respondents. A certified, professional course on healthy eating was taken by 9% of respondents (19 persons).³

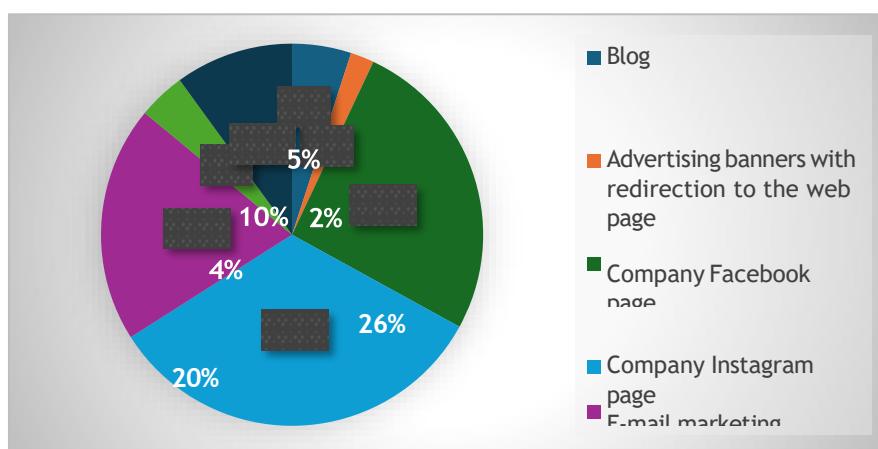
Figure 3 Mode of dietary and lifestyle change



Source: Own processing

In the survey, we asked respondents which online promotion tools they think are the most effective. The Instagram business page was mentioned by 99 respondents, which represents 33% of the respondents. The second most effective online promotion tool, according to respondents, is the company Facebook page, with 80 people marking the answer, representing 26% of respondents. The reason for choosing these two answers may be due to the fact that respondents get their inspiration for healthy food on these networks, where quality content in the area of healthy eating is added daily, as well as advertisements from influencers. Email marketing was identified by 60 respondents, representing 20%. Other effective tools according to respondents are: influencer marketing (10%), blog (5%), newsletter (4%) and banner ads with redirection to the website (2%).⁴

Figure 4 Effectiveness of online tools



Source : Own processing

³ Data collected through the questionnaire applied to prepare this text.

⁴ Data collected through the questionnaire applied to prepare this text.

We used statistical research assumptions because we wanted to find out what impact healthy foods have on online platforms. In this way, we focused on analyzing the effectiveness of digital marketing tools and strategies around healthy eating to better understand how these factors influence consumer decision-making.

Assumption 1: We assume the existence of a relationship between the media campaign and the respondents' decision to consume healthy products. To verify it, we used Chi X2 square contingency test to see whether its evaluation of the first assumption is confirmed or not.

Table 1 shows the results from the statistical test where we addressed the difference between the influence/dependence between eating healthy products and which contained the individual responses. The table includes the number of respondents for each combination of responses to questions related to health intolerances, consumption habits from family background and interest in healthy lifestyle.

Table 1 ChiX2 Square Test

ChiX2 Square test			
	Value	Degree of freedom df	Asymptotic meaning (2-sided)
Pearson Chi	6,563 ^a	2	0,038
Likelihood Pomer	6,594	2	0,037
N valid cases	309		

Source: Own processing

The value of asymptotic significance for the two tests is approximately 0.038 and 0.037, which is below the threshold often considered the cutoff value for statistical significance. This indicates that there is no dependency between the media campaign and the respondents' decision to consume healthy products, so we can accept the stated assumption is significant.⁵

Assumption 2: We assume that there is a statistically significant difference in purchase preferences. We used Friedman's test to verify it.

Table 2 Friedman test

Q (Observed value)	374,028
Q (Critical value)	9,488
DF	4
P-value	<0,0001
alpha	0,05

Source: own processing

Using Friedman's test, the results (p-value=<0.0001) confirmed that there are statistically significant differences in purchase preferences . Furthermore, we subsequently subjected these factors to a non- parametric contrast test using Neményi's method.

⁵ Data collected through the questionnaire applied to prepare this text.

Figure 3 Neményi method

Sample	Frequency	The sum of the values	Average of values	Groups			The importance of the factor
Taste	309	639,000	2,068	A			The most important
Price	309	846,500	2,739	B			
Nutritional value	309	849,000	2,748	B			
Recommendation	309	1087,000	3,518		C		
Advertising	309	1213,500	3,927			D	The least important one

Sources : own processing

The individual factors were divided into four groups (A, B, C, D) according to importance. Table 3 shows that respondents ranked taste the most important, while advertising was considered the least important. This may indicate that consumers rely more on personal experience and recommendations than on advertising campaigns, which may appear exaggerated. In addition, the availability of information from other sources, such as reviews and social media, reduces the perceived value of advertising in healthy food consumption decisions.

Discussion

According to Liu (2023), food is one of the most discussed topics on social media. Therefore, more and more brands are looking for foodbloggers to market their food products and services. People like to look at food. Videos and photos that highlight tasty dishes have a great success rate nowadays.

Patrick et.al (2024) writes that consumer preferences are constantly evolving in the dynamic food industry where competition is fierce. This is why successful food marketing now relies on more than just product quality and innovation. It also depends on aligning brand values with consumer expectations.

Rosário et.al (2021) writes about just that, it is a multifaceted process that involves researching market trends, developing products that meet consumer demands, setting competitive prices, choosing the right places to sell, and promoting those products through a variety of communication channels.

4 Conclusion

Promoting food online has become an indispensable element in the modern food industry, with businesses ranging from restaurants to small food producers leveraging the internet's vast potential. As outlined in the literature review, the digital landscape offers an unprecedented opportunity to reach target audiences, build brand awareness, and foster customer loyalty. Theories on digital marketing strategies, such as those discussed by Chaffey and Ellis-Chadwick (2022), emphasize the importance of visual appeal, content consistency, and audience engagement as key components for success in online food promotion. The first step in crafting an effective online food strategy is creating attractive and unique content, a concept supported by the aesthetic aspect of consumer behavior. As discussed earlier, people often "eat with their eyes," and well-presented food can trigger emotional responses, leading to higher engagement rates. The connection between visual marketing and emotional engagement aligns with the emotion-based marketing theory, which suggests that appealing visuals evoke both curiosity and desire in consumers, prompting them to interact more with the content. Furthermore, the importance of storytelling in online food promotion connects to the narrative marketing theory, which emphasizes the power of brand stories in building deeper consumer relationships. Consumers increasingly seek transparency and values in the brands they support, underscoring the relevance of ethical production, sustainability, and local sourcing, as identified by various researchers on sustainable consumer behavior (e.g., White et al., 2019). Social media platforms like Instagram, Facebook, and TikTok serve as the primary channels for food brands to communicate with their communities. As explored in the theoretical background, these platforms offer diverse ways to engage with audiences through content sharing, customer feedback, and influencer collaborations. The social influence theory demonstrates that influencers and food bloggers can act as powerful agents in shaping consumer attitudes and driving purchasing decisions, often more so than traditional advertising methods. As such, engaging with influencers allows brands to build credibility and trust, which are pivotal for establishing long-term consumer loyalty. Finally, customer reviews and feedback play an essential role in online food marketing, reflecting the importance of reputation management in digital marketing. Consumer opinions not only impact brand reputation but also influence purchasing decisions. Responding to both positive and negative reviews promptly, as suggested in the theoretical discussions on online trust-building is crucial to maintaining a transparent and trustworthy relationship with customers. In conclusion, the success of online food promotion hinges on adapting to current trends, understanding consumer needs, and effectively using

technology to streamline marketing efforts. The theoretical frameworks reviewed in the literature, including visual marketing, narrative storytelling, social influence, and reputation management, provide valuable insights for developing strategies that can drive engagement, loyalty, and growth in a competitive digital space. By integrating these theoretical perspectives with practical applications, businesses—whether small or large—can achieve long-term success in the dynamic and evolving food industry.

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Consumer Perceptions and Effectiveness of Loyalty Programmes in Food Retail Chains

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Abstract: The use of mobile apps in retail has become an inherent part of today's consumers' shopping experience, not just for groceries. Loyalty is what links the name of the grocery chain very closely with the loyalty member (shopper) and what the retailer prides itself on. Our study focuses on consumer perceptions and the effectiveness of retail chains 'use of loyalty programs, with close attention to the aforementioned mobile applications. The Net Promoter Score (NPS) and System Usability Scale (SUS) metrics were used to assess consumer satisfaction and loyalty. The aim of the study was to compare the effectiveness and perception of loyalty applications of selected retail chains from the perspective of their active users. The analysis further highlights the importance of user experience when interacting with apps and their impact on long-term customer loyalty. The results provide insight into how differences in app design and functionality can affect the success of loyalty programs.

Keywords: consumer behaviour, mobile applications, loyalty programs, retail

JEL Classification: M31, M37, M39

1 Introduction

A loyalty program is a tool that companies use to reward loyal customers and strengthen the relationship with them. These are marketing initiatives that aim to increase customer loyalty to a brand by offering them benefits and rewards for repeat purchases or use of services. Loyalty programs have become a part of today's customers of various retail chains, as suggested by the term "polygamous loyalty" i.e., a customer is enrolled in several loyalty programs at the same time (Dowling & Uncles, 1997), such as Lidl, Kaufland, Tesco. The reason for the use of loyalty programmes is mainly due to the use of a system of collecting points (Khodakarami, Petersen & Venkatesan, 2024), which, in a certain amount, convert their value into monetary or financial rewards.

In their study Bombaj and Dekimpe (2020) discussed how the design of the loyalty program, the retailer's business strategy, and the nature of the country influence the success of these programs. Independently, Agarwal et al. (2022) investigated how customers' perceptions of the benefits of loyalty programs and their satisfaction with these programs are related to customer satisfaction and their overall shopping experience. In their study Gabel and Guhl (2022) compared the effectiveness of traditional loyalty program rewards and personalized coupons on customer shopping behaviour in a German grocery chain. The authors found that the two types of rewards complement each other and contribute to increase the profitability of the program. Hwang et al. (2020), in turn, looked at how airline customers perceive different forms of compensation for service failure. Their results suggest that customers prefer specific and targeted compensation, such as discount coupons. Although these studies have yielded interesting findings, there is still a dearth of research that comprehensively examines the impact of promotions on the effectiveness of loyalty programs in the long run. Customer loyalty has become a key element in the success of many businesses (Chhabra, 2017).

In the retail industry, loyalty programs are often used to build loyalty (Bijmolt & Verhoef, 2017; Leenheer & Bijmolt, 2008). However, a growing body of research questions the effectiveness of these programs (Alshurideh et al., 2020; Belli et al., 2022; Bombaj & Dekimpe, 2020; Hendl, LaTour & Cotte, 2022; Wait, 2022). According to practitioners, these programs often focus on transactions and not on building a real relationship with the customer, which speaks to the need for a new perspective on loyalty (Wallström, Hjelm Lidholm & Sundström, 2024). There is a gap in research that focuses on customer loyalty in the context of brand credibility and place marketing (Reitsamer & Brunner-Sperdin, 2021) as well

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as the emotional aspect of loyalty (Cachero-Martínez & Vázquez-Casielles, 2021; Högberg et al., 2019). Loyalty is not just the result of an exchange of goods and services, but rather a deeper emotional bond between the customer and the firm. However, retailers often use tangible rewards to gain loyalty (Liu, 2007), which is not the happiest choice for their brand, as loyalty forms an emotional bond based on the customer experience. Loyalty programs play a key role in customer retention and building long-term relationships in retail. This study takes an in-depth look at how these programs affect customer loyalty, increase sales and overall satisfaction. The authors combine academic research with practical insights to offer a comprehensive perspective on the topic. The study emphasizes that customer loyalty is a complex concept that goes beyond simple reward systems. While passive brand acceptance plays an important role, the authors point to the need for a deeper understanding of what truly motivates customers. Based on a three-step strategy that includes customer journey analysis, program design, and use of technology, the study offers practical recommendations for implementing successful loyalty programs. Research (Ahsan et al., 2022) suggests that intrinsic motivation may not be directly linked to customer loyalty. On the contrary, extrinsic motivators such as rewards have a greater impact on customer retention. At the same time, however, the study highlights the importance of the perceived value that customers attach to the brand. Other research (Gupta & Kim, 2021; Preeta H. Vyas & Piyush K. Sinha, 2008; Hofman-kohlmeyer, 2016; Bolton, Kannan & Bramlett, 2000) have confirmed the importance of personalization, relevant rewards, and long-term relationships in building customer loyalty. Thus, it can be argued that loyalty programs have the potential to significantly impact the success of a business, and their effectiveness depends mainly on how they are designed and implemented.

Traditional retailers are facing increasing competition from online retailers who offer more attractive services to customers (Kumar et al., 2023). In response to this situation, many retailers have decided to invest in mobile apps to increase customer loyalty (Akdim et al., 2022; van Heerde et al., 2019). Even though many customers have downloaded these apps, actual usage is often very low (Statista, 2022). This means that even if customers download the app, they do not use it regularly because they forget about it. According to Chen et al. (2020) & Kim et al. (2015), it is challenging for retailers to keep customers' attention in a crowded digital environment. Therefore, it is crucial for retailers to find ways to increase the usage of their apps to retain customers (Darvasi et al., 2024). The reason why people stop using apps may be because our attention span is limited due to information overload (Gabaix, 2019). However, research suggests that advertising can solve this problem by reminding us of the app itself (He & Klein, 2022).

The authors' collective Zhang, Wang & Cao (2024) also confirm the importance of e-commerce in which mobile channels have become an integral part of retail strategies. Optimizing mobile apps and websites for mobile devices offers a different user experience. Mobile apps, as Liu et al. (2019) point out, provide a seamless and intuitive interface, increasing customer engagement. On the other hand, mobile websites, although simpler and cheaper to develop (Wagner et al., 2020), may provide a less immersive experience. The decision whether to invest in a mobile app or a website is a crucial one for companies, as each option has its advantages and disadvantages (Reeck et al., 2022; Xu et al., 2014).

To understand the differences between mobile apps and websites, we can turn to visual attention theory. According to Hüttermann & Memmert (2015) & Streicher et al. (2021), the breadth of visual attention varies, i.e., our attention can focus on a small or large part of a visual scene. Mobile apps with rich content and intuitive interfaces (Akdim et al., 2022; Huang & Chueh, 2022; Kim et al., 2016) tend to broaden our attention and encourage us to explore more deeply. In contrast, simpler mobile websites (Liu et al., 2019; Wagner et al., 2020) are more likely to lead us to focus on a specific goal. Research on mobile channels is gradually expanding, and more attention has been paid to mobile apps, the reasons for their use, or the factors that influence their adoption by customers, and what factors influence their adoption (Darvasi et al., 2024; Yi et al., 2024).

2 Methods

The research methodology is based on qualitative research on a sample of 30 respondents who were asked to evaluate their own experience of using the loyalty mobile applications of the selected chains. The conducted research included an in-depth interview, which included questions for calculating predetermined indicators. The subject of interest was a comparison of 3 selected mobile applications of well-known grocery chains Kaufland (Kaufland Card), Lidl (Lidl Plus) and Tesco (Tesco Clubcard). From the obtained qualitative research data, the calculation of NPS (Net Promoter Score) and SUS (System Usability Scale) methods was implemented.

- *System Usability Scale Method (SUS)*

The System Usability Scale (SUS) is a questionnaire used to measure perceptions of usability that was designed by John Brooke in 1986. There are 3 main stages, that are: questionnaire deployment, score calculation, and classified the rating based on grade. By the stage of calculation, the answers from participant will be scored. Firstly, divide odd number questions and even number questions. For each odd number questions, reducing the value (x) by 1:

$$x - 1$$

For each even number questions, do the

$$5 - x$$

Combines the result value of odd questions and the even questions. Multiplies the combination result by 2.5. The highest score of the SUS result is 100, thus the score more than it, is categorized as an error value, or not valid result see Figure 1 (Alathas, 2018).

Figure 1 Interpretation of the SUS score



Source: Own processing

- *Net Promoter Scale Method (NPS)*

It is an effective method of measuring and controlling the level of customer satisfaction, which is useful for measuring customer loyalty. NPS is a simple method that can categorize respondents based on their answers using a single question. Adopting this method, the goal is to calculate the obedience level of the customer on each product that we tested. Customer will be classified into 3 categories, that are: Promoter, Passive, and Detractor. Passive respondent will not be calculated on the formulation $Promoter\% - Detractor\% = NPS$. The higher the promoter value, the lower value of detractor, then the loyalty value will be better. After NPS is gained, then it will be divided into 4 rate categories, which are: NPS star, NPS leader, NPS excellent and NPS good, see Figure 2 (Rajasekaran & Dinesh, 2018).

Figure 2 Interpretation of the NPS score



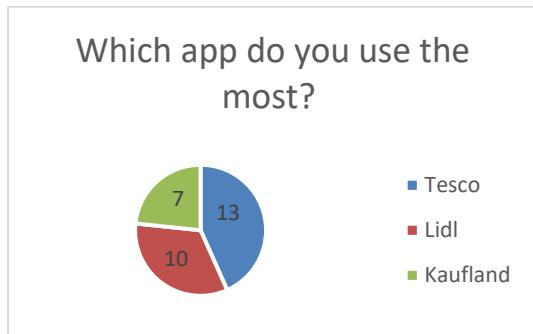
Source: <https://www.retently.com/blog/good-net-promoter-score/>

The qualitative research was conducted in the Laboratory of Consumer Studies at Faculty of Economics and Management, at Slovak University of Agriculture in Nitra, from September 30 to October 5, 2024. Respondents who use all 3 mobile applications of loyalty programs for the selected three food chains took part in the testing.

3 Research results

From the in-depth interview, we found that the most used mobile application within loyalty programs among the selected Slovak food chains is the Tesco (**Tesco Clubcard**) application (see Figure 3), which may be due to its ease of use and guaranteed discounts on every purchase.

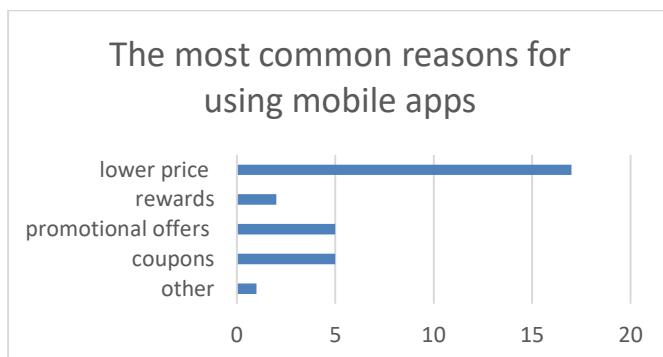
Figure 3 The most used mobile app



Source: Own processing

As many as 17 respondents identified "lower price" (see Figure 4) as the most common reason for using a mobile app. Approximately 17% of respondents, representing 5 mobile app users, gave the reason for redeeming coupons or being informed about promotional offers. The rewards system was used most frequently by 2 respondents, and the option "other reason for using a mobile loyalty app" was indicated by 1 respondent.

Figure 4 The most common reasons for using mobile apps



Source: Own processing

Table 1 NPS and SUS score for selected food chains and their mobile applications

	Kaufland (Kaufland Card)	Tesco (Tesco Clubcard)	Lidl (Lidl Plus)
NPS (score)	+14%	+21%	+16%
SUS (score)	55%	65%	58%

Source: Own processing

Net Promoter Score (NPS)

NPS expresses the willingness of customers to recommend the app to others. A higher percentage indicates greater satisfaction and loyalty. **Tesco Clubcard (+21%)** has the highest NPS, indicating that customers are more satisfied with the app and willing to recommend it. This may indicate a better user experience, features that customers value, or better deals. **Lidl Plus (+16%)** scores second, meaning it still has a positive perception, but slightly less pronounced than Tesco. **Kaufland Card (+14%)** has the lowest NPS, which may indicate that although the app is meeting expectations, customers are less likely to recommend it to others compared to other chains. Lidl and Kaufland cited frequent updating as the most common problematic aspect of their mobile apps, which may affect usage (see Table 1).

System Usability Scale (SUS)

SUS measures the usability of an application and expresses how easy it is to use. A higher percentage means better usability and intuitiveness. **Tesco Clubcard (65%)** again leads in this category, indicating that the app is easy for customers to use, intuitive and provides a good user experience. **Lidl Plus (58%)** comes in second, indicating that the

app is intuitive enough, but there is room for improvement compared to Tesco. **Kaufland Card (55%)** has the lowest score, which may indicate that customers have encountered issues with the usability or overall intuitiveness of the app, which may affect their satisfaction and willingness to use the app regularly. On the other hand, the lower score in the case of Kaufland may also be due to the menus themselves, which affect the overall perception of the app (see Table1).

4 Conclusions

This analysis is part of a pilot study that provides an initial insight into the perception of Kaufland, Tesco and Lidl's apps based on the Net Promoter Score (NPS) and System Usability Scale (SUS) indicators. The results show that the Tesco app currently leads in both categories, indicating high customer satisfaction and a good user experience. Nevertheless, it should be pointed out that the results could have been influenced by several factors, such as the offer of the different chains, the updates of the apps, as well as the actual frequency of app usage by customers. In the next phases of the study, we plan to extend the research with neuromarketing measurements focusing on user experience (UX) and user interface (UI) design. These advanced methods will allow us to gain a deeper understanding of customers' emotional and cognitive responses to individual app elements and identify areas that need to be improved to optimize the overall user experience.

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Prevailing Risks and the Way Forward Towards Safe and Resilient Tourism for Sustainable Development

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Abstract: Tourism is a well-known services industry with a significant impact in the economy. However different risks are hindering its share in countries' sustainable development. This study attempts to examine prevailing risks and the way forward towards safe and resilient tourism for sustainable development in Ethiopia. The document analysis was used to draw evidence and deeply analyze reports from international organizations, government, the World Travel and Tourism Council and internet sources. The study reveals that security is a dominant risk in the tourism sector. The study concludes that the Government should eliminate security risks and cooperate with stakeholders to make a change in the tourism sector. Finally, limitation of study, future research direction and implications for the way forward towards resilient tourism are specified in the study.

Keywords: Risks, Resilient Tourism, Sustainable Development.

JEL Classification: Q5, Q54, Q56, Q58

1 Introduction

Tourism has long been recognized as a significant economic growth and development driver. Tourism is a vital sector of the world economy, playing a crucial role in job creation, generating substantial revenue, and promoting economic prosperity. (Tourism, 2030). During the past few decades, tourism has been a leading sector and driving force for economic growth and development in developing and developed economies. (Balsalobre-Lorente et al., 2021)

World Travel and Tourism Council (WTTC) reported that in 2023, Travel & Tourism as an important economic activity have a direct economic impact, the industry has significant indirect and induced impacts. The World Travel and Tourism Council (WTTC) reported that in 2023, the Travel & Tourism sector contributed 9.1% to the global GDP, marking a 23.2% increase from 2022 and remaining only 4.1% below the 2019 level. Additionally, 27 million new jobs were created in 2023, representing a 9.1% growth compared to 2022 and staying just 1.4% below the 2019 level. Domestic visitor spending surged by 18.1% in 2023, surpassing the 2019 level. Meanwhile, international visitor spending experienced a significant 33.1% jump in 2023 but remained 14.4% below the 2019 total. (WTTC, 2023)

Since tourism fosters employment possibilities and economic growth in local communities, it is crucial for sustainable development. With advantages for the economy, society, and environment, its growth has a significant influence on nations' sustainable development. The goal of sustainable development is to promote economic and human growth while preserving the integrity of the social structures and ecosystems that support the economy. It also serves as the cornerstone of the Sustainable Development Goals (SDGs) and the 2030 Agenda for Sustainable Development, the preeminent worldwide framework for collaboration (*THE 17 GOALS / Sustainable Development*, n.d.)

The progress of human and economic growth while protecting the social and ecological systems that support local economies is the core principle of sustainable development. In many countries and regions throughout the world, tourism has played a significant role in promoting sustainable development. One of the most important strategies for promoting economic growth, lowering poverty, creating employment, and improving food security in developing countries has been the expansion of the tourist sector. Many developing countries have rich natural resources, high biological variety, and culturally important sites. These qualities attract foreign visitors, who subsequently spend their money locally to promote economic growth and job creation. Tourism has been associated with the ideas of sustainable development because of its capacity to support both environmental conservation and sustainable livelihoods. (Richardson, 2021)

In 2015 a historic agreement was reached between the world leaders at the United Nations on a universal 2030 agenda for sustainable development. All the governments promised to work on 17 sustainable development goals (SDGs) for the

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better future. Tourism can play a major role in achieving 17 SDGs and corresponding 169 SDG targets for sustainable solutions for people, the planet, prosperity, and peace. (*Tourism & Sustainable Development Goals – Tourism for SDGs*, n.d.)

This study focuses on the attainment of SDG 11 Make cities and human settlements inclusive, safe, resilient, and sustainable. while SDG 8 promotes sustained, inclusive, and sustainable economic growth, full and productive employment, and decent work for all.

In recent years, stakeholders' participation in sustainable tourism development has received more attention. They play an immense role in practicing sustainability in the industry. In building sustainable tourism and achieving its long-term goals, primary stakeholders like the Government have a huge responsibility to create and enforce policies and regulations and also collaborate with other stakeholders like local communities, tourism businesses, NGOs, and tourists. (Ilkhanizadeh, 2021). Diverse contributions of stakeholders, connectivity and coalition, multi-level governance system, and environmental sensitivity collectively improve the adaptive capacity and resilience of tourism despite various challenges and changes like natural disasters, terrorism, demographic shifts, and over-tourism. (Hartman, 2018)

Prevailing risks such as security and international relations significantly influence the tourism sector in Ethiopia. (Engda et.al, 2020). According to Addis Standard magazine, consistent conflicts and instability in the country discourage tourists, which leads to a significant drop in the number of arrivals by large in conflict-affected areas and leads to travel restrictions. This situation creates economic hardship and job losses for those dependent on the industry (Standard, 2023)

A year before the Tigray war in Ethiopia starte in 2019, tourism was one of the major contributors to the Ethiopian economy by representing 6.3% of the GDP after two years of bloody war in 2022 the total contribution of travel and tourism to GDP dropped to 5.6%. Since 2020 Ethiopia has experienced various serious wars in Tigray (2020-2022), Amhara and Oromiya conflicts(2020-present), and ongoing regional tensions with neighboring countries (*Global Conflict Tracker*, n.d.) are the major risk for domestic and international travel because of safety. Safety is very important for ensuring a positive experience for visitors. it greatly influences tourists' recreation satisfaction, place dependence, and destination loyalty. (Wang et al., 2019). This paper provides perspective on building the way forward to safe and resilient tourism.

This paper uses data from existing policy and research documents on tourism, and sustainability in Ethiopia. Literature, the objective of the study, methodology, findings, and recommendations are presented consecutively. Finally, conclusion and limitation.

2 Literature

Tourism is one of the major sources of economic growth, by increasing GDP and creating jobs, especially in developing countries. It generates revenue through international visitors' spending, which supports local businesses and economies. (Richardson, R. B.,2021). According to the World Tour and Travel Council, the sector contributed 9.1% to the global GDP, nearly reaching pre-pandemic levels. For 2024 it is projected to reach around 10%. In 2023, 330 million jobs are supported by this sector, and expected to support 348 million jobs in 2024. Simpson and World Travel and Tourism Council (2024) According to the WTTC economic impact report in Ethiopia in 2024, Total contributions to GDP were ETB 450 billion (5.5% of GDP) in 2023, including indirect induced impacts.in 2024 it is forecasted to rise to ETB524.7 billion (6.2% of GDP). In terms of total employment contribution, this sector accounts for 3.3% of total employment, generating 1,965,054 jobs (WTTC, 2024). As one of the ways to attain sustainable development goals (SDGs), The Federal democratic republic of Ethiopia developed a sustainable tourism master plan from 2015 to 2025 to establish a national framework for sustainable tourism development to contribute to socio-economic development and poverty alleviation. (*Ethiopia-sustainable-tourism-master-plan-2015-2025*2015)

Tourism safety encompasses tourists' perceptions of their safety and their confidence in managing uncertainties during their travels. Safety and security are very important for tourists, influencing their travel intentions and perceptions of destinations. ((Wang et al., 2019). Over the past two decades, safety and security reasons have gained significant attention due to natural disasters, epidemics, and social violence worldwide. dramatic decrease in tourism activities in different parts of the world; sexual assault and murder of tourists in Thailand, coup attempt in Turkey in 2016; COVID-19 outbreak; Russia's aggression towards Ukraine and other problems showed the notable spot of safety and security issues in Tourism industry (Toker & Emir, 2023). Therefore, safety in the tourism industry crucially influences future tourism sustainability short-term tourist arrival numbers, and residents' tourism revenue. (Zou & Meng, 2019)

The travel and tourism industry is vulnerable to a range of global factors, such as economic and energy price risk is one of the risks affecting travelers' spending power and travel patterns. (Menegaki et al,2023). Living cost increases greatly affect the tourism industry by altering both demand and price structures. as living expenses tourists frequently reevaluate their travel budgets, potentially leading to a decline in domestic tourism demand. This is especially true in developing countries, where travelers are more sensitive to price changes. (Garača et al., 2018).

Economies that depend heavily on tourism often see overall price increases, particularly in consumer services like hospitality and recreation. (Vizek & Tkalec, 2014).

Security risks, such as terrorism and corruption, have a profound effect on global tourism by dissuading travelers from visiting impacted locales. The research indicated that minimizing insecurity and uncertainty to their lowest possible thresholds could enhance the economic contribution of tourism by 14.3%, whereas elevating these risks to their highest levels could diminish it by 17.5%. This underscores the essential importance of safety in luring tourists and the significant economic advantages associated with maintaining secure travel conditions. ((Manrique-De-Lara-Peñate et al., 2022)

Social unrest, governmental instability, and incidents of terrorism profoundly affect the sector crucial for most economies. (Mawby, 2014). For the last forty years, the correlation between criminal offenses and tourism has attracted scholarly attention. A substantial body of literature substantiates the inverse correlation, as elevated crime rates can deter potential tourists and adversely affect the tourism sector. Conversely, it is also posited that a direct correlation may exist; tourism can contribute to an uptick in crime rates, as tourists are often perceived as easy targets due to their lack of familiarity with the locale and their propensity to carry valuable items. (Shchokin et al., 2023)

The tourism sector is more vulnerable to natural disasters. A threat or happening of an emergency in tourist attraction areas pushes them to consider other places to avoid such dangers. This can cause a decrease in revenues from tourism activities. Furthermore, the damage caused by natural disasters is much worse. (Genç, R,2018). There has been a marked escalation in the attention devoted to the implications of climate change, primarily due to its detrimental impacts on the environment and, subsequently, the tourism sector, thereby affecting tourist preferences and the choice of destinations. This escalating threat underscores the critical necessity for sustainable tourism practices to alleviate the industry's negative consequences of climate change. (Belias et al., 2022)

The COVID-19 pandemic imparted a profound lesson to the tourism sector. The circumstances necessitated the cessation of operations due to lockdown measures, travel restrictions, booking cancellations, and constrained logistical capabilities.. ((Foday & Drammeh, 2024). Travelers have meticulously sought information on health metrics and safety protocols at their destinations, significantly influencing their travel decisions. The discord between public health imperatives and the tourism sector's necessity to sustain travel was apparent, as the pursuit of information frequently led to a decline in travel demand.

Challenges of Ethiopian Tourism

As of 2024, Ethiopia housed the largest number of sites (12) in Africa declared as world heritage. Which makes the country lead in the continent. (UNESCO World Heritage Centre, n.d.)



Source:whc.unesco.org

The tourism sector in Ethiopia has significant potential due to its diverse natural, religious, historical, and cultural attractions. However, its development is hindered by several challenges, such as insufficient tourism infrastructure, a shortage of skilled workers, ineffective promotional efforts, and limited government involvement. (Engda, B. J. et.al, 2020). Amahara regional state of Ethiopia is rich in cultural, historical, archaeological, and eco-tourism resources, with well-known sites like the Simien Mountains National Park, Lalibela Rock-hewn Churches, and Gondar Castles. the negative perception of Ethiopia in international media, often associated with instability and famine, adversely affects tourism growth Besides the limited involvement of local communities and the need for improved service quality and diversified tourism activities are some of the major problems. (Abuhay et al,2019).

Poor infrastructure including inadequate roads, and communication networks hindered Promoting tourism in Ethiopia. Insufficient cooperation between stakeholders, lack of budget, and low awareness about the tourism potential in tourism attraction areas like Bale Zone are the major challenges. (Bayih et al,2017). “13 Months of Sunshine.” This evocative phrase has epitomized Ethiopia for the last half-century. In the year 2016, the Ethiopian Tourism Organization (ETO), now referred to as Tourism Ethiopia launched a new slogan – 'Land of Origins' – to restore the country's faltering tourism sector. Notwithstanding these efforts, the sector remains deficient in marketing endeavors, with most enterprises relying on social media as their principal instrument. Nevertheless, challenges related to accessibility, elevated media expenses, and seasonality present substantial obstacles to proficient marketing. ((Muluneh et al., 2023)

Resilient Tourism and SDG

Resilience typically refers to a system's ability to withstand disruptions and reorganize during changes, while maintaining its core functions, structure, identity, and feedback mechanisms. Tourism resilience denotes the capacity of tourism destinations to assimilate disruptions and reconfigure themselves during periods of transformation, thereby preserving their fundamental functions and organizational frameworks. This notion is vital for destinations to adjust to both abrupt shocks (such as natural calamities) and gradual transformations (like climate change). Cultivating resilience necessitates the enhancement of diversity, interconnectedness, and adaptive governance to proficiently manage and foresee changes.(Hartman,2018)

Tourism occupies a critical role in the formation of sustainable and adaptive communities by enhancing economic resilience, promoting environmental stewardship, preserving cultural heritage, and facilitating social inclusivity. It diversifies economic frameworks, creates employment prospects, and generates revenue, thereby equipping communities to withstand economic perturbations. Moreover, tourism advocates for the conservation and sustainable use of natural resources, consequently alleviating environmental degradation. It is also instrumental in protecting cultural heritage and

local traditions, thereby enriching community identity and pride. By involving local stakeholders in the tourism planning and development processes, tourism promotes social cohesion and inclusivity, ensuring equitable distribution of advantages while minimizing negative effects. Collectively, these strategies seek to foster resilient communities through the adoption of responsible tourism methodologies.(Khater & Faik, 2024)

Diverse sustainable methodologies can significantly contribute to the attainment of Sustainable Development Goals (SDGs), which are crucial for advancing resilient tourism. By promoting local economic advancement (SDG8), homestays facilitate community empowerment, thereby enhancing their capacity to withstand economic volatility. Furthermore, homestays can strengthen community solidarity and promote sustainable urban development (SDG11), rendering destinations more capable of adapting to transformations and challenges.(Bansal et al., 2024)

Sustainable Development Goal 11 is dedicated to fostering cities that are both inclusive and sustainable, with particular attention to the safeguarding of cultural heritage, which is essential for the promotion of resilient tourism. Sustainable tourism, as delineated in Sustainable Development Goal 8, aims to generate employment opportunities and advance local cultural practices, thereby ensuring that tourism yields a positive economic impact while concurrently preserving cultural heritage. The equilibrium between the economic utilization of cultural heritage for tourism purposes and its conservation represents a considerable challenge, thereby highlighting the necessity for resilient tourism methodologies that are in alignment with these Sustainable Development Goals. (Xiao et al., 2018)

3 Materials and Methods

The study aimed to identify the various risks currently affecting the tourism industry in Ethiopia and to propose strategies for fostering a safe and resilient economy that supports sustainable development.

The author employed document analysis to gather evidence and critically assess both the risks and potential solutions for promoting safe tourism development.

4 Discussion

Safe and resilient tourism

Achieving safe and resilient tourism through Sustainable development Goal SDG 8 promotes sustained, inclusive, and sustainable economic growth, full and productive employment, and decent work for all. in this goal different targets are included To attain sustainable economic progress, it is essential to aim for a minimum of 7% annual GDP growth in the least developed countries. Strategies should encompass enhancing productivity through diversification, technological advancements, and encouraging high-value, labor-intensive industries, while also advocating for policies that promote job creation and support entrepreneurship, particularly within micro, small, and medium enterprises. Furthermore, there must be a unified effort to enhance global resource efficiency, ensure fair employment practices, eliminate forced labor and child exploitation, and strengthen financial access, particularly in support of sustainable tourism and youth employment initiatives.

Sustainable development SDG 11 Make cities and human settlements inclusive, safe, resilient, and sustainable. It also has targets like ensuring access to adequate, safe, and affordable housing and basic services for all, and upgrading slums. It also emphasizes the need for safe, affordable, accessible, and sustainable transport systems, with a focus on public transport and the needs of vulnerable groups. Additionally, it aims to enhance inclusive and sustainable urbanization, protect cultural and natural heritage, and reduce disaster-related losses. Other goals include reducing the environmental impact of cities, providing universal access to green and public spaces, and supporting positive links between urban, peri-urban, and rural areas. By 2020, it seeks to increase the number of cities adopting integrated policies for resource efficiency, climate change mitigation, and disaster resilience.

Governance and Stakeholder Engagement

Inadequate community participation in tourist destination areas poorly engages sustainable tourism development, which hinders socio-economic benefits and environmental sustainability efforts (Datiko et al. 2023). Actively engaging local communities and stakeholders is crucial for sustainable tourism development. In Arbaminch, for example, local communities are currently not sufficiently involved(Wondirad et al. 2019).the Sustainable Tourism Master Plan for Ethiopia underscores the critical role of stakeholder engagement in formulating and executing tourism initiatives, involving diverse actors such as government representatives, private sector stakeholders, civil society, and local

communities.(ethiopia-sustainable-tourism-master-plan-2015-2025) most tourist destination local communities lack strong involvement.

Insufficient coordination and policy execution among stakeholders significantly obstructs the advancement of community-based tourism and the broader tourism industry, resulting in inefficiencies and lost growth opportunities. (Woldu, 2018). Political instability and violence, whether overt or subtle, adversely influence the nation's perception, discouraging prospective tourists and diminishing tourism revenue; thus, the maintenance of political stability is essential for the favorable advancement of the tourism sector. (Abuhay et al,2019). political instability in Ethiopia significantly undermines its tourism sector by reducing tourist arrivals and revenue, with data from 139 countries from 1999 to 2009 indicating that a one-unit rise in political instability correlates with declines of 24% to 31% in tourist arrivals and 30% to 36% in tourism revenue, while the impact of terrorism on tourism demand, although negative, is less severe than that of political instability(Yap & Saha, 2013)

Political instability generates safety concerns that damage the destination's image, making it less attractive to potential tourists. Reversing this negative perception can be challenging and expensive. Because of the high levels of insecurity across the country, political instability will continue to be severe in 2024. The main threats to stability and security include an unstable peace agreement in the Tigray area and ongoing insurgencies in the Amhara and Oromia regions (*Ethiopia Insights & Analysis*, 2024)

Local communities' involvement in tourism is hampered by institutional obstacles and political upheaval. The development of sustainable tourism is made more difficult by this absence from decision-making processes. Cultural and natural heritage assets' conservation and tourist potential are also impacted by political instability. For example, present political unrest has made it difficult to document and promote hypogea churches in South Gondar.

Crisis Management and Resilience

Crisis management entails steps necessary to overcome circumstances that endanger the survival of an organization, with an emphasis on short-term, urgent issues and prompt resolution. It entails planning, coordinating, and carrying out actions to stop or lessen a crisis's detrimental impacts. (Krekova et al,2017). Ethiopia's tourism industry has suffered greatly from inadequate crisis management, mostly as a result of the nation's continuous political unrest. Inadequate management techniques may result in fewer visitors, monetary losses, and a damaged reputation for the country. (Kebede,2018). Even though the national tourism master plan underline the importance of designing and developing a tourism safety and security strategy through developing a strategy for tourist safety, ensuring the national disaster and risk management plan take tourism into account and establishing a tourist police unit and establish tourism victim support service; currently there is no clear framework for tourism safety and security in the country(tourism master plan 2015-2025).

Inadequate Human Resources The tourist industry has a severe lack of qualified workers, which has an impact on crisis management skills and service quality. **Poor Marketing** Due to insufficient marketing and promotional efforts, the industry's worldwide exposure and appeal are restricted. (Petković et al., 2022) . The primary obstacles to crisis management in Ethiopia's tourist sector include the country's high vulnerability to different types of crises, the necessity of preventative actions, efficient supply chain and human resource management, and the significance of government assistance and communication.

Marketing and Promotion

Ethiopian tourism's growth and sustainability are hampered by a number of marketing and promotion issues. Important concerns include Effective advertising efforts are severely lacking. This includes not making enough use of contemporary marketing resources that are essential for reaching a worldwide audience, such websites, social media, and manuals. Marketing initiatives' reach and extent are significantly limited by financial restrictions. As a result, the nation's abundant natural and cultural treasures are not well promoted, and there is a severe lack of qualified experts in tourist marketing, which lowers the Caliber and efficacy of promotional tactics and Among stakeholders, including public and commercial organizations, the tourist industry suffers from a lack of focus and collaboration. This results in dispersed efforts and lost chances for unified marketing plans.(Bayih et al.,2017),Fakana et al,2018),Muluneh et al,2022). the marketing and promotion problems in Ethiopian tourism have significant economic, cultural, and environmental implications. Leveraging technology, such as smart tourism systems, can offer potential solutions to address these challenges and promote sustainable tourism development in the country.

5 Conclusion

A comprehensive strategy addressing sustainable economic growth, stakeholder participation, crisis management, and strong marketing tactics in line with Sustainable Development Goals (SDGs) 8 and 11 is required to achieve safe and resilient tourism in Ethiopia. Prioritizing inclusive economic policies is essential to promoting entrepreneurship, job creation, and increased productivity in the tourist industry, especially in micro, small, and medium-sized businesses. However, this vision is heavily dependent on local communities' active participation in tourist planning and implementation, which has historically been constrained by systemic institutional impediments, political instability, and inadequate stakeholder coordination. In addition to impeding the growth of tourism, this political unrest damages Ethiopia's reputation as a safe travel destination, turning off prospective visitors and lowering tourism-related income. Building a resilient tourist industry that supports local lives and natural assets despite political or economic setbacks requires addressing these governance gaps via stakeholder partnerships and community participation.

Furthermore, strengthening Ethiopia's tourist industry and protecting it from future crises depend heavily on improved marketing techniques and efficient crisis management. Ethiopia's current marketing initiatives are hampered by a lack of funding and a poor use of digital platforms, which limits the country's visibility abroad and costs it chances to promote its rich natural and cultural assets. Ethiopia's attraction to visitors worldwide would be increased by using cutting-edge marketing strategies, such as smart tourism systems, and creating a specific crisis management framework that includes visitor support services and enhanced security measures. Ethiopia may be further positioned as a competitive and alluring travel destination by cultivating qualified human resources and creating strong marketing efforts.

Recommendation

- **Augment Community Engagement and Stakeholder Cooperation:** To foster sustainable and resilient tourism, Ethiopia ought to emphasize systematic interaction with local populations and a variety of stakeholders, including governmental agencies, private sector entities, and non-governmental organizations. The establishment of participatory mechanisms, such as community advisory committees and regional collaborations, would empower local communities in the decision-making processes, thereby enhancing the effectiveness of tourism policy implementation and amplifying socio-economic advantages.
- **Enhance Policy Coordination and Political Stability:** Mitigating political volatility and advancing collaboration among stakeholders are essential for creating an environment favorable for tourism. This necessitates governmental efforts to adopt stable governance structures, bolster inter-agency cooperation, and advocate for transparency to reduce disruptions in the tourism sector. Additionally, establishing frameworks to improve the resilience of tourism destinations in politically sensitive regions will contribute to sustaining Ethiopia's reputation as a secure travel locale.
- **Formulate a Holistic Crisis Management Framework:** Establishing a well-defined crisis management strategy is imperative for the effective anticipation and response to crises that may adversely affect the tourism sector. This framework should encompass the establishment of a specialized tourism safety division, the incorporation of tourism-specific protocols within the overarching national disaster response structure, and the provision of support services for tourists to guarantee safety and prompt response during emergencies. Furthermore, enhancing crisis management capabilities among tourism enterprises and local communities is essential to mitigate economic repercussions during periods of instability.
- **Engage in Digital Marketing and International Promotion:** The tourism industry in Ethiopia stands to gain significantly from the adoption of contemporary digital marketing methodologies aimed at enhancing its global presence. Utilizing social media platforms, websites, and advanced tourism technologies, in conjunction with traditional marketing channels, can substantially elevate the visibility of Ethiopia's cultural and natural heritage. Allocating resources towards the development of digital competencies among tourism practitioners will ensure that marketing initiatives are not only innovative and professional but also capable of reaching a broader and more engaged audience.

Limitation and Scope Of Future Research

A notable constraint of this investigation is the lack of direct, face-to-face surveys at Ethiopian tourism destinations, potentially diminishing the contextual richness of the results. Subsequent studies could enhance this aspect by implementing field surveys involving both tourists and local inhabitants, thereby yielding firsthand insights into visitor

experiences and indigenous viewpoints, which would serve to deepen the comprehension of the dynamics underpinning tourism in Ethiopia.

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Subliminal Audio Stimulation: A Theoretical Overview of Effects and Mechanisms Influencing Perception

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Abstract: Subliminal audio stimulation: A theoretical overview of effects and mechanisms influencing perception. Subliminal audio stimulation, which uses sounds at a level of consciousness unobserved, has the potential to influence perception, behavior and emotional response in individuals. This article offers a theoretical summary of the mechanisms, effects, and applications of subliminal audio stimuli. The review covers the historical development, basic principles, and neuropsychological mechanisms through which these stimuli can influence brain activity and decision-making. The article also examines various experimental studies and applications of subliminal stimulation in areas such as marketing, therapy, and cognitive performance, focusing on the ethical aspects and possible implications of this technique. The results of these investigations may contribute to a better understanding of the abilities of sound stimuli to improve human perception and decision-making processes.

Objective: The aim of the article is to examine the theoretical mechanisms and applications of subliminal sound stimuli in various fields, with an emphasis on their influence on behavior, emotional reactions and decision-making.

Methods: This review is based on an analysis of current research and experimental studies investigating subliminal sound cues in a variety of contexts, including marketing and psychology.

Results: Research suggests that subliminal sounds can improve attention, emotional response, and decision-making, and may have significant applications in marketing and therapy. However, the ethical and moral issues surrounding their use require further attention.

Keywords: Subliminal audio stimulation, subliminal stimuli, cognition, perception, decision making

JEL Classification: M31, I18, D12, C91

1 Introduction

Subliminality is a complex and often debated phenomenon that refers to the perception of stimuli without conscious awareness, which can still influence a person's psychology and behavior. Research on subliminal stimuli is grounded in the basic premises of psychology and neuroscience, exploring mechanisms that enable unconscious perception. These stimuli, whether visual or auditory, lie below the threshold of conscious perception, meaning they are not intense enough to be registered by conscious awareness, yet they can initiate specific brain responses that affect our decision-making, emotions, and even memories (Karremans, Stroebe, & Claus, 2006).

In the field of sound stimulation, the subliminal is of particular interest because the human sensory system can process sound stimuli even at an unconscious level. This approach finds application not only in psychology, but also in marketing and therapeutic practice.

Elgendi et al. (2018) argue that subliminal sound stimulation can lead to significant changes in consumer behavior, using specially designed sound cues to influence mood, increase attention, or create an emotional bond with a product.

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These techniques are based on the knowledge of psychology and neuroscience and offer more sophisticated and effective ways of communicating with customers than traditional methods.

Subliminal stimuli are also used in therapy to promote relaxation, reduce stress or solve problems related to anxiety and depression. (Karremans, Stroebe, & Claus, 2006) suggest that specific sound frequencies can stimulate brain activity and create favorable conditions for psychological well-being and mental health. These applications of sound stimulation often focus on long-term benefits, such as improving sleep quality, promoting creativity, or increasing cognitive performance in areas such as concentration and memory.

In recent decades, interest in subliminal stimuli has grown significantly, mainly due to technological advances allowing more precise measurement and analysis of their effects on brain activity. Kihlstrom, J.F. (2004) focuses on investigating the interaction of subliminal stimuli with brain structures and their influence on conscious behavior. This research provides new insights into how unconscious processes influence everyday decision-making and responses in a variety of contexts—from shopping behavior to emotional regulation and therapeutic interventions.

Despite growing interest and positive findings, subliminal stimuli also raise many ethical and moral questions. While some experts, such as Elgendi et al. (2018), see these techniques as valuable tools for improving mental well-being and enhancing the effectiveness of marketing strategies, others caution against the risks associated with influencing thoughts and behaviors without an individual's awareness. The misuse of subliminal stimuli can compromise individuals' autonomy and personal integrity, raising questions about responsibility and regulation in their use.

This article, therefore, seeks to provide a comprehensive overview of experimental studies and practical applications of subliminal stimuli, focusing on their potential uses in marketing, therapy, and cognitive performance enhancement. It also closely examines the ethical and moral aspects that are integral to this issue and analyzes the possible implications of subliminal stimuli for individuals and society. Thus, the question of using subliminal stimuli becomes not only a technological challenge but also a matter of ethical principles that should guide their application in the modern world.

2 Methods

This theoretical article relies on the methods of literature review and systematic examination of available research focusing on subliminal auditory stimuli and their use in cognitive and relaxation techniques. The literature collection process began with identifying key studies that explore the mechanisms, effects, and applications of these stimuli. Reputable academic databases, such as PubMed, PsycINFO, and Google Scholar, were utilized, with keywords including "subliminal messaging," "auditory stimulation," "cognitive performance," "relaxation techniques," and "binaural beats." This approach enabled the collection of relevant studies reflecting the latest knowledge in the field.

The literature was carefully reviewed based on criteria such as the quality of theoretical works, methodological accuracy, and contributions to the understanding of subliminal stimuli. Studies directly related to topics like the impact of sound stimuli on brain function and emotional responses were subjected to detailed analysis. The review focused on various types of audio stimulation, such as binaural beats, isochronic tones, and subliminal audio messages, considering differences in their mechanisms of action.

Furthermore, the topic of the effectiveness of subliminal stimuli is frequently discussed in the context of cognitive tests, subjective questionnaires, and biological measurements, such as heart rate and heart rate variability. This comprehensive approach provides insight into how subliminal stimuli may influence different aspects of cognitive performance and relaxation in various contexts.

The ethical aspects of this topic were also a focus of the review, emphasizing theoretical works that discuss issues related to manipulation, informed consent, and the responsible use of audio stimulation in therapeutic and commercial applications.

3 Research results

Subliminal sound stimulation focuses on the influence of sound stimuli that are too weak or have such a frequency that they are not consciously perceived by the listener. Although these sounds do not evoke direct conscious perception, they can influence cognitive and emotional processes. Subliminal stimulation is used in a variety of fields, including psychology, marketing, and therapeutic techniques. This review focuses on the theoretical mechanisms and effects of subliminal sound stimuli that influence the perception and behavior of individuals.

Mechanisms of effect of subliminal sound stimuli

• Limbic system and emotional reactions

Modern studies show that subliminal stimuli affect the limbic system, which is involved in the processing of emotions such as fear, stress or well-being. Research by Williams et al. (2006) shows that these stimuli can trigger emotional responses that influence behavior without conscious awareness.

Another author whose study we examined as it related to the limbic system and emotional responses was Nierhaus et al. (2015). His research focuses on the identification and manipulation of perceptual thresholds, which has direct implications for the way subthreshold stimuli are processed at the behavioral and neural levels.

Driver & Noesselt (2007) explore how different sensory modalities (eg sight, hearing, touch) interact and influence each other. In doing so, they question the traditional view that the processing of sensory information takes place in isolation in brain areas specific to individual modalities.

The differences between the studies are in the type of stimuli examined. Williams et al (2006) examines emotional stimuli, particularly fearful faces, and their effect on the limbic system (amygdala), while Nierhaus et al. (2015) on somatosensory stimuli and perceptual thresholds. Driver & Noesselt (2007) focus on multisensory integration, where different sensory modalities (sight, hearing, touch) interact with each other.

The authors agree that subliminal stimuli can influence behavior, even without the subject's conscious awareness. Overall, the works complement each other by examining subliminal stimuli and their impact on brain processing and behavior.

• Impact on cognitive decision-making

More recent research suggests that subliminal stimuli can influence cognitive decision-making, especially in quick intuitive decisions. The following authors contributed significantly to the understanding of the influence of subliminal stimuli on cognitive decision-making:

Bargh & Morsella (2008) examined how unconscious behavioral influences, including associations between subconscious cues and everyday decisions, influence behavior. Their research highlights the automaticity of behavior that can be controlled by subconscious processes.

Research by Bault & Rusconi (2020) analyzed the connection between neuroscience and consumer decisions. The authors investigated how neural processes influence individual choices, especially in the context of marketing strategies, using neuroimaging methods to investigate these processes.

Sofi, Mir & Baba. (2020) investigated the interaction between cognitive and affective factors. Their research provides deeper insight into how emotional and psychological factors influence consumer decision making.

The differences in the mentioned works are that Bargh & Morsella (2008) focused on how subliminal stimuli influence behavior through unconscious associations, without conscious control. Bault & Rusconi (2020) focused on the connection between neural processes and consumer decisions, with an emphasis on marketing strategies and their influence on decision-making. And Sofi, Mir & Baba (2020) in turn investigated how emotional and cognitive factors interact and shape consumer decision making.

The studies of the mentioned authors have in common that they examine the processes affecting the decision-making of individuals, in different contexts: in everyday life (Bargh & Morsella), in the consumer context (Bault & Rusconi) or at the psychological level (Sofi, Mir & Baba) and focus on the factors influencing the choices. This means that studies

combine different dimensions of decision-making – from unconscious cues and emotions to cognitive and affective factors.

All studies focus on factors that influence choices and together provide different perspectives on decision-making processes.

Ethical and moral issues of subliminal sound stimuli

The Audiovisual Media Services Directive (AVMSD) prohibits the use of subliminal techniques in audiovisual commercial communications.

In addition, Regulation (EU) 2024/1689, known as the Artificial Intelligence Act (AI Act), contains provisions aimed at regulating artificial intelligence systems that use subliminal techniques.

The regulation states that AI systems that use subliminal components, such as audio, visual or video stimuli that cannot be perceived by persons, or other manipulative or deceptive techniques that interfere with or weaken the autonomy, decision-making or free choice of persons in a way that persons not aware should be banned.

This legislation reflects the EU's commitment to protect citizens from unethical practices linked to subliminal incentives and to ensure that technologies, including artificial intelligence, are developed and used in a way that respects human autonomy and decision-making.

Analysis from the point of view of theoretical research:

Interdisciplinary methods such as neuroimaging (EEG, fMRI), behavioral experiments and cognitive analysis are used in the theoretical investigation of subliminal sound stimuli. These methods make it possible to investigate the processing mechanisms of subliminal stimuli and their influence on the limbic system and decision-making.

Our theoretical stance integrates knowledge from neuroscience, psychology, and law, while emphasizing the ethical issues associated with manipulating subliminal techniques. This approach enables a comprehensive understanding of the influence of these stimuli on behavior and autonomous decision-making.

4 Conclusion

Critical summary and theoretical approaches

Research on subliminal sound stimuli in recent years reveals diverse theories and approaches that suggest that their use in marketing and therapy can significantly influence individual behavior. However, the most discussed aspect is the ethical side of using these techniques, especially in commercial applications where they can influence decision-making without conscious consent.

The following table provides an overview of the authors who investigated the individual mechanisms of the effect of subliminal sound stimuli.

Table 1. Overview of mechanisms of the effect of subliminal sound stimuli:

Mechanism	Description	Key studies
Mechanisms of effect of subliminal sound stimuli		
Emotional re-actions	Subliminal stimuli affect the limbic system, which controls emotional reactions and behavior.	Williams et al. 2006; Nierhaus et al. (2015); Driver & Noesselt (2007)
Influence on cognitive decision making	They influence consumers' intuitive decision-making and preferences without their awareness.	Bargh & Morsella (2008); Bault & Rusconi (2020); Sofi, Mir & Baba. (2020)

Source: Own creation, 2024

Theoretical investigations of subliminal sound stimuli demonstrate their ability to influence emotional responses and cognitive decision-making without conscious awareness. Interdisciplinary approaches that include neuroscientific, psychological, and ethical perspectives provide a deeper understanding of their mechanisms and impacts.

Regulations such as the AVMSD Directive (2018) and the AI Act (2024) emphasize the importance of protecting individual autonomy from manipulative practices. These legislative frameworks reflect a commitment to ensure the ethical use of technology, emphasizing the need for transparency and informed consent. Current knowledge also suggests that further research is needed to better understand the long-term effects and to establish clear ethical boundaries for their practical use.

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Session:
Strategic Management and Sustainability

A Systematic Literature Review on Cooperative Strategy and Sustainability

Mariami Denosashvili¹

Abstract: Achieving Sustainable Development Goals (SDGs) covering complex economic, social, and environmental issues requires an active partnership between multi-stakeholders. When cooperating, stakeholders can share knowledge, expertise, technologies, and financial resources to approach sustainable development effectively. This paper aims to contribute to a comprehensive understanding of the role of cooperative strategy in sustainable development. Methodologically, this research develops a systematic literature review based on existing papers published in the last five years and available in the Scopus and Web of Science academic databases. As a result, 21 publications were selected and analyzed to identify patterns and gaps in understanding the cooperative strategy in the context of sustainability and propose directions for future research. Overall, this research provides valuable insights for practitioners and academics interested in cooperative strategies and sustainable development.

Keywords: Cooperative strategy, strategic alliances, joint ventures, sustainability, sustainability development, SDGs, SLR.

JEL Classification: M10, O19, O32, Q56,

1 Introduction

Sustainability has been a mainstream issue, receiving increasing attention from academics and practitioners over the last three decades (Do et al., 2019; Hübel et al., 2022). Achieving sustainability is closely connected with sustainable development, which ensures meeting current needs without compromising future needs (Pinho Santos & Proença, 2022).

The concept of sustainable development was mentioned for the first time in the report of the Brundtland Commission during the Rio Earth Summit in 1992 (Do et al., 2019). However, it became one of the most discussed topics when the United Nations (UN) adopted the 17 Sustainable Development Goals (SDGs) in 2015 as part of the 2030 Agenda for Sustainable Development. By adopting SDGs, the UN tried to highlight complex challenges that called for prompt action and encouraged countries to combine forces to address these interconnected issues.

The SDGs with 169 targets cover the three main areas (dimensions, pillars, components) of sustainability, particularly the economic, social and environmental, also known as the triple bottom line of sustainability (Do et al., 2019; Dzhengiz, 2020; Horan, 2022; Miranda et al., 2023; La Bella et al., 2022; Lopes Cancela et al., 2023; Pereira et al., 2023; Pinho Santos & Proença, 2022). Since all the goals, targets, and indicators are interconnected, achieving the Agenda 2030 and SDGs requires nations, organizations, individuals, and other stakeholders to cooperate, leveraging expertise, knowledge, technologies, and financial resources (Bulmer & del Prado-Higuera, 2021; Dzhengiz, 2020; Horan, 2022; La Bella et al., 2022; Pereira et al., 2023; Pinho Santos & Proença, 2022). This notion is reflected in the last goal (SDG 17), which intends to motivate and promote effective global multi-stakeholder partnerships (public, public-private, and civil society). According to some authors, the execution and successful implementation of SDG17 are necessary for achieving the other SDGs (Bulmer & del Prado-Higuera, 2021; Dzhengiz, 2020).

The private sector's effort is crucial in reaching sustainable development goals, especially SDG 17 (Dzhengiz, 2020; Muñoz de Prat et al., 2020; La Bella et al., 2022). However, some academics believe that SDGs pose significant challenges for the business sector (Dzhengiz, 2020). Consequently, strategic alliances, joint ventures, partnerships, networks, or other cooperative strategies make it easier for companies to take their share of responsibility in resolving challenges that might be too complex to be addressed alone, e.g., climate change (Dzhengiz, 2020; Miranda et al., 2023; Muñoz de Prat et al., 2020; Pinho Santos & Proença, 2022), develop sustainability-oriented innovation (SOI), i.e., create new business interactions, models, processes, products, and services meeting the criteria of sustainability (Dzhengiz, 2020; Miranda et al., 2023; Pereira et al., 2023), embrace new value frames, develop environmental capabilities and sustainability strategies incorporating SDGs into their core activities (Dzhengiz, 2020).

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This paper aims to contribute to a comprehensive understanding of the role of cooperative strategy in sustainable development by answering the following research questions:

- Q1. Which methodologies are most frequently employed in cooperative strategy and sustainability studies?
- Q2. How do joint ventures contribute to achieving sustainability and sustainability goals?
- Q3. How do strategic alliances contribute to achieving sustainability and sustainability goals?
- Q4. How do cooperative strategies contribute to achieving sustainability in different industries?
- Q5. What are the promising future research directions?

Methodologically, this research develops a systematic literature review based on existing papers published in the last five years and available in the Scopus and Web of Science academic databases. The review follows the PRISMA reporting guidelines to increase transparency.

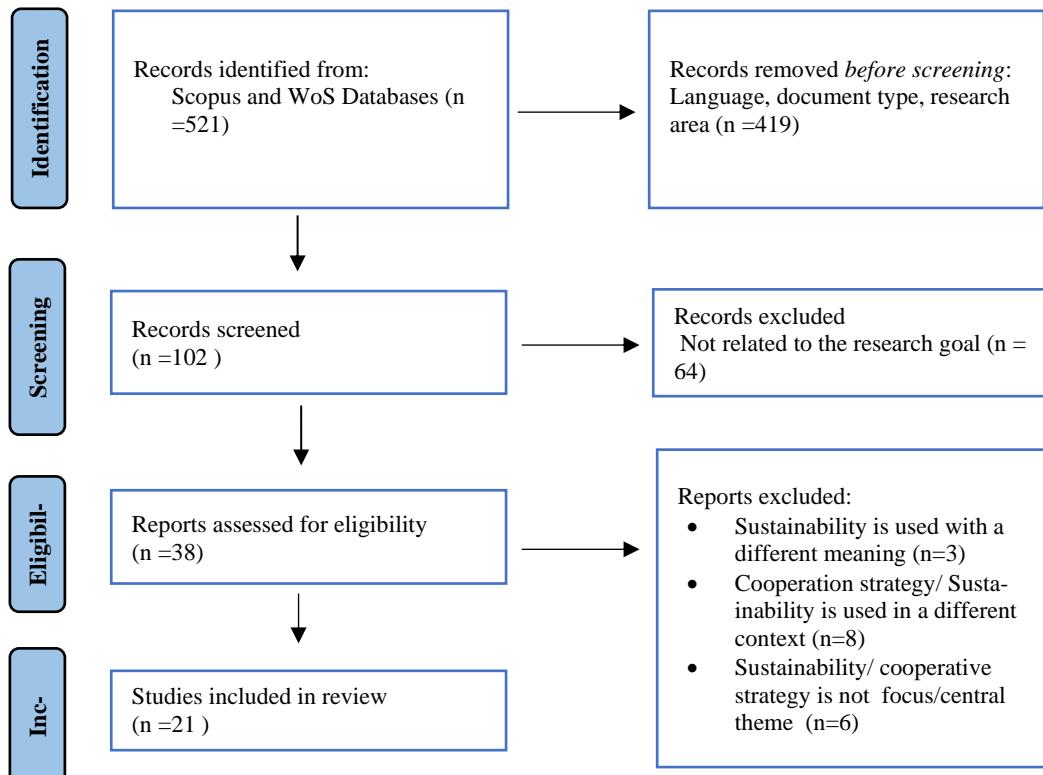
The article contributes to the theoretical literature on cooperative strategy and sustainability. It highlights the importance of cooperative strategies, especially strategic alliances and joint ventures, for effective sustainable development. Furthermore, based on the SLR, the author suggests future research directions for academics interested in the abovementioned topics.

The paper is organized as follows. After the introduction section, the author represents the methods and results of the research. Finally, the paper ends with a discussion and conclusion.

2 Methods

A systematic literature review (SLR) was conducted to reach the research objective and provide a comprehensive understanding of the role of cooperative strategy in sustainable development. Generally, SLRs help scholars identify, assess, and synthesize already published data in a systematic way based on a pre-defined process, develop new conceptualizations, and suggest future research directions (Dzhengiz, 2020; Miranda et al., 2023; Pereira et al., 2023). The review followed the PRISMA framework (Figure 1).

Figure 1 Systematic literature reviewn PRISMA flow diagram.



Source: Own processing

The Scopus and Web of Science (WoS) — Core Collection databases were chosen to identify and gather the publications for the systematic review. The WoS was a primary source since it offers access to vast publications and is considered the most rigorous and comprehensive research publication database (Dzhengiz, 2020; Miranda et al., 2023; Pereira et al., 2023). The publication date range was the last five years (2019–2024). The search process took place in September 2024. The keywords were selected based on the research objective: For sustainability, the keywords were sustainability and sustainable development, whereas, for the cooperative strategy, they were cooperative strategy, strategic alliance, and joint venture since they present the most popular cooperative strategies.

Due to the high number of documents, search results were refined to receive more precise outcomes. The search was limited to articles, review articles, and proceedings in the English language in the areas of Business and Management. The titles, abstracts, and keywords were analyzed to determine whether the papers were related to the research goal, i.e., if they were focused on cooperation strategies (strategic alliances, joint ventures, etc.) in the context of sustainability (sustainable development). After that, all full-text articles were assessed for eligibility. Finally, 21 scientific articles were included in the systematic review.

3 Research results

3.1 Most frequently employed methodologies

8 Out of 21 articles (Table 1.) followed the case study to offer in-depth, contextual insights and explore successful sustainability practices from different industries and countries. However, these studies lack generalization as they focus on specific cases and depend on the interpretation and subjective judgment of the researcher. Six scientific articles were literature reviews on strategic alliances, joint ventures, and sustainability. Although a literature review provides a comprehensive synthesis of existing knowledge about specific topics and helps to identify research gaps and future research directions, it does not provide new empirical insights. It is highly dependent on the quality and scope of the reviewed articles. Four articles employed quantitative research using questionnaire surveys to investigate the relationship between measurable variables and receive more generalized results. However, the nature of the study and sample size are often limitations, as a larger sample size is needed to better validate, generalize, and interpret results and avoid biases. Exploratory methods (interviews), game models, and secondary data (documents) analysis got the least attention from researchers. Although interviews are a good strategy to gather useful insights and opinions about specific topics, they tend to be subjective, difficult to generalize, and require further investigation. As for secondary data analysis, it is cost-effective and efficient to analyze existing documents about R&D and finances instead of conducting primary research, however, the accessibility and availability of necessary information may be limited. Finally, although game models allow researchers to compare different models and test multiple hypothetical outcomes, this method may lack real-world applicability and empirical validation.

Table 1 Frequently employed methods in cooperative strategies and sustainability studies

Research method	Articles	References
Case Study	8	Durugbo & Amankwah-Amoah, 2019; Hübel et al. 2022; La Bella et al., 2022; Lechler et al., 2019; Mousavi & Bossink, 2020; Pereira et al., 2022; Riosvelasco-Monroy et al., 2022; Strand, 2024;
Literature review	6	Dzhengiz, 2020; Dzhengiz, 2020 b; Miranda et al., 2023; Muñoz de Prat et al., 2020; Pereira et al., 2023; Tetteh et al., 2019
Quantitative	4	Krechowicz, 2022; Lopes Cancela et al., 2023; Tetteh et al., 2021; Tumelero et al., 2019
Exploratory	1	Pinho Santos & Proença, 2022
Game models	1	Liu et al., 2024
Secondary data analysis	1	Harada et al., 2021

Source: Own processing

3.2 Joint ventures for sustainability

Generally, companies collaborate with external actors in sustainability processes to obtain, test and transform new ideas and technologies, diversify operations, ensure that the product/service satisfies customers' needs, reach potential customers in new markets, gain reputation/status/recognition and improve corporate image, legitimise corporate

responsibility, connect with other actors or jointly develop resources and capabilities (Dzhengiz, 2020; Miranda et al., 2023; Pereira et al., 2022).

Companies, communities, and governments see joint ventures as a vehicle to solve different problems and tackle a complex reality. The first article studying the relationships between joint ventures and sustainability appeared in 1997. Since then, joint ventures dealing with sustainability issues have been popular among academics from developing and developed countries, especially the US, Australia, UK, and Canada. Research interests seem to depend on the nature of JVs: private-public joint ventures focus on sustainable development, while private-private JVs focus on management sustainability. The most studied activity sectors are construction, mining, natural resources, chemical/biotechnology, Energy/Electric, management, and telecommunication (Muñoz de Prat et al., 2020).

Joint ventures in the construction sector are also known as construction joint ventures. Companies have engaged in international construction joint ventures (ICJVs) to survive and effectively approach sustainable development (Tetteh et al., 2019; Tetteh et al., 2021). ICJVs are a good strategy for gaining sustainable advantage/power and contributing to sustainable development by increasing corporate firms' operational efficiencies through combining complementary resources (operational capabilities, social organizing capacity, capital, etc.) to deliver mega-projects with high stakes and significant social, economic, and environmental impacts (key indicators of sustainability). There are different reasons why developed and developing countries adopt ICJVs: developed countries/jurisdictions adopt ICJVs primarily to adhere to governmental/domestic policies and hedge potential uncertainties/challenges, whereas developing countries/jurisdictions engage in ICJVs for operational competencies (Tetteh et al., 2021).

Generally, businesses cooperate and establish joint ventures to receive benefits, i.e., gain competitive advantage, transfer knowledge and experiences, share available resources and technology, new product innovation, value creation, increase sustainability, etc. (Krechowicz, 2022; Riosvelasco-Monroy et al., 2022). However, it is vital to identify and assess relationship-specific risks and risk determinants that endanger receiving these benefits, i.e., unfavorable and inexplicit contracts, orientation on self-interests, hiding internal problems and problems related to the joint venture, etc. (Krechowicz, 2022).

3.3 Strategic alliances for sustainability

Companies usually form two types of alliances: inter-firm alliances with their suppliers, customers, and other firms, including their rivals, and cross-sector partnerships with organizations from the public, private, and third sectors, like governments, NGOs, and research institutions. However, they can also develop and manage extensive alliance portfolios to create product, process, or organizational innovations addressing complex sustainability challenges, e.g., environmental and social sustainability issues (Dzhengiz, 2020 b).

Strategic alliances between established companies and startups

Increasing sustainability regulations and stakeholder pressures force established firms to assess their strategies and practices regarding sustainability requirements and develop and adopt sustainability innovations. However, unlike startups, which often introduce sustainability innovations, they face difficulties. Consequently, established companies create strategic alliances with sustainability startups to overcome these struggles, survive competition, gain competitive advantage, and contribute to the shift of markets and industries towards sustainable development. Apart from indirectly and directly improving the contribution to the sustainable mass market shift, companies in alliances with startups engage in product-related (i.e., development, marketing) and sustainability-related learning (i.e., perspectives, goals) (Hübel et al. 2022).

Strategic alliances are an essential requirement for sustainable activities (sustainable innovation) in the pharmaceutical industry. Biotech startup firms frequently partner with existing (conventional) pharmaceutical companies since the generation of innovative drugs is associated with significant Research & Development (R&D) expenses, long-term operations, and low probability of success. Furthermore, these alliances play a significant role in startup development, i.e., funding opportunities, knowledge and skills acquisition, positive influence on the stock market, and improving corporate reputation. However, existing companies, especially in Japan, tend to hesitate to enter alliances because of the business profitability (i.e., low-profit margins, lack of differentiation from competing products, etc.), strategic suitability (i.e., outside their core therapeutic areas, etc.), and organizational capacity issues (i.e., intellectual property management issues, etc.) (Harada et al., 2021).

Strategic alliances between companies and universities

One of the reasons why companies partner with universities is to access the research and development (R&D) necessary for process development and product innovation. Generally, these strategic alliances benefit both parties, i.e., expanding network, development of common growth (skills and capabilities), value creation, improving position in specific areas, knowledge transfer, achieving sustainability, etc. (Pinho Santos & Proença, 2022). Furthermore, cooperation between companies and higher education institutions plays a significant role in developing their region and surrounding community and leads to impactful social and environmental change (Pereira et al., 2023).

Strategic alliances between companies and NGOs

The most frequent and important partners in collaborations/alliances focused on social and environmental goals are private non-profit and nongovernmental organizations (NGOs) (Miranda et al., 2023; Mousavi & Bossink, 2020).

Cross-sectoral collaborations/alliances between corporations and NGOs have become common practice to address complex environmental issues that are difficult to handle alone, realize environmentally sustainable innovation (ESI), and achieve sustainability. Each party has a different motive for entering alliances: NGOs often pursue economic capital, while corporations pursue social capital and see NGOs as an external source of specialized skills, knowledge, resources, and competencies that are costly, inefficient, and time-consuming to develop internally, e.g., market knowledge, local expertise, legitimacy among different stakeholders, systems for sourcing and distribution. One of the examples of a successful corporation-NGO collaboration for ESI is the long-standing partnership between KLM (corporation, airline) and WNF (NGO, part of WWF) established to fight against climate change and reduce CO2 emissions by developing and promoting a market for sustainable aviation biofuels (Mousavi & Bossink, 2020).

Strategic alliances for sustainable supply chain management (SCM)

Engaging and leveraging sustainability has been suggested as an efficient solution to many challenges global supply chains have faced in recent years. Strategic alliances can contribute to building more sustainable, integrated supply chains, business models and processes (La Bella et al., 2022; Pinho Santos & Proença, 2022). Sustainable supply chains improve firms' competitiveness and financial performance and form capital for mitigating business risk consequences. For example, Vendor Flex is an efficient inter-firm strategic alliance between Amazon and its supplier (vendor) to streamline processes and increase supply chain efficiency while enabling many of the sustainability requirements, development goals, and targets to be met. By intensively using technology and exchanging knowledge and assets between partners, the processes are faster, the interaction chain is avoided, and CO2 per year is significantly reduced (La Bella et al., 2022).

Sustainability issues in the supply chain are difficult to avoid, especially in for the second, third, and more upstream suppliers (La Bella et al., 2022; Lechler et al., 2019). Since these sustainability violations can damage focal firms' reputations, it is important to manage suppliers regarding sustainability and improve their compliance with the focal companies' corporate sustainability standards (CSS). Firms from the same industry are forming assessment sharing strategic alliances (ASSAs) to better manage the increasing number of suppliers with respect to growing stakeholders' sustainability expectations, improve suppliers' sustainability capabilities and compliance with CSS, and exchange best practices, sustainability-related knowledge and sustainability evaluation reports of common suppliers (Lechler et al., 2019).

Cooperation in R&D

Companies often form strategic alliances known as cooperation in R & D to complement technological-scientific capabilities and share costs and risks associated with common innovation goals. Technology partners may cooperate in R & D for several main reasons, such as transaction costs related to the creation and transfer of technical knowledge, industrial organization connected to the potential market failure of created scientific/technological knowledge, and strategic management connected to analyzing competitive forces, complementarity of dynamic capabilities, strategic networks, future technological development. Furthermore, another reason can be introducing and managing complex environmental innovations and adapting practices like organizational changes, changes in the product portfolio, and production processes aimed to reduce the "environmental footprint" and influence companies' socioeconomic performance (Tumelero et al., 2019).

Sustainability-oriented innovation, green strategic alliances and coopetition

Sustainability-oriented innovation (SOI) is an umbrella term frequently replacing sustainability/sustainable innovation or sustainability-driven/related innovation. SOI includes developing new/improved products and creating new processes that bring advantages to the environment and society. Since this type of innovation is characterized by a higher degree of complexity, uncertainty, and unpredictable financial returns for companies, the innovation process is more challenging. Usually, developing new and viable sustainable solutions requires the involvement of external partners (Miranda et al., 2023).

The demand for sustainability has driven firms to establish environmental (green) strategic alliances leveraging and exploring environmental technologies to take advantage of new market and business opportunities, improve environmental performance and reputation, and positively impact and promote environmental and social sustainability. Green Strategic Alliances (GSAs) representing green culture help companies in achieving green development and management and focus on protecting the environment, reducing emissions, conserving energy, developing a low-carbon economy, innovatively responding to emerging green societal needs, e.g., introducing new and improved products and services (Lopes Cancela et al., 2023).

Recently, rival firms have begun creating technological cooperations (coopetitions) to reduce investment costs connected to green innovation R&D, mitigate risks and avoid uncertainties, produce more eco-friendly products to meet the market demand, and achieve a „win-win-win“ situation regarding profit, environment, and social welfare (Miranda et al., 2023; Liu et al., 2024). Frequent cooperative agreements are cost-sharing contracts, e.g., innovation collaboration between Intel and Micron for sharing R&D expenses concerning memory technology, and technology licensing contracts, e.g., JAC New Energy licensing its cutting-edge new energy technology products to Volkswagen Germany. In technology licensing agreements, strong-weak combinations between leading and emerging enterprises are likely to receive win-win profits, increase consumer environmental awareness, and reach higher levels of product sustainability, facilitating low-carbon transformation (Liu et al., 2024).

3.4 Practical examples from different industries

As mentioned above, establishing strategic alliances is a beneficial strategy for a diverse group of actors from different sectors, industries, and social systems. Pereira et al. (2022) discussed the significance of strategic alliances for the sport tourism industry and environmental sustainability in the example of Portuguese nautical stations. According to them, managers of nautical stations should use these alliances to improve competitiveness, promote regional development and market destinations, achieve sustainability, increase governance, and improve experience with clients using cooperative marketing. Furthermore, Durugbo & Amankwah-Amoah (2019) discussed sustainability partnerships in the Oil and gas industry in the example of Shell. Through a case study, they found that Shell cooperates with stakeholders, including scientific and conservation organizations, academic institutions, and NGOs like the International Union for Conservation of Nature (IUCN), to set standards and run programs for sustainable development. The company mostly operates its business through joint ventures that have to comply with Shell's frameworks and key corporate sustainability criteria. Finally, Strand (2024) explored how Nordic countries (Denmark, Finland, and Sweden) and companies (Novo Nordisk, Ørsted, Chr. Hansen, Neste, and IKEA) sustainability practices contribute to achieving sustainability and sustainable development goals. The Nordic approach involving long-term vision, cooperative strategies, and stakeholder (other companies, governments, international organizations and their agencies, NGOs, local communities, universities, investors, employees, customers, and other key stakeholders) engagement helped companies (Novo Nordisk, Ørsted, Chr. Hansen, Neste, and IKEA) successfully transform their business models, make massive sustainability transitions, and become global sustainability frontrunners.

4 Future research directions

The SLR showed that although cooperative strategy in the context of sustainability has received a fair share of attention from academics in the last five years, there are still several areas that require further investigation. Future research should focus more on the role of cooperative strategies, especially joint ventures, in achieving sustainability and sustainable development goals. Partner selection and drivers/motives for engaging in sustainability-oriented inter-firm alliances and cross-sector partnerships are also worth exploring. Furthermore, academics can research different aspects of these alliances, such as governance structures, management, and performance outcomes.

Since most studies center around environmental sustainability and addressing complex environmental issues, it will be interesting to discuss how companies collaborate with different stakeholders (other companies, governments, NGOs,

universities, international organizations, local communities, etc.) to overcome social challenges and achieve social sustainability. Moreover, it is suggested that academics increase research areas and investigate cooperative strategies in the context of sustainability in other industries apart from the most common ones like manufacturing, pharmaceutical, construction, and aviation.

5 Conclusions

Sustainability has been a mainstream issue, receiving greater attention from academics and practitioners after the UN adopted the 17 SDGs in 2015. The private sector's participation is crucial in reaching sustainable development goals. Increasing sustainability regulations and stakeholder pressures force firms to assess their strategies and practices regarding sustainability requirements. Consequently, companies usually collaborate with external actors (companies, governments, international organizations and their agencies, NGOs, local communities, universities, customers, and other key stakeholders) in sustainability processes to make sustainability transitions, embrace new value frames, develop, test and transform new ideas and technologies, diversify operations, ensure that the product/service satisfies customers' needs, gain reputation, and improve corporate image. The SLR results showed that although cooperative strategy in the context of sustainability has received a fair share of attention from academics in the last five years, several areas still require further investigation.

Overall, this research provides valuable insights for practitioners and academics interested in cooperative strategies and sustainable development. Academically, the review provides a comprehensive understanding of the role of cooperative strategies (strategic alliances and joint ventures) in achieving sustainability and sustainable development goals and emphasizes the necessity to further investigate the issue. The research insights can help practitioners consider multi-stakeholder partnerships as a superior strategy to address complex sustainability challenges.

The article, like any other study, has several limitations. Firstly, the literature review was restricted to studies published in the last five years (2019-2024), which may have overlooked earlier foundational research regarding cooperative strategies in the context of sustainability. Second, the review focused on the publications available only on Scopus and Web of Science, which are considered comprehensive databases, however, using them may have excluded grey literature or regional studies available in other databases like Google Scholar. Finally, the choice of search keywords and refining search results, like limiting research results to only English-language articles, may have excluded critical perspectives on cooperative strategies for sustainability.

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Impact of Digitalisation on the Competitiveness of SMEs in Slovakia

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Abstract: This paper examines the impact of digitalization on the competitiveness of small and medium-sized enterprises (SMEs) in Slovakia. In a rapidly changing business landscape, SMEs face many challenges and opportunities brought about by technological advances. The study analyses how digital transformation affects key competitiveness factors such as operational efficiency, market access, innovation capabilities and customer engagement. The data was collected through available statistical data, providing insights into the current adoption of digital technologies and the barriers that businesses face in effectively using these tools. The findings suggest that SMEs which are using digital solutions show increased productivity, better market adaptability and improved customer satisfaction, which contribute significantly to their competitiveness. Nevertheless, challenges such as limited financial resources, lack of digital skills and inadequate infrastructure persist and hinder the wider adoption of these solutions. The paper concludes with recommendations for policy makers and business support organisations on how to create the conditions to foster digital growth, which is key to increasing the resilience and global competitiveness of Slovak SMEs.

Keywords: digitalisation, competitiveness, SMEs

JEL Classification: O31, M10

1 Introduction

The impact of digitalization on the modern business environment is extensively studied, with numerous studies emphasizing the role of digital technologies in enhancing business efficiency and competitiveness (Brynjolfsson & McAfee, 2014). SMEs, which make up a significant portion of economies, face challenges in adopting technologies due to often limited resources and technical capacities for fully leveraging the advantages of digitalization (Matt, Hess, & Benlian, 2015; Bharadwaj, El Sawy, Pavlou, & Venkatraman, 2013). Digital technologies offer SMEs opportunities not only to improve productivity but also to expand market access and increase customer satisfaction key factors for achieving a competitive advantage (Porter & Heppelmann, 2015; Yoo, Henfridsson, & Lyytinen, 2010). Nevertheless, SMEs frequently encounter barriers that hinder their digital transformation, including insufficient financial resources, lack of technical skills, and unprepared infrastructure (Grenčíková A., et. al, 2020). These limitations are often associated with uncertainties about the return on investment in digital technologies (Sebastian et al., 2017). The COVID-19 pandemic during the years 2020-2021 has also accelerated digitalization, leading to significant shifts in the business environment. This pressure has forced many SMEs to adapt their processes and transition to digital platforms, thereby improving their ability to respond to new market conditions (McKinsey & Company, 2020; Wessel, Thies, & Benlian, 2020). This study examines the impact of digital transformation on the competitiveness of SMEs in Slovakia through surveys and interviews with representatives of these businesses. We analyze how digitalization affects key aspects of competitiveness, such as productivity, flexibility, and customer satisfaction. These factors are frequently considered critical for the success of SMEs that implement digital solutions (Teece, 2018; Li, Su, Zhang, & Mao, 2018). Findings confirm that companies with effective digital transformation exhibit higher productivity and an enhanced ability to swiftly respond to market demands, ultimately supporting their competitiveness (Westerman, Bonnet, & McAfee, 2014; Kane et al., 2015). Additionally, the work by Bresciani, Ferraris, and Del Giudice (2018) demonstrates that implementing digital innovations contributes to greater business dynamism and adaptability to market changes. Verhoef et al. (2021) further emphasize that digitalization significantly influences competitive advantage through improved data analysis and customer relationship management, thereby strengthening SMEs' long-term sustainability. The aim of this study is to provide recommendations for policymakers and organizations supporting SMEs to create a conducive environment for broader adoption of digital technologies. Digitalization is regarded as a crucial factor for long-term competitiveness and resilience of SMEs in the

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global market, and thus, it should be included in strategic goals for SME development in Slovakia (Chania, Myers, & Hess, 2019; Nambisan, Lyytinen, Majchrzak, & Song, 2017).

2 Methods

The main objective of this study is to analyze how digitalization affects the competitiveness of SMEs in Slovakia, focusing on aspects like productivity, market access, customer satisfaction, and overall digital integration. Fulfilling the main objective was carried out through a literature search of currently available literature research and studies carried out for the period from 2013 to 2023. Secondary data were processed through available sources based on scientific databases Eurostat, Digital economy and society index (digitalization of SME, competitiveness of SME, digitalization and innovation of SME).

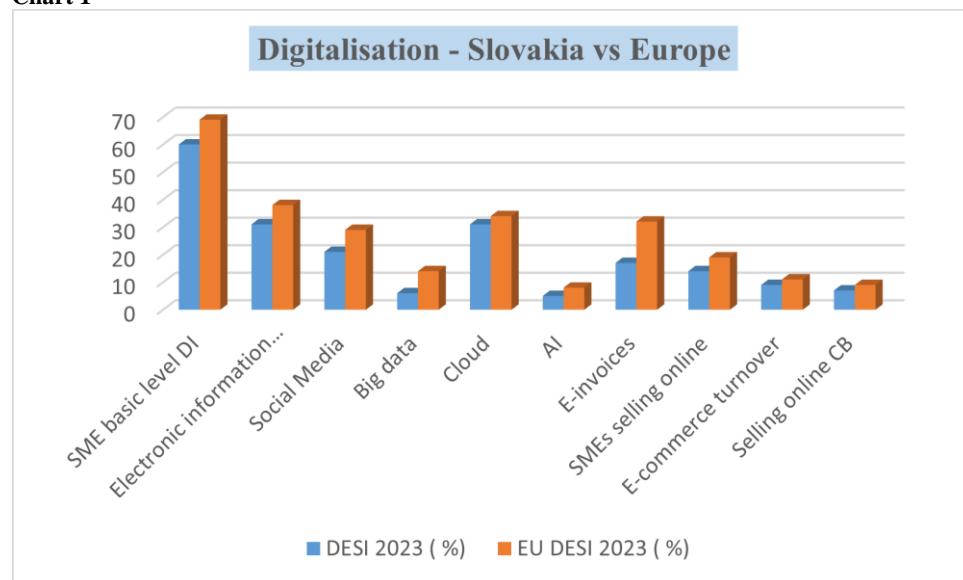
In this paper, the main focus is on finding answers to the research questions:

1. What is the current level of digitalization among SMEs in Slovakia?"
2. How does digitalization impact key competitiveness factors such as productivity and market reach among Slovak SMEs?

3 Research results

Based on the available sources, we present in Chart 1 Digital comparison Slovakia vs EU average for year 2023 based on Digital economy society index for year 2023

Chart 1



Source: own processing based on file file:///C:/Users/Lenovo/Downloads/SK_country_report_dGHTuRCONA-Aet0dy9vchl6g4_98633.pdf

This chart compares several digitalization indicators between Slovakia and the EU average for 2023, based on the Digital Economy and Society Index (DESI). It highlights the percentage of SMEs adopting various digital technologies and practices, providing insights into areas where Slovak SMEs lag or match up to EU standards.

Key Indicators and Insights:

1. SME Basic Level of Digital Intensity (DI):
 - Slovakia (approx. 60%) vs. EU Average (approx. 68%).

- Observation: Slovak SMEs show a slightly lower level of basic digital intensity compared to the EU average. This suggests that while many Slovak SMEs meet basic digitalization requirements, there is still room to improve their overall digital engagement.

2. Electronic Information Sharing:

- Slovakia (approx. 40%) vs. EU Average (approx. 55%).
- Observation: Slovakia lags behind the EU average in electronic information sharing, indicating that Slovak SMEs may not be fully utilizing digital tools for data and document exchange, potentially limiting their operational efficiency.

3. Social Media Usage:

- Slovakia (approx. 35%) vs. EU Average (approx. 45%).
- Observation: Slovak SMEs are less active on social media compared to their EU counterparts. Given the importance of social media in digital marketing and customer engagement, this represents a missed opportunity for SMEs to enhance their market presence and customer outreach.

4. Big Data:

- Slovakia (approx. 10%) vs. EU Average (approx. 20%).
- Observation: Slovakia is significantly behind the EU average in big data adoption. This could limit SMEs' ability to analyze customer trends, optimize operations, and make data-driven decisions that could enhance competitiveness.

5. Cloud Computing:

- Slovakia (approx. 40%) vs. EU Average (approx. 50%).
- Observation: Cloud adoption in Slovakia is lower than the EU average. Cloud computing is crucial for flexible, scalable operations, and this gap may indicate barriers such as cost or lack of technical skills that prevent SMEs from leveraging cloud-based services.

6. Artificial Intelligence (AI):

- Slovakia (approx. 5%) vs. EU Average (approx. 8%).
- Observation: Both Slovakia and the EU show low levels of AI adoption, though Slovakia is slightly behind. This suggests that AI technologies are still emerging, and many SMEs may not yet be investing in AI-based solutions.

7. E-Invoicing:

- Slovakia (approx. 30%) vs. EU Average (approx. 40%).
- Observation: Slovakia's e-invoicing adoption is lower than the EU average, indicating that a significant number of SMEs may still rely on traditional invoicing methods. E-invoicing can streamline financial operations, so this is an area for potential improvement.

8. SMEs Selling Online:

- Slovakia (approx. 15%) vs. EU Average (approx. 20%).
- Observation: A smaller percentage of Slovak SMEs sell online compared to the EU average, which limits their market reach and revenue potential. Expanding e-commerce activities could enhance competitiveness, especially in the post-pandemic economy.

9. E-Commerce Turnover:

- Slovakia (approx. 7%) vs. EU Average (approx. 10%).

- Observation: Slovak SMEs generate a lower percentage of their turnover from e-commerce activities compared to the EU average, indicating that they are not fully capitalizing on digital sales channels to drive revenue growth.

10. Selling Online Cross-Border (CB):

- Slovakia (approx. 7%) vs. EU Average (approx. 9%).
- Observation: Cross-border e-commerce is also less prevalent among Slovak SMEs compared to the EU average. This suggests that many Slovak SMEs are missing out on the opportunities offered by the broader European market.

4 Conclusion

Based on the results from the research part, we conclude the answers to the research questions as follows:

RQ1 - What is the current level of digitalization amongs SME in Slovakia?

The current level of digitalization among Slovak SMEs, as indicated by DESI 2023 data, shows that while the majority of SMEs have achieved a basic level of digital intensity (around 60%), Slovakia still lags behind the EU average in several critical areas. Key gaps include advanced digital technologies such as big data analytics and artificial intelligence (AI), where Slovak SMEs are significantly underrepresented compared to their EU counterparts. Moreover, the adoption of essential digital tools like cloud computing and electronic information sharing remains below the EU average. These shortcomings suggest that while Slovak SMEs are making progress in digitalization, they face substantial challenges, such as limited financial resources, a lack of digital skills, and inadequate infrastructure support. To close these gaps, targeted investments in digital tools, enhanced training, and public policy support are essential.

RQ2 - How does digitalization impact key competitiveness factors such as productivity and market reach among Slovak SMEs?

Digitalization has a direct positive impact on the competitiveness of Slovak SMEs, particularly in areas such as productivity, market reach, and customer engagement. SMEs that have adopted digital technologies such as e-commerce, cloud computing, and social media report improved operational efficiency and increased opportunities for market expansion. However, the relatively low percentage of SMEs engaged in online sales and cross-border e-commerce suggests that many are not fully leveraging digital tools to enhance their market reach. Those that have embraced digital solutions have demonstrated stronger performance in terms of customer satisfaction, speed to market, and overall agility. However, the low adoption rates of advanced technologies like AI and big data hinder the ability of many Slovak SMEs to compete effectively on a global scale. To maximize competitiveness, SMEs need to focus on integrating these advanced technologies and expanding their digital footprint, both domestically and internationally.

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Enhancing Team Performance: How Personality Tests Optimize the Composition of Small Teams

Lucie Martinkovičová¹, Jaroslav Vrchota², Martina Kubešová³, Petr Řehoř⁴, Zdeněk Štefek⁵

Abstract: The article discusses the critical role of project management in the success of team-oriented tasks. The study explores how personality tests, particularly the Belbin Team Roles test, optimize team composition and improve team performance. The article distinguishes between groups and teams, highlighting that effective teams possess shared goals, complementary skills, and strong collaboration dynamics.

The article also presents a study comparing two project teams: one formed naturally and the other structured based on Belbin test results. Through the analysis of performance metrics such as productivity, adherence to budget, and communication efficiency, the research demonstrates that diverse and well-balanced teams perform better, as identified through personality tests. The conclusion recommends that organizations integrate personality assessments into team formation processes to enhance efficiency and collaboration in project-based environments. The main contribution of the paper is to highlight the importance of the variety of methods used in the formation of work teams, as after the study was conducted, the use of solely the Belbin test was proved to be limiting. The article also supports the importance of the combination of methods in monitoring team performance. Likewise, the article considers it important to emphasize the continuous deepening of knowledge of communication, collaboration and enabling career growth in leadership positions.

Keywords: Project management, Human resources, Team roles, Modern work approaches, Belbin test

JEL Classification: M21, J11

1 Introduction

Project management is critical to successfully implementing complex tasks and goals with a clearly defined beginning and end. It is specific in that it involves planning, managing and controlling resources, time and costs to ensure the project achieves the set goals within given time and financial limits (Svozilová, 2016). Each project brings unique challenges, from risks to changes in requirements, which require a flexible approach and the ability to adapt quickly. In this context, a good project team is essential, as the success of a project depends not only on the technical skills of individual members but also on their ability to collaborate, communicate effectively, and solve problems. A quality project team can better allocate roles, leverage the strengths of individuals, and thus maximize productivity and the quality of results, which is essential for successful completion of the Project (Doležal, 2016).

The text perceives the differences between a team and a group, although these terms are sometimes used synonymously. A team is characterized by cooperation, shared identity and belonging, where each member contributes to achieving a common goal (Doležal, 2023a). The main characteristics of a team include a shared goal, complementary skills, collective norms, a proactive approach and responsibility to achieve quality results. On the contrary, a group is a more permanent structure where individuals focus on their tasks and are interchangeable, often formed based on physical or cultural proximity (Plamínek, 2018a). The teams can be divided according to formal or informal structure and duration.

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Another division includes action, consulting, project, production and virtual teams (Korecký & Trkovský, 2011). Action teams focus on repetitive tasks, but they do so in different conditions each time. Advisory teams provide information to the company's management and may sometimes have decision-making powers. Project teams are the leading executive link in the implementation of projects and are characterized by a high level of expertise. Manufacturing teams are relatively stable and less complex, while virtual teams allow for remote collaboration, which is becoming increasingly popular. The main benefits include a more comprehensive range of knowledge, stimulating creativity, reaching solutions faster, and meeting the social needs of team members. Also significant is the synergy effect, in which the team's performance is higher than the sum of the individual performances (Plamínek, 2018b). Disadvantages include suppression of individuality, potential conflicts, groupthink, social laziness, and the need to accept a common goal (Křivánek, 2019). Groupthink can manifest itself in well-functioning teams and leads to the suppression of opposing opinions, which can negatively affect decision-making.

In team management, personality tests are increasingly used for optimizing team performance and efficiency. Some of the most well-known personality tests include the MBTI (Myers-Briggs Type Indicator) (Siakas & Siakas, 2014; Tennant et al., 2011), which categorizes personalities based on four dimensions, such as extraversion vs. introversion, sensing vs. intuition, and more (Armstrong et al., 2015). This test is famous mainly due to its ability to reveal individual preferences in thinking and decision-making, allowing for better understanding among team members. Another renowned test is the Big Five (five-factor personality model), which examines personality according to five essential traits: openness, conscientiousness, extraversion, agreeableness and neuroticism. This model provides a comprehensive view of the human personality and allows you to identify how an individual reacts to different situations, which is crucial in managing team dynamics (Löhken, 2014). In the corporate environment, the DISC test is also often used, focusing on four basic styles of behaviour: dominance, influence, constancy, and conscientiousness. This test is used to understand better individual team members' communication styles and preferences, which can significantly facilitate collaboration and conflict resolution. Other tools include the Hogan Method, which measures personality in the context of the work environment, and the 16-personality test, which is a simplified version of the MBTI. Each of these tests has its own specific value and helps managers and HR specialists better understand workers' personality traits. Although all of these tests offer useful insights into individuals in terms of teamwork effectiveness, it is advisable to focus on the Belbin Test of Team Roles. Unlike other tests that focus on individual personality traits, the Belbin test focuses on team dynamics and how different personalities work together. It identifies nine team roles that reflect the individual's natural contribution to the team, helping to create a more efficient group. This test allows you to optimize the distribution of tasks and ensure that the team uses the full potential of all members, which is key to achieving success in projects and team goals.

The Belbin Test of Team Roles (Flores-Parra et al., 2018; Gutiérrez et al., 2019), developed by British management expert Meredith Belbin, is one of the most widely used tools for identifying team roles. Its main idea is that the effectiveness of a team is not only determined by the expertise and skills of individual members but also by the roles each of them occupies in the group. According to Belbin, the team works best when it comprises people with complementary roles. The test identifies nine primary roles, including the innovator (the one who comes up with new ideas), the shaper (the person who energetically pushes the team to achieve goals), the coordinator (the one who takes care of the smooth running of the team), or the team player (the person who ensures harmony and support among members) (Khelerová, 2010). Each role has its strengths and weaknesses. For example, an innovator may be great at generating new ideas but sometimes lacks attention to detail or practicality. The Belbin test is a helpful tool for better understanding team dynamics, identifying weak points, and optimizing the composition of teams to achieve the best possible results. Although the Belbin personality test has long been considered an effective instrument, its limitations must not be overlooked. Its static view of personality and its limitation to 9 basic roles can be considered as bottlenecks. Despite several authors are adding to the roles, such as Plamínek's addition of the role of dictator or recluse, Belbin's view of human diversity is considerably simplistic. Another limiting factor for validity may be context, corporate and national culture, which may give different roles different weight in different settings, or ignoring situational factors. The Belbin test is available in many countries, including the Czech Republic, where its use is licensed and subject to training. This tool is often used in the corporate environment when building and evaluating teams.

For the needs of the article, the monitored criteria were defined based on authors (Aparicio Fenoll & Zaccagni, 2022; Junker et al., 2022; Paros et al., 2022; Pavez et al., 2022) and at the same time to enable the transfer of data into numerical form and subsequently their graphic display. Each of the criteria reflects the level of teamwork, which is closely related to the effectiveness of communication, the atmosphere within the team and the commitment of its members. If the team communicates appropriately, it can plan accurately and meet the set deadlines, which usually leads to staying on budget—

such cooperation results in an effective and successful team that can be considered well-composed. The first criterion is productivity. Within the scrum approach, this is expressed by the number of completed user stories during individual sprints. Each sprint is scheduled according to the complexity and difficulty of the team's tasks. Productivity is therefore not only measured by the absolute number of completed tasks but, above all, by how the team can deal with work difficulty during the sprint. The second criterion concerns the budget, which is critical in the business environment. It is monitored whether the teams can meet the set financial framework. The budget is expressed as a percentage to make the financial data comprehensible. Any deviations in the budget may arise for various reasons, such as savings when borrowing tools from another department or, conversely, increased costs due to overtime, which represents additional person-hours. For graphical processing, the values are converted to decimals, improving the visualisations' clarity and accuracy.

The third criterion is the dates, divided into three consecutive sprints. Each sprint lasts three weeks, with a standard time allowance of 40 hours each week. The total time for the completion of the project is, therefore, nine weeks. However, teams can complete sprints earlier if they complete all assigned tasks. The remaining days are not considered downtime but are used to start the next sprint immediately, which increases work efficiency. Another criterion is the success of testing intermediate results. The quality of the delivered outputs is essential for the team's success, so testing is carried out twice a week during each sprint. A well-functioning team should be able to deliver usable and high-quality outputs. The overall success rate of the tests performed by each team during the sprints is measured. The fifth criterion focuses on communication in the team. Daily meetings are crucial to maintaining team coordination and effective planning within the Scrum methodology. This criterion, therefore, monitors how often teams hold these meetings and how they meet within a maximum of 15 meetings per sprint. The last monitored criterion is planning accuracy, referred to as throughput. This indicator evaluates how well the team can estimate the scope of individual user stories. Effective communication and feedback are signs of good planning. If the estimates are accurate and agree among team members, it shows their high knowledge of the issue and understanding of the assignment. On the other hand, low throughput can mean that the team does not understand the task well enough, leading to inefficient performance. The team leader, called the scrum master, can also use this metric to validate members' attention by assigning illogical guesses and observing whether the team critically evaluates and adjusts these evaluations or accepts them without thinking. The main aim of the paper is to compare two selected teams, one of them was formed naturally and the other one was formed on the basis of Belbin's personality test. The aim was to explore how the effectiveness and performance of these teams would differ and what the key areas of success or setback would be.

2 Methods

The article's main objective is to prove, based on the research of small teams, that it is possible to achieve higher results of the monitored criteria by appropriate selection and with the help of personality tests when assembling teams. Data collection occurred in the spring of 2024, specifically from early January to early March. The data was obtained based on cooperation with the HR department, where the company itself monitored some of the criteria for a long time, and others were added to the monitoring for the needs of the work. For the needs of the research, two small project teams (8 people) were created. The primary sample consisted of employees of a company focused on industrial technologies. They used deliberate methods, i.e., non-random selection, and approximately 20 potential members were addressed. The final teams consisted of eight members each, as the work required different professional specializations and knowledge. At the same time, the team size also corresponded to the recommendations from the professional literature (Doležal, 2023b) about team size and interpersonal relationship management. The main characteristic of Team A was its natural formation when colleagues who are used to working together have already done some everyday activities and can be said to be able to work together. The five-member core of the team was supplemented by three other employees who were finishing their work in other positions during the preparation of the project. On the other hand, Team B was created completely anew and artificially, using the results of the Belbin test of team roles to cover individual positions as best as possible. The main limiting factor for the formation of Team B was the availability factor. The project, which was used to monitor selected criteria and compare teams' performance, dealt with software optimization of industrial robots. Therefore, when assembling the team, emphasis was placed on sufficient representation of technically oriented roles. A total of six critical criteria were determined, including productivity measured by the number of user stories completed, adherence to the budget, adherence to the time allocation, i.e. deadlines, the success of testing, the number of daily meetings held, i.e. the criterion of communication efficiency, and the parameter of planning accuracy, which make it possible to monitor the performance of the team and assess whether its composition has an impact on its success. The selected criteria are loosely based on the KPI or Key Performance Indicator methodology. This methodology collects indicators that express the quality, efficiency or performance of an enterprise or its department.

Tools from the field of decision analysis were chosen as the critical methods of data processing. As a part of the broader scientific field of statistics, decision analysis focuses primarily on comparing and determining the usually best or most advantageous variant of the options offered, i.e., processing the decision problem. A decision-making problem is a situation where either criteria are compared concerning one fundamental piece of information or criteria against several pieces of information, i.e. variants. The data obtained were processed in the second way, i.e. multi-criteria analysis (Plzáková, 2023). The criteria are characterized by unambiguous formulation, logical interconnection with each other and for the goal under investigation, limitation of the number of phenomena monitored concerning the difficulty of the decision-making problem and, last but not least, evaluation using assigned weights. Weight means the significance of a given criterion, i.e. a criterion of very relevance will be evaluated with 10 points on a scale of 1 – 10. In contrast, a criterion of lower to negligible significance will be evaluated, for example, with only 2 points (Plzáková, 2023). Three weighting tools were used to maintain the most remarkable possible objectivity when monitoring the teams. These include 1) the scoring method, the interval of which depends on the discretion of the questioner and consists of the distribution of points according to the most objective consideration; 2) Metfessel allocation, which is based on the principle of simply assigning 100 points between the criteria, i.e. the weight is the ratio of the awarded points to the whole, 3) Saaty's method, which is based on Fuller's paired comparison, which he further specifies (Fotr et al., 2003). The main stage of data processing consisted of a calculation using 1) the weighted sum method, 2) the base variant method and 3) the utility sum method. Each of the variants of the calculation looked at the data in a different way, so the combination of 3 different approaches aimed to increase the validity of the conclusion. The main intermediate result was always to find the team order in the area of the given criterion in the sprint. From these intermediate results, a purpose function was calculated, which expressed the result for a given sprint. A team whose purpose achieved a better rating in 2 out of 3 methods used was always mentioned as more effective.

3 Research results

Team A was created naturally and without the use of any above-standard personnel management tools. In retrospect, the roles represented were determined to be represented by the team consisting of 1. resource finder, 2. team player, 3. team player, 4. team player, 5—specialist, 6. implementer, 7. implementer and 8. evaluator. From the view of the team composition, the absence of the finisher and innovator is noticeable, where the role of the innovator is especially critical due to the nature of the project with a focus on software optimization. At the same time, there is not a single role in the team that would be dedicated to team management or delegation of tasks, i.e. the role of coordinator or former. On the contrary, a team player is represented several times, which predicts a pleasant and friendly working atmosphere but can lead to inefficiency. To maintain objectivity, it is necessary to highlight the coverage of the role of the specialist and evaluator, together with the two implementers who can work on testing and implementing new solutions. The aim of assembling Team B with the help of the Belbin test was to fill the individual roles in the team as optimally as possible to achieve the best possible work results. Three main limiting factors consistently worked in the composition of Team B: the availability of suitable workers on time, the technical knowledge required for the project, and Trying to cover roles as diversified as possible. Due to working in a natural environment with limited human, financial and time resources, it was not possible to fill all the roles as presented in the theoretical part, but there was a natural overlap between them, which brought a positive synergic effect in the end. The newly assembled team consisted of: 1. coordinator, 2. innovator, 3. specialist, 4. specialist, 5. implementer, 6. team player, 7. evaluator and 8. finisher.

The actual work with the data was divided into two directly related steps. In the first step, weights were assigned to the individual criteria on the basis of the above-mentioned methods, i.e. the significance of the individual criteria was determined. As part of the interaction with the members of the project teams, scoring, i.e. determining the weights, was entrusted to them. Workers in each team were given 25 points, which they were to divide among six criteria according to their own notability preference. The sum of the individual points of each criterion is then determined by its significance. To give you a better idea of the character of the team, the absolute difference in the distribution of points was also calculated, where the most minor point difference between the teams was given to the productivity criterion, which both teams had in the first place. On the other hand, the lowest level of agreement was in the significance of the planning criterion, where the difference was 16 points. Team B collectively considered the planning parameter to be essential and assigned it second place, while Team A ranked the criterion 6th, i.e. last. During the conversion of weights using the scoring method, Metfessel allocation and Saaty method, the correctness of the calculation was confirmed. Since it was necessary to unify the opinions and preferences of both teams in a certain way, the calculation was performed by the classical arithmetic mean. These values are further used in all calculations.

The monitored project consisted of 3 consecutive sprints, where one sprint consisted of three consecutive working weeks, i.e. 15 days. Information about the sprint was always recorded in the appropriate table of input data. It summarized the criteria, their planned scope and the actual values fulfilled by both teams. The table was the basis for calculations according to the base variant method, the utility sum method and the order-weighted sum method (Zmatlík, 2024).

Figure 1 1: Table of input data, sprint no. 1.

	Productivity	budget	terms	Testing success rate	communication	planning
Team A	16	97%	13	5	13	8
Team B	14	104%	15	6	15	10
Extent	16 user stories	100%	3 weeks	6 tests	15 daily meetings	Accuracy 1-10

Source 1: Own processing.

Comparing the first sprint, it is clear that Team A, which was created naturally, did not experience problems in the area of productivity. It even managed to deliver the assigned work two days earlier, even with the absence of the role of the former coordinator. There were no problems, even if the budget criterion was met, and the team was even able to create savings by working effectively with other departments of the company. It is evident that the high success rate of the testing was the result of the presence of two implementers. The bottleneck of the first sprint was communication. The degree of accuracy of planning is acceptable.

Although a representative of the role of the so-called coordinator was also a member of Team B, the team exceeded the budget by 4% and failed to deliver the specified number of user stories on time. However, it is necessary to highlight the active role of the implementer and finisher, who were responsible for testing partial intermediates and supervising the holding of the daily meetings. It can be considered that in the first semester, i.e. the first 3 weeks of the project, the team went through the typical phases of getting used to the team, which include norming and storming, and only then follows the practical performing phase.

In the calculation according to the utility sum method, it is evident that team A was generally more mature and effective in the first sprint.

Figure 2 Table of input data, sprint 2.

	Productivity	budget	terms	Testing success rate	communication	planning
Team A	17	98,5%	15	6	12	9
Team B	19	102%	18	4	15	7
Extent	19 user stories	100%	3 weeks	6 tests	15 daily meetings	Accuracy 1-10

Source 2: Own processing.

In the second sprint, the number of user stories entered by the company increased, and team A did not deliver all, so the absence of a coordinator is still evident. The absence of the role of the coordinator began to become apparent. In terms of budget, team A managed to stay below the planned limit in this sprint and was also able to increase the number of successfully performed tests. Stagnation or resignation is visible in the criterion of communication, i.e. the number of daily meetings. At the same time, however, it is necessary to highlight the role of the evaluator, who reworked the method of planning based on the data from the previous sprint and thus managed to increase its accuracy. Team A was still well functioning, probably due to the strong representation of team players.

Thanks to specialists, Team B managed to deliver the required number of user stories in the second sprint, but at the expense of a three-day delay. Although the team exceeded the deadline, they were able to coordinate their finances better and only exceeded the budget by 2% over the set limit. The decrease came in the criterion of success of testing when team B fell to only four successful tests out of 6 attempts. However, the company also perceived this result as positive. In the

area of communication, Team B maintained a set regime of 1 meeting per day, but a slight deterioration occurred in the area of scheduling accuracy.

The calculations showed that even in the second sprint, Team A still proved to be more efficient, clearly in all three methods of calculation.

Figure 3 Table of input data, sprint 3.

	Productivity	budget	terms	Testing success rate	communication	planning
Team A	24	96%	16	4	14	7
Team B	24	100%	15	6	15	9
Extent	24 user stories	100%	3 weeks	6 tests	15 daily meetings	Accuracy 1-10

Source 3: Own processing.

In the last sprint, both teams were able to fill the set number of user stories, but in the case of team A, there was a one-day delay. However, there was no problem in completing and handing over the project due to the previously created time reserve. At the same time, Team A kept expenses below budget and was able to increase the number of daily meetings that employees collectively began to attach more importance to during the project. However, the accuracy in the planning and delegation of work within the team section has decreased.

At the end of the monitored period, the functionality of Team B was fully demonstrated, which clearly recorded the most successful sprint. Team B delivered all the assigned tasks within the set deadline and in high quality, which they believed and confirmed the 100% success rate of testing. For the first time, Team B was able to keep to the prepared budget, where the increasingly precise work of the coordinator in the area of delegation of work and other resources is evident. Team B also maintained its typically high level of daily meetings.

It was not until the last sprint that the internal compatibility and synergy of Team B were fully demonstrated when the calculations clearly marked Team B as more efficient. Team B occupied the position of leader in all three calculation methods, as it achieved the desired values of objective functions. The leading difference that Team B managed to create was 0.49 units.

In addition to quantitative data, qualitative data were also found through group discussions, which were to marginally complement the conclusions obtained by the calculation and possibly reveal other strengths or weaknesses of work in the created teams. The discussion focused on questions such as the strengths and weaknesses of cooperation in the team, how employees perceived the presence and intensity of roles, and whether the composition of the team had an impact on the results delivered.

The discussion showed that the A team especially appreciated the high level of mutual trust, felt the positive synergy effect and was able to complete all the assigned tasks. On the other hand, he perceived as a weakness the loss of objectivity, grouping and a certain degree of neglect of planning and communication duties, which probably arose from a certain indolence and collectively higher self-confidence of the naturally formed team.

In the environment of Team B, the complementary skills of the selected roles and the effort to communicate as effectively as possible, based on a high level of engagement of team members, were significantly evident. At the same time, a positive synergistic effect was manifested here, along with higher objectivity in decision-making. The team perceived the overloading of specific roles as a weakness, while the incomplete use of the work capacities of the roles of others and the associated lower degree of flexibility.

The results of the self observation coincide with the current literature, confirming and supporting its thesis on the importance of cooperation between the HR department and the company's employees. The findings highlight the importance of combining team performance monitoring tools, i.e. quantitative and qualitative methods. They also point to the importance of maintaining a diversity of roles in the team when circumstances allow, since Team B, which was composed on the basis of personality characteristics and had a greater diversity of team roles, was ultimately able to achieve higher results on the criteria monitored. One of the key finding is the necessary communication support, where Team A missed several of the daily meetings, creating "blind spots" that led to delays in the work. Recommendation for the business would be to introduce regular reporting on internal communication and meetings as well as ongoing

performance monitoring. In the absence of a key role, the company should respond by assigning a suitable person to an existing team. Companies could take inspiration from Belbin's team role test when selecting employees, especially in the case of long-term projects where it is desirable to cover diversity. Similarly, companies should not be reluctant to change the composition of the team and, if financial possibilities allow, extend their HR tests to include other forms of personality testing. The more comprehensive information a company can obtain about its employees, the better it can work with human capital and talent development.

4 Conclusions

The results show that although the company provides its employees with quality working conditions, several essential factors have been identified that the company should take into account in the future when creating teams. One of the main findings is the importance of the diversity of roles in the team. The data show that teams that were built on the basis of diverse personality characteristics and that included a more comprehensive range of team roles performed better. The complementarity of individual members contributed to the synergy effect, which led to higher productivity and successful completion of projects. Creating teams with a balanced mix of personality types seems to be a critical factor in achieving better results. Another important aspect is the promotion of communication (Rehan et al., 2024). Although teams approached communication differently, information sharing and regular reporting proved essential to the success of team collaboration. Teams that regularly shared their knowledge and experience achieved better results than those that relied only on informal communication. Therefore, the company should ensure regular meetings and information sharing, even in smaller teams, to avoid information gaps. The last important finding is the continuous monitoring of team performance. This made it possible to identify weaknesses in the work of individual teams and to identify missing roles. In the case of longer-term projects, it would be advantageous if the HR department had the opportunity to respond flexibly to these deficiencies and add a missing member to the team, which would increase the overall efficiency of work. As part of the recommendations, the company should emphasize the selection of employees with suitable leadership and organizational skills for leadership roles in teams. If the company's financial possibilities allow, it would also be appropriate to extend the testing of personality characteristics of team leaders beyond the Belbin test, which would provide the company with a more comprehensive overview of the potential of employees and allow them to use their talents and abilities better.

The article has several limitations that may affect its conclusions. First, the study analyzed only two teams, which limits the generalizability of the findings to a broader population. Additionally, the focus was on a specific industry and project type (software optimization for industrial robots), which may restrict its applicability to other sectors. The use of the Belbin test as the primary tool for optimizing team performance is another limitation, as it focuses on team roles and may not account for other crucial factors, such as specialized expertise or environmental dynamics. Moreover, the team's performance evaluation was based on quantitative criteria, potentially overlooking critical qualitative aspects of teamwork, such as motivation and interpersonal relationships. The results may also be influenced by contextual factors, such as organizational culture (Almarashdah, 2024) or the team members' previous experiences, which were not explored in depth. Due to the limitations mentioned above, the findings are only intended to complement the broader and more extensive studies that are being produced on the topic of the combination of human resources managerial tools and agile management. The findings of the study should serve as background information and insight into the situation and success of the use of HR tools in medium-sized companies in Central Europe.

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Old-age Dependency Ratio in the Czech Republic: Challenges for Businesses in the Context of an Ageing Population

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Abstract: This article focuses on the analysis of demographic indicators in the Czech Republic, with an emphasis on South Bohemia. The main objective is to evaluate changes in the old-age dependency ratio (ODR) and young-age dependency ratio (YDR) in different regions and to identify critical factors that affect it. The results show that areas with high ODR, such as Jindřichův Hradec, Písek, and Hradec Králové, face significant challenges, especially in connection with labour shortages, which can negatively affect the sustainability of local businesses. On the other hand, regions such as Prague East, with low ODR and high YDR, have a younger demographic structure, which supports their economic growth and attractiveness to young families. The article also concludes by outlining how these demographic differences may affect the ability of companies to adapt to changing market conditions and maintain competitiveness.

Keywords: Old-age Dependency Ratio, Czech Republic, Population Ageing, Regional Enterprises

JEL Classification: M21, J11

1 Introduction

Jonsson et al. (2023) consider age management as an umbrella term that emphasises the active role of organisations in adapting work to the capabilities of older workers. Vrabcová & Urbancová (2022) view age management as the management of an organisation where the age of their employees is considered. In the same breath, they add that a sustainable human resource management system enables an organisation to utilise the full potential of its employees of all ages. Silva & Helal (2022) see age management as the best way to strategically cope and deal with the changes that result from the ageing population and the related changes in the labour market. Therefore, the main objective of age management is to enable more employees over 50 to participate in the workforce. Procházková et al. (2022) add that this concept encompasses global trends. According to Flynn & Schröder (2021), these include global population contraction, while Cameron (2023) adds population growth, urbanisation and international migration. Procházková et al. (2022) also talk about changes in human resource management that have transformed the workforce into a sustainable workforce. This is most often done by creating and maintaining flexible working conditions. Age management interventions are usually implemented through specific actions, such as preventing workplace accidents, retaining older workers' experience in the organisation, or reducing absenteeism due to worker illness.

A significant term in age management is the concept of workability. According to Lahti et al. (2024), workability is understood as the balance of health with work demands. Understanding this concept is essential for policymakers and preparing for future challenges with enough time to make the right and necessary decisions. Ehmann et al. (2021) view work capability as the potential of individual employees to perform job tasks given their health, working conditions and mental resources. According to the authors, good workability is related to the high quality of work, high productivity, and enjoyment of staying on the job. Efforts to maintain workability throughout a worker's working life are thus seen as the key to a good life in retirement. Perceived work ability (PWA) is also an important point. According to McGonagle et al. (2022), this characterises the relationship between how workers perceive their ability to continue working in their current jobs. PWA can have the strength of a leading indicator at points of worker absence or retirement.

Another essential concept is the Work Ability Index (WAI). According to Ronchese et al. (2023), this can be considered a tool that measures the workability of employees. Workability can be influenced by individual factors such as work-life balance, lifestyle or work environment. Mateo Rodríguez et al. (2021) consider the work ability index the

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most used method in measuring workability. He adds that it comprises a combination of self-assessed work ability, diagnoses and absenteeism. Ezzatvar et al. (2021) add that this index relies on different spheres of the employee's life, such as the organisation of the structure of their work or the work environment where the employee is located. They also argue that it is pretty highly age-dependent, and Rieker et al. (2023) are inclined to suggest that a lower level of the Work Capability Index may be related to a longer duration of incapacity for work, early retirement or even an increased risk of premature death of the employee.

The related notion of the old-age dependency ratio also appears in this context. According to Skirbekk et al. (2022), the old-age dependency ratio measures the ratio of people aged 65 and over to people of working age, i.e., those aged between 20 and 64. Romp & Beetsma (2023) argue that people over 15 can already be included in the working-age population. „Flying Responsibly“ (2024) favours the old-age dependency ratio methodology to compare people aged 65 and over with the working population between 20 and 64.

The old-age dependency ratio, as reported by Kämpfen et al. (2020), is also known by the acronym OADR. They also talk about the fact that these are fundamental demographic indicators of the potential challenges and opportunities associated with old age in a given population. Soukupova et al. (2024) add that this indicator is essential in measuring population ageing.

Šetek (2021) argues that the old-age dependency ratio may double by 2100. Emerson et al. (2024) say a high old-age dependency ratio may drag future growth. According to the authors, education could help, as they argue a positive relationship between education and development. If the old-age dependency ratio is high in a population, there is low investment in education and, therefore, in human capital, which the authors argue is critical to growth. This is confirmed by Jedwab et al. (2021), who also say that a high old-age dependency ratio can lead to slower economic growth.

The impact of ageing on companies themselves then presents several realities. Ranasinghe et al. (2023) discuss that ageing is associated with declining physical abilities and a decrease in cognitive function and adaptability, affecting an individual's ability to perform at work. Therefore, they recommend that employers put in place appropriate measures to ensure better employee health and safety. Blomé et al. (2020) argue that there may be a slight decline in the productivity of older workers. The authors further describe older employees as being more loyal to the company and having a negative attitude towards new technologies. According to the authors, ageing can also be beneficial in terms of higher managerial skills or adherence to work ethic. Kollmann et al. (2020) add that older employees experience fewer negative emotions and also experience limited time. From a management perspective, motivation changes for these older employees or goal setting should be more short-term.

2 Methods

This study aims to analyse demographic indicators in the Czech Republic, focusing on population ageing in individual regions and districts. Specifically, the study uses old-age dependency ratio (ODR) and young-age dependency ratio (YDR) indicators to identify areas with the highest and lowest values of these indicators. At the same time, we try to understand and analyse the factors contributing to the differences in demographic structure between these regions. To achieve this goal, we set two main research questions. The first question is which regions in the Czech Republic have the highest and lowest ODR and YDR values. The second question is, what are the main factors influencing the differences in demographic structure between regions with high and low values of these indicators?

The data for this analysis were obtained from the EUROSTAT (2024) and Czech Statistical Office (CZSO) (2024) databases. We focused on data from 2023 to ensure that the results of our study are as relevant as possible to current demographic trends. First, a descriptive statistical analysis was carried out based on the representation in individual regions of the ratio of persons over 65 and under 14 years of age and the number of persons between these years. For the article, we have leaned towards the Romp and Beetsma methodology (2023) due to the increasingly common involvement in the work process of people between 15-20 years of age in the Czech Republic.

Subsequently, we calculated the necessary ratio indicators for ODRs and YDRs, which best reflect the ratio of dependent age groups to the working-age population. Based on the results obtained, an analysis of selected regions was carried out in terms of economic, social and geographical factors better to understand the causes of differences in demographic structure.

The results of our analysis are presented using graphs and tables that visualise the ODR and YDR values for each region. These visualisations allow us to compare demographic trends between regions better. We focused on visualising

the differences between areas with extreme values, which helped us identify the key factors influencing demographic structure.

It is essential to mention that the availability and accuracy of data from public databases limits our study. Furthermore, we focus only on demographic indicators, so we do not include all possible factors influencing population ageing.

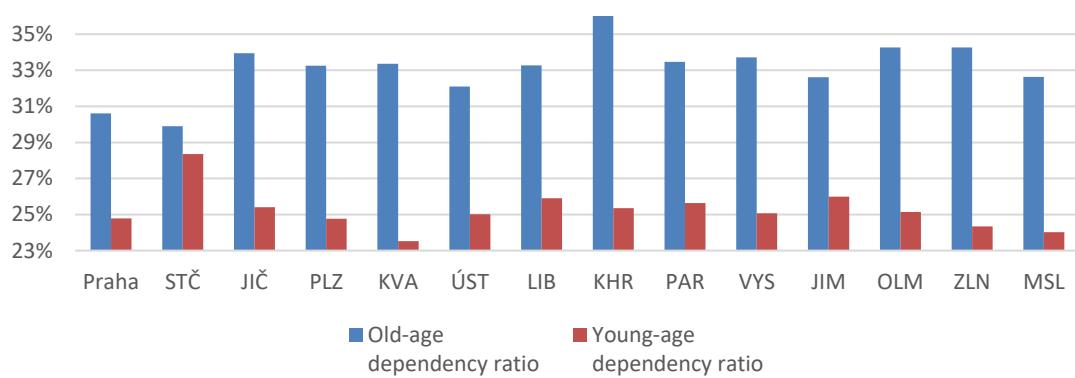
3 Research results

The Results chapter is devoted to an overview of demographic trends in the Czech Republic, with a particular focus on the region of South Bohemia. An analysis of the old-age dependency ratio (ODR) and young-age dependency ratio (YDR) reveals significant differences between areas, which can have important implications for socio-economic stability and the sustainability of enterprises in these areas. Special attention is paid to South Bohemia, where some regions, such as Písek or Jindřichův Hradec, face a significant ageing population, which affects the availability of labour and poses a challenge for local businesses. This chapter focuses on identifying the regions with the highest and lowest values and analysing the factors contributing to these demographic disparities.

The Czech Republic (Czechia) is somewhat more balanced, with an old-age dependency ratio of around 32%, which is lower than the EU average. The young-age dependency ratio in the Czech Republic is around 25%, which is relatively high compared to other countries such as Germany 20%, Austria 20%, and Poland 23%. This suggests that the Czech Republic, like many different European countries, is facing challenges related to population ageing. Still, the situation is not as critical as in other parts of Europe. Demographic trends in the Czech Republic reveal various challenges and opportunities across regions, as seen in Figure 2. Analyzing the old-age dependency ratio (ODR) and young-age dependency ratio (YDR) provides valuable insight into population ageing and its impact on regional development.

In Prague, ODR is 31% and YDR 25%, indicating a relatively balanced proportion of the older and younger population. With its attractiveness to young workers and families, the capital maintains a stable demographic structure. However, a slight predominance of older residents poses a potential health and social services challenge. Similarly, the Central Bohemian Region has an ODR of 30% and a YDR of 28%, indicating a younger population, probably due to affordable housing near Prague. The Hradec Králové Region, with the highest ODR in the country (36%), is an example of a region with a significantly ageing population. This demographic development may result from the migration of the younger population to dynamically developing areas, which leaves the older generations in the region without sufficient support from the younger population. The South Bohemian (ODR 34%, YDR 25%) and Plzeň (ODR 33%, YDR 25%) show similar trends, suggesting a lack of stimulation to attract and retain younger residents. The same applies to regions such as the Liberec Region (ODR 33%, YDR 26%) and the South Moravian Region (ODR 33%, YDR 26%), which also show a higher proportion of older and younger populations, which, however, from the national average, may indicate a specific stability and balance between generations. These regions have a particular capacity to retain young people, which is crucial for their future development.

Figure 1 Young-age dependency and Old-age dependency ratio in Czech Republic regions

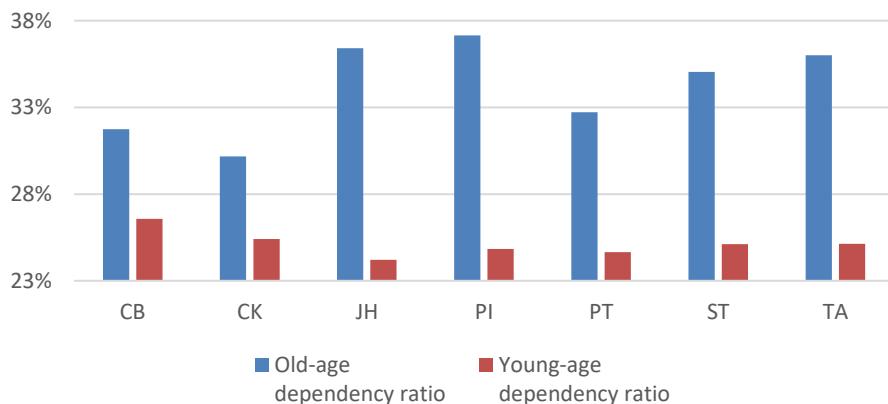


Source: Own processing

Figure 2 focuses specifically on this region to meet the needs of the Inproforum conference held in South Bohemia. České Budějovice (CB) has an ODR of 32% and a YDR of 27%, indicating a relatively balanced proportion of the older and younger population. The region has a slightly higher proportion of younger residents than other areas, which can be an advantage for the city regarding long-term population sustainability. This effect is undoubtedly due to the status of a

regional and university city. On the other hand, Český Krumlov (CK), with an ODR of 30% and a YDR of 25%, has a lower proportion of the older population and an average share of younger people. Known for its historic centre and UNESCO-listed castle, this region attracts many tourists, which affects the local economy. However, the high dependence on tourism means that many job opportunities are seasonal, which can limit the stability of the labour market and the availability of affordable housing for young families. Jindřichův Hradec (JH), with an ODR of 36% and a YDR of 24%, has a higher proportion of older residents, which indicates an ageing population. Unlike Český Krumlov, however, its economy is more diversified, including industry, trade and services. This provides more stable job opportunities, which can be attractive to younger residents. Lower real estate prices compared to tourist-attractive locations such as Český Krumlov make Jindřichův Hradec more accessible to young families.

Figure 2 Young-age dependency and Old-age dependency ratio in the South Bohemian region



Source: own processing

Another region is Písek (PI), where the ODR reaches 37% and the YDR 25%. This region has the highest proportion of elderly inhabitants, which indicates a significant ageing population. The high proportion of older people may reflect a lack of opportunities for young people moving from the region in search of better opportunities.

When comparing Český Krumlov and Jindřichův Hradec, it is clear that while the former is an attractive tourist destination with higher housing prices and seasonal job opportunities, the latter offers more stable economic conditions and more affordable housing. This combination of factors contributes to the differences in demographic structure between these regions, with Jindřichův Hradec having a more significant potential to attract and retain a younger population.

Strakonice, Prachatice and Tábor face similar demographic challenges. The high proportion of the elderly population in all three regions indicates that these areas may face challenges linked to population ageing, which may hurt their long-term sustainability and economic development. These regions are likely to need to develop strategies to improve economic and social conditions to attract and retain younger generations, thereby mitigating the effects of population ageing and supporting their development for the future.

Overall, regions such as Český Krumlov and Písek face challenges associated with population ageing. At the same time, Jindřichův Hradec shows more excellent demographic stability, which could support long-term development and attract young families looking for favourable living conditions. This data is crucial for understanding demographic trends and can serve as a basis for planning social and economic strategies in individual regions.

4 Conclusions

Based on the analysed demographic trends in the Czech Republic, especially concerning the old-age dependency ratio (ODR) and young-age dependency ratio (YDR), it is clear that population ageing poses a significant challenge for social systems and businesses across different regions. As the data show, areas with a high proportion of older populations, such as Písek or Jindřichův Hradec, are facing significant demographic changes that can lead to an acute shortage of labour.

Businesses in these areas have to contend with several key challenges. The first is the shrinking base of the young workforce, which complicates recruitment and threatens the long-term sustainability of businesses. Young people often migrate to larger cities such as Prague or Brno in search of better job opportunities, which leads to an outflow of talent

from regions with higher ODRs. This trend leaves an older population in these regions that can no longer perform more demanding work tasks, which can directly affect local companies' productivity and competitiveness.

Another problem is the lack of investment in education and training in regions with a high proportion of older populations. Businesses may have limited access to modern skills and technology because the younger generation, which brings innovation and new approaches, is either not present in the region or only in limited numbers. This leads to stagnation and the limited ability of companies to adapt to new market conditions. This can be seen, for example, in the number of secondary schools in the Jindřichův Hradec district, where there are only 13, including three grammar schools. In contrast, 31 secondary schools and 9 grammar schools are in the České Budějovice district. The České Budějovice district has the highest YDR values, while the JH district has the lowest (*Rejstřík škol*, 2024).

In addition, in areas with high ODR, such as Jindřichův Hradec or Písek, retaining existing employees cannot be easy. A higher proportion of the older population also means higher retirement rates, which further reduces workforce availability. This forces businesses to rethink their HR management strategies, including finding ways to extend older employees' working lives or introduce flexible working arrangements that could attract back younger workers, for example, through teleworking or the provision of part-time work. In 2020, 10.9% of employees aged 15-24 and 4.6% of employees aged 25-49 worked part-time. In 2022, these numbers increase to 15.4% (15-24 years) and 6.1% (25-49 years) (*Part-Time Employment / CEDEFOP*, 2020). The part-time trend is really clear and companies should encourage it even more. Another way to support the attractiveness not only of the company but also of the region is undoubtedly company benefits aimed at supporting young families. These benefits can include childcare allowances, company nurseries, family insurance or time off for family matters.

On the other hand, regions with relatively low ODR and higher YDR, such as Prague East, can provide a specific pattern for different areas. These regions attract young families thanks to affordable housing, quality infrastructure and good access to job opportunities, leading to more sustainable demographic developments. Firms in these regions can benefit from a larger workforce while benefiting from a higher share of the working-age population, contributing to higher productivity and innovation.

Overall, demographic trends, as described in this article, directly impact businesses, especially in terms of labour availability. Businesses in regions with high ODR will have to face significant challenges and adapt their strategies to maintain competitiveness. This context highlights the need for targeted interventions and policies to support regions with ageing populations, essential to ensure long-term economic stability and growth.

Among the limitations of the paper is that the study is based on data from public databases such as EUROSTAT and the Czech Statistical Office, which may not capture all demographic nuances or recent trends. The accuracy and availability of data may affect the conclusions of the study. At the same time, the analysis focuses primarily on demographic indicators (ODR and YDR) while not including other factors such as economic policies, cultural influences or migration patterns that can significantly affect regional demographics and the sustainability of businesses. While the paper mentions that population ageing poses a challenge for businesses, there is a lack of detailed economic analysis of the impacts on productivity, innovation and investment in individual regions. The article focuses only on the current state of demographic trends. Still, it does not provide long-term forecasts that could better reveal future developments and allow for planning strategies to mitigate the negative impacts of population ageing. All these aspects offer opportunities for future research and the extension of scientific knowledge.

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Sustainability and Efficiency in Iraq's Cement Factories

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Abstract: Currently, the cement industry is responsible for approximately 8% of global CO2 emissions and as such faces severe environmental constraints despite its importance for infrastructure development. Manufacturing of cement, including in the Republic of Iraq, will have a significant role to play in post-conflict economic recovery. Profiling of strategic management practices to improve sustainability and efficiency in the cement factories of Iraq: A focus group study to assess the level of implementation of sustainability practices and their associations with operational efficiency (e.g., CO2 emissions reduction, energy usage). This study used a mixed-methods approach combining quantitative analysis of data from 19 cement factories and qualitative interviews with key decision-makers. Quantitative data was collected on sustainability performance, energy outcomes, emissions, and operational efficiency, while qualitative insights were provided through semi-structured interviews exploring participants' attitudes towards sustainability as well as barriers to strategic implementation. The potential prevalent usage of waste management systems (100%), energy efficiency measures (79%), and alternative fuel usage (63%) is shown in the results. There are water conservation strategies in only 37% of factories. Improved energy efficiency was highly correlated ($r = 0.72$) with the adoption of sustainability practices. Manufacturers that continued investing in energy-saving features, such as heat recovery systems and alternative fuels, are now using significantly less electricity and producing fewer greenhouse gases per manufactured unit. While these sustainable practices are meant to clear a path for improvements regarding environmental and operational outcomes, challenges exist in the forms of high implementation costs and lack of technical expertise that hinder worldwide adoption. There needs to be a concerted effort between key players in industry and government to tackle these problems head-on if Iraq's cement industry is to remain sustainable for the long term.

Keywords: Cement industry, sustainability practices, energy efficiency, strategic management, Iraq.

JEL Classification: L61, Q01, M10, O53

1 Introduction

The worldwide initiative for sustainability is reshaping industries, especially those with considerable environmental impacts, such as cement production. This industry, which is responsible for around 8% of worldwide CO2 emissions, is under increasing pressure to adopt more sustainable practices (Andrew, 2018). The manufacture of cement, crucial for infrastructure development, is energy-intensive and significantly contributes to environmental degradation. In Iraq, where cement production is essential for economic development and post-conflict reconstruction, it is imperative to tackle these challenges for long-term industrial sustainability.

Iraq, with its rich natural resources, is strategically positioned for cement manufacturing. However, similar to most developing countries, it confronts a dual challenge: fostering industrial expansion while minimizing environmental damage. This paper examines how strategic management practices might assist Iraq's cement manufacturers achieve both sustainability and efficiency, thereby ensuring the industry's long-term viability in a dynamic global environment. Sustainability is becoming a fundamental component of corporate strategy rather than an isolated concern. Bastas (2021) observed that sustainable technologies and processes in manufacturing enhance resource efficiency and reducing environmental impact, thereby reconciling profitability with sustainability objectives. For resource-dependent industries such as cement, the adoption of sustainable practices is crucial for maintaining profitability and adhering to increasing

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environmental standards. In Iraq, where cement industry is crucial to the national economy, especially in infrastructure development, sustainability must be included into strategic management procedures.

The cement sector in Iraq, like its international counterparts, must reduce its environmental impact to sustain viability. Benn, Edwards, and Williams (2018) promote a triple bottom line framework for strategic management that encompasses environmental, social, and economic aspects. Iraq's cement manufacturers must reduce emissions, enhance energy efficiency, and optimize resource utilization, while simultaneously benefiting local communities through job creation and adherence to environmental standards. The implementation of clean technologies is one of the most successful ways for reducing the environmental impact of cement production. Alternative fuels, including waste incineration for power generation, can significantly reduce carbon emissions. Additionally, enhancing kilns and integrating heat recovery systems can improve energy efficiency. Technological advancements are crucial for countries like Iraq, where energy consumption is elevated, and environmental issues are escalating.

Efficiency, closely associated with sustainability, is a primary emphasis for the cement industry. Effective resource utilization not only reduces waste but also enhances productivity, supporting both environmental and economic objectives. Lean management approaches, which aimed at eliminating inefficiencies in production, have demonstrated efficacy across diverse industries and may provide analogous advantages to cement manufacturing. By minimizing waste and optimizing supply chain management, lean practices can enhance both productivity and sustainability in Iraq's cement factories. Technological innovations, including automation, data analytics, and artificial intelligence (AI), present further prospects to improve efficiency in cement manufacturing. Predictive maintenance technologies, for example, can anticipate equipment breakdowns, thereby minimizing downtime and enhancing operational efficiency. AI-powered optimization tools can evaluate extensive datasets to identify inefficiencies in production processes, allowing managers to make data-driven decisions that improve both productivity and environmental performance. These improvements could provide a competitive advantage to Iraq's cement sector while addressing sustainability issues.

Despite the potential advantages of these technologies, Iraq's cement factories encounter difficulties in complying with international environmental regulations. Investing in innovative technology and prioritizing sustainability in management practices are crucial for addressing these difficulties. Porter's (1985) theory of competitive advantage underscores the necessity of including environmental and efficiency factors into strategic planning. Organizations that implement such strategies are more inclined to dominate their sectors in the long run. This strategy not only advances environmental objectives but also enhances the industry's standing in a progressively competitive global marketplace. In Iraq, attaining sustainable cement production is both a problem and an opportunity, necessitating a collaborative endeavor between industry executives and politicians.

2 Methods

This study used a mixed-methods research design, integrating both quantitative and qualitative approaches to examine sustainability and efficiency in the strategic management practices of cement factories in Iraq. The mixed-method approach facilitates a comprehensive understanding of complexity management strategies while enabling the empirical data collection necessary for the statistical analysis of sustainability and efficiency changes across time.

The quantitative part encompasses the collection of data from 19 out of 22 cement factories in Iraq. The collected indicators include output, energy consumption, emissions, and resource efficiency. The objective is to assess the impact of strategic management practices on environmental and operational performance. These are evaluated against data to establish a correlation between sustainable management methods and enhancements in manufacturing performance, encompassing energy usage and emissions reductions.

The qualitative component relies on engagement with key decision-makers in the cement factories. Semi-structured interviews were conducted with a group of managers, environmental officers, and strategic planners to investigate their perspectives on sustainability, operational challenges, and the strategic decision-making process. The interviews collected data on the integration of sustainability and efficiency within the factories' comprehensive management processes.

Nineteen cement factories were chosen for quantitative analysis, representing most of the Iraq's cement industry. The selection criteria include manufacturing capacity, technological expertise and application, and involvement in environmental activities. This list includes both privately owned and state-operated factories, offering a thorough examination of industry-wide strategic management concerning sustainability.

Purposive sampling was employed to choose 25 key decision-makers from 19 cement factories for the qualitative analysis. The sample includes general managers, production managers, environmental officers, and strategic planners engaged in formulating and executing strategic management practices, specifically concerning sustainability and operational efficiency. The sample size was determined using the idea of data saturation to guarantee thorough data representing diverse perspectives.

Structured questionnaires were distributed to collect quantitative data from the 19 cement factories. The survey addressed sustainability and efficiency measures, encompassing energy consumption, waste management, emissions control, and resource utilization. Data focused on operational performance and sustainability results, facilitating quantitative analysis.

Interviews with executives from the selected cement factories examined strategic decision-making, obstacles in implementing sustainability initiatives, and perceived advantages of adopting sustainable practices. Interviews spanned 60 to 90 minutes, and transcripts were analyzed for reoccurring topics pertaining to strategic management and sustainability.

Alongside primary data, secondary data were obtained from government reports, industry publications, and environmental records to contextualize and enhance the credibility of qualitative observations.

Descriptive statistics summarized the characteristics of the cement plants and their sustainability policies. Inferential statistical techniques, including correlation and regression analysis, were utilized through SPSS software to assess the impact of adopting sustainable management practices on operational efficiency and environmental consequences, such as energy saving.

Thematic analysis was employed to examine the interview data, highlighting main themes related to sustainability, strategic management, and operational efficiency. The analysis examined the implementation of strategic management practices and the challenges encountered by managers in Iraq's cement industry.

All participants granted informed consent before engaging in the study. Confidentiality was preserved by anonymizing identifiable information in the final report. The study was conducted in compliance with the ethical standards set forth by the Iraqi Government and the relevant academic institution. The ethical concerns guaranteed that the research was conducted with regard for participants' privacy and the integrity of the data obtained.

3 Results

Adoption of Sustainability Practices

The analysis of sustainability practices in 19 cement factories across Iraq highlights different levels of adoption in critical sustainability domains. Waste management systems have been universally adopted, with all factories applying these practices due to regulatory demands and an increasing emphasis on environmental stewardship. A total of 79% of industries have implemented energy efficiency measures, indicating substantial knowledge of the financial and environmental benefits associated with decreased energy consumption. Manufacturers have progressively acknowledged the significance of energy efficiency in minimizing expenses and emissions. Approximately 58% of plants have implemented measures to decrease emissions, indicating moderate but increasing efforts to address the environmental effects of cement production. Fifty-three percent of manufacturers have implemented employee training on sustainability, reflecting an increasing but still constrained effort to cultivate a proficient workforce in sustainable operations.

Nonetheless, merely 37% of factories have adopted water conservation techniques, highlighting a continual challenge in prioritizing water efficiency, potentially due to the absence of immediate financial incentives. The utilization of alternative fuels has achieved a moderate adoption rate of 63%, indicating a collective industry initiative to reduce dependence on fossil fuels and investigate sustainable energy sources. Although sustainable measures such as waste management and energy efficiency are widely adopted, sectors like water conservation and emission reduction require broader adoption within Iraq's cement industry.

Barriers to Adoption

The cement factories encountered multiple obstacles in implementing sustainability practices, reflecting those previously observed in Iraq. Interviews with managers from the 19 factories revealed that high implementation costs are the predominant barrier, with 74% identifying it as a primary concern. These expenses constrain the factories' capacity to

invest in eco-friendly technologies and sustainable practices. A deficiency in technical expertise constituted a considerable barrier, as 63% of respondents indicated challenges in managing and operating advanced sustainability systems. The shortage of qualified individuals in energy management and sustainable production hinders the implementation of environmentally friendly techniques. Fifty-two percent of managers cited insufficient government incentives, suggesting that although regulatory support is present, it fails to adequately mitigate the substantial initial expenses associated with sustainability programs. Moreover, 41% of industries encounter difficulties in obtaining alternative fuels, impeding their transition from conventional, less sustainable energy sources. Fifty-seven percent of managers identified infrastructure problems, citing insufficient waste management systems that hinder efficient processing and recycling of materials. Approximately 48% of respondents recognized the procurement of sustainable materials as a barrier, indicating broader obstacles in incorporating environmentally sustainable inputs into production methodologies.

Efficiency in Operation

The data reveals significant variations in the extent to which organizations have implemented sustainability practices that directly influence operational efficiency. There are 17 small-scale factories, however only a limited number of mid-scale factories, specifically Factory 1 and Factory 5, are considered energy efficient, exhibiting energy consumption rates of approximately 95 kWh/ton and 90 kWh/ton, respectively. These factories have implemented contemporary technologies such as kiln heat recovery systems and process automation, markedly decreasing their energy consumption. Conversely, less energy-efficient factories, specifically Factory 17 and Factory 19, recorded energy consumption levels of 130 kWh/ton and 140 kWh/ton, respectively. These operations incur higher costs and utilize more energy, leading to a larger environmental impact compared to analogous factories utilizing contemporary technology and sustainability attributes. The research demonstrates a strong correlation between sustainability initiatives and operational performance. Factories with high energy efficiency ratings have invested in greener technologies and intelligent management strategies to minimize energy consumption. This not only reduces production costs but also lowers environmental impact, fostering long-term sustainability within the industry. Factories that have not yet adopted these techniques continue to encounter elevated energy consumption rates, impacting their efficiency. The study's data indicates a substantial correlation between the implementation of sustainability and enhanced energy efficiency, underscoring the importance of sustainable practices.

Correlation between Sustainability and Efficiency

A significant correlation was found between sustainability practices and energy efficiency, indicated by a Pearson correlation coefficient of $r = 0.72$. This suggests that factories with stronger environmental practices are generally more energy efficient. Optimal energy efficiency levels were noted in industries with advanced sustainability frameworks that focus on emissions reduction, resource optimization, and the implementation of cleaner technology. The data indicates that as factories adopt environmentally sustainable practices, they optimize their operations and attain cost-efficient output. This correlation highlights the two advantages of sustainable management practices: environmental improvements and increased operational efficiency. Factories that aggressively implement sustainability initiatives surpass others with fewer measures, utilizing less energy per unit of production. The results substantiate the notion that although investing in sustainability may incur initial expenses, it ultimately yields long-term savings and financial gains. Moreover, sustainability serves as a strategic instrument to enhance the competitiveness of Iraq. A research of 19 cement factories indicated a clear correlation between sustainability initiatives and operational efficiency. The implementation of sustainability strategies markedly enhances energy efficiency. In the six-factory regression, sustainability measures had a negative correlation with energy consumption; nonetheless, they were insufficient: each extra sustainability measure corresponds to a net reduction of 5.3 kWh per ton of cement produced, as anticipated. The link is represented by the equation: $\text{Efficiency (kWh/ton)} = 120 - 5.3 * (\text{Sustainability Measures})$. This equation forecasts that a facility disregarding sustainability would necessitate 120 kWh per ton of cement. Energy consumption decreases by 5.3 kWh for each additional liter. If a factory implements three measures, its energy usage would be 104.1 kWh per ton. An R-squared value of 0.64 indicates that 64% of the variance in energy consumption is attributable to the number of sustainability initiatives implemented, demonstrating a strong association between sustainability and operational efficiency. The study findings underscore the necessity of integrating sustainability as a crucial aspect of operational excellence within the cement sector.

4 Limitations of the Study

While the findings provide valuable insights, this study has some limitations. Key socio-economic factors, such as workforce skills and regulatory frameworks, were not included in the analysis. These factors may have influenced the adoption of sustainable practices and operational efficiency. Additionally, the study focused on technical and environmental dimensions of sustainability, leaving economic and social aspects relatively unexplored. Future research could address these limitations by incorporating a broader range of variables and conducting longitudinal studies to better capture changes over time.

5 Conclusion

The sustainability initiatives have significant impact on environmental and operational performances of Industry. The adoption of waste management systems across the board demonstrates that the sector has understood the need to diminish pollution; energy-efficient practices are conducted by 83% of factories, representing a growing recognition of the cost benefits from reduced energy consumption. However, gaps remain, particularly in water conservation, as only 33% of factories manage their water resources. This highlights the need for a more holistic approach to sustainably improve efficiencies. Investments in sustainability reduce energy consumption and improve operational performance, with a strong positive relationship between the number of energy efficiency measures implemented and sustainability actions taken. Factories that also adopted alternative fuels and emission reduction technologies saw their CO2 emissions decrease by an impressive 35%, demonstrating the potential for lowering environmental concerns through these steps. Despite these benefits, the study revealed significant challenges to sustainability adoption, including high initial and maintenance costs, a lack of expertise, and insufficient government incentives. To address these challenges, combined efforts from industry leaders and policymakers are required to provide both financial and technical support. The findings of this study have significant implications for practice and policy. Policymakers could use these results to develop strategies aimed at incentivizing the adoption of energy-efficient technologies and sustainable practices within the cement industry. Industry stakeholders can leverage the insights to identify critical areas for reducing carbon emissions and enhancing resource efficiency, ultimately contributing to Iraq's sustainable development goals. The sustainable strategic management of cement factories is essential for preserving environmental sustainability in this sector while safeguarding competitiveness and operational capacities over the long term.

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Hybrid Work Models and Their Impact on Burnout and Employee Autonomy

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Abstract: Employee burnout has become a global issue with significant implications for both individuals and organizations. With the emergence of new work arrangements, the question of how these new work models and increased levels of employee autonomy affect burnout rates has become a focal point for businesses. Understanding the relationships between these factors is essential for developing effective strategies to prevent burnout, promote well-being, and enhance job performance. This paper provides a systematic review of the literature on the impact of hybrid work arrangements and the degree of autonomy among employees working in these arrangements on burnout. Based on a systematic review of the literature, we identified and examined three main areas of current research: (1) the impact of work arrangements on employee burnout, (2) the impact of autonomy in performing employee tasks on their burnout, and (3) methods and tools to reduce employee burnout rates. This systematic literature review provides a framework for future research in this area and identifies gaps that require further attention, such as examining the direct impacts of autonomy in multiple areas on employee burnout, as this area has not been sufficiently explored.

Keywords: burnout, autonomy, hybrid work models, employee satisfaction.

JEL Classification: I31, M12, J28

1 Introduction

The COVID-19 pandemic, triggered by the coronavirus, has had a profound and widespread impact on the global economy and society (ManpowerGroup, 2020). Its adverse effects have been felt across the board, from developed to developing nations. (Siddiquei & Khan, 2020; Besenyő & Kármán, 2020).

The COVID-19 pandemic has shifted companies' focus towards remote work (outside the office) (Orsini & Rodrigues, 2020). To overcome the various obstacles caused by COVID-19, most companies had to adopt a form of remote work protocol. This was done to ensure continued productivity and minimize the risk of infection and virus spread (Chong et al., 2020). Several studies confirm that countries, regions, industries, and companies that shifted a higher proportion of their employees from office work to remote work reported significantly lower infection rates (Alon et al. 2020, Dingel and Neiman, 2020, Hasan et al., 2021). The widespread use of remote work has also brought about significant changes in organizational work procedures and the means of carrying them out (Donnelly & Johns, 2021). Currently, so-called hybrid work arrangements, which combine working from home with working from the office, are becoming increasingly prominent (Yang et al., 2023). Several authors in their publications have found that hybrid work arrangements have a positive impact on employee work-life balance and firm performance (Rohit et al., 2023, Nugroho, A., Desiana, P., 2024, Siddika, 2024).

Based on these findings, the use of hybrid work models is becoming increasingly popular, also due to the reduction of company costs (Peggy et al., 2022). In connection with the implementation of hybrid work arrangements, the question now arises as to how this new work model and the increased level of employee autonomy affect the level of employee burnout (Höcker et al., 2024, Safira, N., Hanami, Y., & Batubara, M. 2023, Horváthová et al. 2024). It is therefore necessary to consider which jobs will be performed using a hybrid work model and what rules will need to be set so that the hybrid work model is effective for both employees and businesses.

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2 Methods

In this study, we will conduct a systematic literature review following the established framework of Senyo et al. (2019) (further detailed in Table 1)

Table 1 Systematic literature review process

Step 1: Inclusion and exclusion criteria for literature review	Classification: Articles from peer-reviewed journals on the topic of work arrangements	Exclusion: books, book reviews, case studies
Step 2: Literature review	Web of science, Google scholar, Scopus databases	Terms: „Work arrangements“, „Employee well-being“, „Employee burnout“, „Employee autonomy“
Step 3: Refinement of the choice of literary studies	Analysis of articles, excluding studies that did not analyze the impact of work regimes or employee autonomy on the level of employee burnout.	Final sample of articles: 8
Step 4: Analysis of selected articles	Summary of each article, including the goal, concepts, methods, and results.	Article categorization, the impact of hybrid work arrangements and autonomy on employee burnout rates.
Step 5: Presentation of findings	Presentation of a set of articles	Comparative analysis and determining the research gap

Source: Own processing based on Senyo et al. (2019)

The chosen procedure enabled us to extract relevant information from the analyzed articles, revealing existing similarities and differences between them. A systematic literature review proved to be an effective approach for comprehensively mapping and structuring current pressing research areas.

The study was limited to peer-reviewed articles in the field of human resources and management. The procedure followed the recommendations of Watson and Webster (2020) and therefore excluded case studies, book reviews, and books. The key terms used in the literature search included „work arrangements“, „employee well-being“, „employee burnout“, „employee autonomy“, and „job satisfaction.“

In the second phase of the research, articles were screened in databases including Web of Science and Google Scholar. The search criteria were based on the presence of specific keywords in the titles, abstracts, and keywords of the articles. This literature search was undertaken in October 2024.

In the third step, 30 unique articles were identified based on the article title and keywords. In the next step, the abstracts of the selected articles were analyzed to determine whether all articles were relevant and related to the topic of work arrangements and whether the articles examined measures of employee burnout..

To understand and categorize multiple articles, it was necessary to analyze the entire texts contained in the articles. In the first phase, 20 articles were excluded. These articles did not sufficiently analyze the problem under study according to the criteria selected in section 3. Results.

In addition to the articles mentioned above, there were doubts in some cases as to whether they discussed the required facts within the scope of the research problem. Following consultation with a peer researcher, a final set of 8 articles was selected based on a consensus regarding their alignment with the established criteria.

In the penultimate phase, all articles were summarized according to their identification, objective, concept, methods, consequences, and proposals for future research. The literature analysis subsequently resulted in a comprehensive mapping of existing research focused on the impact of work arrangements and autonomy on employee burnout. It allowed

us to conduct a thematic analysis that identified three main research areas: (1) the impact of work arrangements on employee burnout, (2) the impact of employee autonomy in completing tasks on their burnout, and (3) methods and tools for reducing employee burnout.

The next step involved conducting a thematic analysis of the literature and coding the main themes explored in the 8 articles. The themes focused on the main areas and empirical objects described in these articles. Each set of articles dealt with areas such as: (a) the impact of work arrangements on employee burnout, (b) methods and tools for reducing employee burnout, (c) the impact of work arrangements on well-being. An analysis of the available research revealed that only two studies examined the impact of employee autonomy on their burnout level.

A comparative analysis of the three main groups will be conducted following a detailed examination of the selected articles. The research will summarize the findings on the impact of hybrid work arrangements and autonomy on employee burnout and identify potential interventions. This analysis has revealed several avenues for future research. The primary findings of the systematic literature review are presented in the subsequent section, and the implications for future research are discussed in the following chapter.

3 Research results

3.1 A review of research on the impact of work arrangements on employee burnout rates in the company

This research focused on the impact of emerging hybrid work arrangements on employee burnout. The specific work arrangements employees adopt significantly influence their productivity, job satisfaction, and ultimately, their level of burnout. The results indicated that employees working in a hybrid model exhibited lower levels of burnout and higher levels of well-being and performance. These findings suggest that hybrid work arrangements appear to be the most sensible choice for retaining satisfied and high-performing employees, which will lead to long-term organizational success and sustainability

Table 2 Review of literature results

author	the impact of work arrangements on employee burnout	methods and tools for reducing employee burnout
1. Safira et al., 2023	The absence of real social interaction with colleagues contributes to higher burnout rates among remote workers.	Companies must consider which work will be performed in a hybrid model and which remotely, as job positions based on this research directly impact employee well-being and the level of employee burnout.
2. Azizan et al., 2024	Hybrid work models have been most effective in reducing burnout among educators.	Teachers should be given the flexibility to choose their work arrangements. However, it is important to recognize that demographics play a significant role in work arrangement choice and burnout levels.
3. Höcker et al., 2024	Remote work and job autonomy have a negative impact on perceived employee burnout. The impact of remote work on perceived burnout is partially mediated by job autonomy.	The implementation of hybrid work has an overall effect on reducing burnout rates, as job autonomy is distributed.
4. Horváthová et al., 2024	Work arrangements have a direct impact on the level of employee burnout in the public sector.	Hybrid work arrangements helped to reduce burnout levels during the pandemic and continue to reduce burnout rates post-pandemic.

author	the impact of work arrangements on employee burnout	methods and tools for reducing employee burnout
5. Perry, 2024	There were no significant differences in job satisfaction or burnout levels across different work arrangements, and no relationships were found based on the other variables included in the study.	By expressing appreciation and increasing the interest of the work, it may be possible to reduce the rate of employee burnout.
6. Raghida et al., 2023	Remote-only workers reported higher levels of burnout than those who combined remote and in-office work.	A hybrid work model has the potential to decrease burnout levels in the humanitarian workforce..
7. Lee et al., 2024	Factors contributing to burnout include: lack of autonomy, frequent work interruptions, repetitive work, and the demand for completing assessments outside of regular working hours.	A hybrid work model will reduce burnout rates because employees will not be under constant pressure. By increasing autonomy, it will be possible to separate employees from the stress caused by the nature of their work.
8. Mucharraz et al., 2024	Burnout levels were higher among remote-working mothers (in leadership positions) compared to office-working mothers.	The hybrid work model, combining remote and in-office work, has been shown to decrease burnout rates among working mothers, while also providing theoretical and empirical insights into burnout levels among women in leadership positions.

Source: Own processing based on the authors'

4 Conclusions

Studies on job burnout, which is not a recent phenomenon, have intensified since COVID-19 forced most people to work from home. With most companies now adopting hybrid work arrangements, the unpreparedness for remote work has pushed many employees to their physical and mental limits, ultimately leading to higher burnout rates among remote-only workers..

Systematic literature review on the topic has revealed a direct correlation between work arrangements and employee burnout rates across various sectors. Remote work has been identified as a primary contributor to increased burnout levels, as employees often postpone their duties until they reach a point of no return. Consequently, most researchers in this field advocate for hybrid work arrangements as a means to reduce burnout rates. These arrangements allow employees to negotiate with their employers the proportion of time spent working remotely and in the office. This is based on the finding that employees require in-person interaction with colleagues, which positively impacts burnout levels. However, author Perry (2024) argues that work arrangements do not influence burnout rates and suggests that recognition and job enrichment are more effective strategies for reducing burnout.

An analysis of data from available research indicates that only Höcker et al. (2024) and Lee et al. (2024) explored the impact of employee autonomy. However, their perspectives on the influence of autonomy on employee burnout diverge. Höcker et al. (2024) argue in their publication that job autonomy has a negative impact on employee burnout, suggesting that the higher the degree of autonomy, the higher the level of burnout. In contrast, Lee et al. (2024) propose that lack of autonomy is one of the factors contributing to increased rates of employee burnout.

Based on these findings, we can conclude that implementing hybrid work arrangements should contribute to improved mental health among employees. However, it is essential to consider which job roles are suitable for hybrid work and which generations of employees would benefit most from such arrangements.

4.1 Suggestions for further research

The emergence of hybrid work arrangements is a relatively recent phenomenon (since the outbreak of the pandemic). There is currently a limited amount of research examining the impact of work arrangements and employee autonomy on burnout levels. Currently, no research has been conducted in Slovakia to address this issue. Therefore, it would be justified to focus on the impact of work arrangements on employee burnout rates in Slovakia."

A review of the literature revealed only two studies that examined the relationship between employee autonomy and burnout. Given the contradictory findings of these studies, there is a clear need for further research to address this gap in the literature.

Now that hybrid working arrangements are becoming part of companies' working regimes, it might be a good direction to also focus on how new working regimes can influence the change of managerial functions in companies in the long run.

We believe that the findings of this study will shed light on the impact of work arrangements on employee burnout rates and help to develop proactive measures that employers can implement to ensure effective job performance without compromising employees' mental health. This research will be valuable not only for the arts, humanities, and social sciences but also for other fields, particularly human resources and psychology, as they strive to develop new designs to create a balanced work and personal life.

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A Systematic Review of Theory on Corporate Culture as a Retention Tool

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Abstract: The study provides a systematic review of theory surrounding corporate culture as an employee retention tool. We define corporate culture as an informal institution characterized by behavioral patterns reinforced by people and events. The research focused on theoretical approaches and concepts related to corporate culture. It explores how different concepts and tools influence employee retention in companies. The primary objective of the study is to examine how corporate culture can influence employee loyalty, satisfaction, commitment and job performance, and how it can be used in mitigating employee turnover. The analysis includes theoretical models highlighting factors such as values, behaviors, communication, or interactions across the enterprise and their relationship to employee motivation and retention. The systematic approach covered the analysis of scholarly and professional articles, various academic databases and publications that contained relevant information within the field of corporate culture and its impact on the work environment. The results indicated that the existence of a strong corporate culture in a company, in the context of building a positive work environment, promotes employee satisfaction and increases employee loyalty to the company. The study concludes with a framework for future research in the area and recommendations for managers in the need to strategically build a strong corporate culture that acts as a tool for achieving higher employee engagement, satisfaction and performance. In turn, it minimizes human capital turnover.

Keywords: corporate culture, workplace culture, employee retention, work environment, work-life balance

JEL Classification: G32

1 Introduction

Corporate culture drives the value of the business. It consists of the values and norms promoted by the people in the company. Culture in the work environment is important to the company and is ranked as one of the main factors that increase the value of the company (Graham et al., 2022). For any company to be successful, a great deal of motivation is needed. Motivation is the driving force of employees. Motivation is demonstrated by the desire to go the extra mile. For people to do the job right, they must be properly motivated. The overall performance of a business is directly related to the level of motivation of those who work there. Motivation is supported by work culture. A work environment in which friendly relationships and social support are fostered. Various events and the friendly presence of managers allow workers to connect informally, get to know each other better, build friendships and thus create a friendly culture in the company. This contributes to strong employee motivation (Ushakov and Shatila., 2021).

Corporate culture creates values, beliefs, attitudes in employees and shapes their behaviour within the organisation. It also has a direct impact on how individual employees interact with each other and how they approach their work. Ultimately, organisational culture influences the performance of the organisation. The existence of a strong and positive organizational culture can provide a number of benefits to organizational performance, including fostering a sense of unity and shared goals among employees. It advances teamwork, collaboration, and communication (Almerri., 2023).

2 Methods

The study follows the systematic literature review process adopted by Senyo et al. (2019) (see Table. 1):

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Table 1: Process of systematic literature review

Step 1: Parameters for accepting and excluding studies in the process of review	Category: papers from academic journals discussing corporate culture as a retention tool	Not considered: dissertations, reviews of books, case studies
Step 2: Literature research	Web of science, google scholar, Scopus database	Search terms: "corporate culture", "workplace satisfaction", "employee performance", "corporate culture as a retention tool", "company"
Step 3: Narrow down the selection of literature studies	Analysis of selected articles, excluded studies, rejected articles not focused on corporate culture and related issues	Final sample of articles: 15
Step 4: Examination of selected studies	An abstract of each article presenting the goals, principles, methods and results	Classification of articles, positive outcomes of corporate culture and negative consequences related to companies' failure to prioritize corporate culture for employee retention
Step 5: Presentation of results	Presentation of a collection of articles	Comparative analysis

Source: own processing

This approach allowed us to obtain relevant information through the scientific studies reviewed, and it was also possible to identify similarities and differences within the articles used. This is also why our research followed the aforementioned systematic literature review procedure as one of the many well-established methodological approaches for mapping and structuring the pressing areas of investigation.

2.1 Formulating criteria for including and excluding studies

The scope of the research presented was reduced to articles found in peer-reviewed journals in the fields of management, people management and leadership, and human resources. The procedure followed Watson and Webster's (2020) methodology and therefore conference articles, books and reviews are not included. Defined search terms included "corporate culture", "employee retention", "job performance", "job satisfaction", "work environment" or "work-life balance".

2.2 Study of existing literature

As part of the literature study, the first step was to review articles in databases such as Web of Science or Google Scholar, the gist of which was the issue of corporate culture (title, abstract, results, keywords) and contained terms such as "corporate culture", "work environment", "job satisfaction", "job performance-performance". The survey was conducted in October 2024.

2.3 Forming the research sample

The next step was to link the databases from which we drew information. We identified about 35 relevant articles. Then we analysed the abstracts of the selected articles within these databases to see how suitable the articles were for our systematic review. That is, the articles had to be related to the topic of company culture or relate to the work environment and the conditions that such an environment provides for employees based on the established company culture.

In order to include different types of articles, it was necessary to study them. 20 articles were excluded. Although they contained some information suitable for processing, other articles were more valuable for our pro-issue under study according to the criteria chosen in section 2.4. Apart from the articles mentioned above, some did not contain sufficient information or the content of their analysis was not the required facts in the framework of our research. After consultation with another researcher, a consensus was reached in which a final sample of 15 articles that met the required criteria was selected.

2.4 Evaluation of chosen literature

In the penultimate phase, all articles were summarized based on the aim, design, methods, implications and suggestions for further research. This was followed by a comprehensive mapping of the existing literature on corporate culture as a

tool for employee retention, which allowed us to identify three areas of research: (1) corporate values and norms needed to promote employee retention, (2) The role and importance of leadership in shaping corporate culture, and (3) methods and tools for strengthening corporate culture to increase employee retention. These criteria differ from each other in the areas of management, leadership, employee involvement, expected results, and so on. At the same time, however, all of the selected criteria are related to the broader context of the addressed issue of "corporate culture as a tool for employee retention in enterprises", the difference is in their specific characteristics. Consequently, it was a matter of tracking and coding the main themes of the selected articles. The selected themes explored important areas within the analysed articles, such as: (a) the diversity of values and working conditions within different companies, (b) the influence of top management on the creation and shaping of corporate culture, (c) the essentials that are necessary within the work of managers to maintain a positive work environment, (d) the management and leadership of employees, (e) the implications that these essentials bring, and (f) the barriers and new challenges that management, executives, and employees need to overcome in the company's quest for long-term employee retention through the building of a strong and positive corporate culture.

2.5 Revealing the findings

As a final step, after a detailed analysis of the selected group of articles, in section 3, "research results", we compare the three selected groups of criteria and summarize the research on corporate culture as a tool for employee retention. Having accomplished our objective, we offer several options for future research. The most important results of the systematic literature review are presented in the next section of the paper, along with the possibilities for future research that emerged from this analysis.

3 Research results

The research was based on the question of corporate culture and its impact on employee retention. How employees perceive the corporate culture has a very strong impact on their satisfaction, loyalty, productivity or performance. Research has shown that employees who feel the importance of the existence of corporate values and norms, and who also positively perceive the efforts of company management to create a strong employee-oriented corporate culture, report higher levels of satisfaction, well-being, loyalty, productivity or performance. Investing time and resources in creating a strong corporate culture supported by the company's leadership is one of the keys to the success and sustainability of companies.

3.1 Review of the research on corporate culture as a retention tool

The following table provides an overview of the sources and literature related to the issue under study, divided into three categories, according to the three identified research criteria:

Table 2: Review of the research results

Author, author's collective	The corporate values and standards needed to support employee retention	The role and importance of leadership in shaping corporate culture	Methods and tools for strengthening corporate culture in order to increase employee retention
Lehulere, 2017	Trust, flexibility, inclusion, communication, transparency	The importance of pro-employee leaders in the support of equality or inclusion.	Strategies for managing change in organizations or models of corporate culture, such as Cameron's Competing Values Framework.
Cherian, and et al. 2021	Collaboration, communication, participation in decision-making, innovation, creativity and engagement - loyalty, sustainability	The fundamental influence of management on the success of corporate culture. Leadership fostering transparency and employee engagement creates a supportive environment	For example, access to the use of innovation, involvement of employees in decision-making processes, sharing of ideas, inclusion of different cultures - participation
Wang and Huang, 2022	Flexibility, creativity, innovation - promoting long-term high employee performance and retention	The key role of leadership. Shapes corporate culture, adapts employees. Inspirational leadership enhances the positive effects of a flexible corporate culture on employees' innovative abilities.	Support in employee adaptation to change, Diversity within different forms of leadership (transformational or transactional style), Depends on the size and type of business (control culture or flexible) - combination.
Ushakov and Shatila, 2021	A culture that supports employee development (rewards, recognition) - increases motivation and loyalty. Culture of mutual respect and fun - fostering engagement - leads to long-term retention.	The company's management plays a key role in the creation and promotion of the company's values and culture. Encouraging open communication, participation in decision-making processes.	A culture that emphasizes rewards, benefits, recognition, "wrap-arounds" in the workplace - reducing stress, increasing social connectedness, improving job performance.
Almerri, 2023	Norms and values supporting belonging and motivation. A strong culture creates a strongly unified social environment.	Leadership is a key aspect in creating, adapting and sustaining an organisation. Standards and values must be consistent and shared.	Open communication, recognition, the possibility of involvement in decision-making processes.
Sadri and Lees, 2001	Increasing cooperation, information sharing, openness to new ideas, a culture based on trust and friendliness.	Culture directly influences the attractiveness of the employer, so it is the leadership of the company that should be the main determinant of its creation. Leadership is the model for the spread of corporate culture.	Increase the possibility of development and continuous improvement of employees through transparent information. Creating a competitive environment.

Iqbal and et al., 2017	Certainty, collectivism, belonging and co-working - fostering and increasing loyalty and motivation. Positive impact on employee retention.	The organization's leadership shapes and maintains the corporate culture. The way top management interacts with employees forms the basis for the creation of corporate culture.	Providing attractive financial and non-financial benefits, appropriate wages, taking into account the needs of employees.
Murtiningsih, 2019	Principles that incorporate work traditions and values. This affects the way employees are deployed. Social relations and work discipline.	The great role of community leadership.	Involving employees at all levels in decision-making and problem-solving. Remuneration transparency.
Haga, 2024	Employee relations, the perception of a strong corporate culture increases the company's financial performance, satisfaction and sense of security.	Management plays a huge role in the creation of corporate culture and the transition to non-formal control structures. Building and sustaining.	A strong organizational culture results in a reduction in the company's accident rate and creates high loyalty and willingness to stay for employees. Improving relationships and reducing risks.
Tran, 2020	Different types of corporate culture. Fostering teamwork, developing social relationships - leads to loyalty and satisfaction.	Leadership has a key role to play. Through different leadership styles, it creates different corporate cultures (clan or adhocracy and others).	Encouraging teamwork, innovation, and innovation together increases employee satisfaction and retention. Promoting an employee-centred organisational culture. Improving working conditions.

Source: own processing

4 Discussion

Our first criterion for the development of this research paper was the values and standards within corporate culture that are necessary to support employee retention. These values and standards are key elements in the development of a strong corporate culture. The literature itself suggests that elements such as trust, open communication, transparency, flexibility and inclusion (Lehulere, 2017), as well as teamwork, collaboration, innovation and creativity (Cherian et al., 2021) are the building blocks of a positive and strong corporate culture. These are values that are not only the building blocks of a positive and strong corporate culture, but also values that positively influence employee loyalty, commitment, or high job performance, as discussed by Wang and Huang (2022). They also emphasize creativity and innovation as integral to employee retention. Van den Steen (2010) said: "*Corporate culture is then defined as the extent to which members have similar pre-beliefs about the best way of doing things*". Thus, corporate culture is made up of many elements that are crucial to companies, such as norms, values, knowledge and customs (Gorton et al., 2022). A corporate culture that fosters inclusion, respect and belonging increases employee motivation, cohesion and retention (Ushakov and Shatila, 2021). However, if companies have a prevailing environment where these values and norms are lost, this can lead to increased turnover. A strong corporate culture that lays the groundwork for creating a strong sense of belonging contributes to employee retention.

Leadership plays a key role in building and sustaining corporate culture. Top leaders not only build the culture, they spread its values and norms throughout the organization. Focusing on openness of communication, employee involvement in decision-making processes, and employee support all have been linked to positive outcomes in employee satisfaction and retention (Cherian et al., 2021). Moreover, creating an inclusive and motivating environment for employees' long-term involvement in their organization's activities is very important (Ushakov and Shatila, 2021). For leadership to be

effective, it is necessary to be aligned with organizational values so as to create an environment that promotes the sustainability of working capital. As Pathiranage (2020) states, "*Business managers are recommended to establish an effective organizational culture in order to enhance corporate performance*".

There are various ways, methods and strategies through which culture can be built, maintained or disseminated within a company. This can be a culture that focuses on change management, the benefits of innovation or participative ways of decision-making. These types of culture are important in the long-term retention of employees. Tools that can be mentioned include reward system, communication, employee involvement in decision making processes, increase loyalty and satisfaction. One of the most effective tools for enhancing employee satisfaction and retention is transparent communication (Almerri, 2023). Lastly, flexible organizational structures that are able to adapt to employees' needs contribute to reducing turnover by being able to provide employees with a sense of security and belonging (Haga, 2024).

5 Conclusion

In our research, which focused on a systematic review of the literature on corporate culture as a retention tool, we can assess that corporate culture plays an important role in employee retention. The values such as trust, flexibility, inclusion or cooperation that it entails create an environment in which employees feel motivated and loyal. The leadership of the company plays a very important role in this. It shapes, builds and maintains the culture, spreading its values and messages throughout the company. Effective methods of approaching corporate culture, which include innovation, transparent remuneration, participation in the company's activities, contribute to the sustainability of employees.

The world today is in the digital age. The digital transformation of companies is an inevitable strategic change that requires the implementation of an appropriate culture that goes hand in hand with an overarching organization-wide strategy that supports such change. Every organization has a unique corporate culture. Continuous technological advances such as artificial intelligence, machine learning and the Internet of Things are creating a new era of competitive environments within which organizational forms, structures and business models are changing and adapting. Digital culture is becoming an important part of the digital transformation and forms its foundation. It is important to embrace various elements of digital culture in the digital transformation, such as teamwork, digital awareness, agile management, knowledge sharing, digital skills development, continuous learning and development. As a result, companies are able to effectively use digital technologies and improve their performance (Khanzad and Gooyabadi 2022). Digital technologies are producing vast amounts of digitized data that can be a new source of value creation for companies. Such data can be used for forecasting purposes or to identify new trends. Enterprise culture is used in information technology research to facilitate the acceptance and use of new information systems. Applying the concept of organizational culture in a digital context results in a digital organizational culture. It is an understanding of the functioning of an organization in a digital environment that is shared by its members. Such an organizational culture is, according to research, a prerequisite for the adoption of new technologies. Moreover, these technologies act as a catalyst for the development of high value-added activities, provided, however, that an appropriate digital culture is in place (Martínez-Caro et al., 2020). The digitalization of corporate culture is blurring the boundaries between IT and the business sector. Companies are enriching their teams by developing digital skills through integrating IT professionals, collaborating with high-growth and emerging companies or building digital units. As part of digital transformation, companies are implementing values and beliefs that support digital innovation (Duerr et al., 2018).

Thus, the digitization of the workplace highly influences the future of corporate culture creation and its relevance by supporting the transformation of organizational values, structures and processes. Digital technologies provide companies with opportunities for improved collaboration through teamwork, integration of IT and business functions, fostering agility, knowledge and insight sharing, developing digital skills, and enabling employees to gain tremendous flexibility. The result of such a transformation is a digital organizational culture that acts as a catalyst for the implementation and acceptance of new technological opportunities and challenges, as well as the development of high value-added activities. Such a culture can increase the performance of organizations and faster adoption of innovation. For the implementation of an appropriate digital culture, a supporting prerequisite is the transition through a successful digital transformation. It is particularly important for companies to invest time and resources in building a strong corporate culture that contributes to long-term retention of employees.

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Procurement Risk Management as an Assumption of Sustainability in Industrial Enterprise

Peter Pajonk¹, Daniela Rybárová²

Abstract: One of the assumptions of economic sustainability in industrial enterprises is the effective management of material resources necessary to produce their own goods. Procurement risks can seriously threaten the sustainability of production. The aim of this contribution is, through the qualitative and quantitative data analysis, to point out the importance of procurement risk management in the procurement process and also to show the most commonly perceived risks in a period of uncertainty.

Keywords: procurement risk management, sustainability, industrial enterprise

JEL Classification: L21, L25, M11

1 Introduction

Nowadays, we are increasingly faced with the demand for sustainable, continuous production and the creation of multiple added value. This can be fulfilled under the assumption of elimination of risks related to all activities of the industrial enterprise.

Hong, Lee, and Zhang (2018) mention that in general, there are five main risks that occur in procurement process which are demand fluctuation, vague price information, unreliable yield uncertain lead time and disruption risks. Other researchers such as Kita divides procurement risks into risks associated with the relationships with suppliers, risks associated with position of customer in the purchasing market, legislative risks, and image risks (Kita, 2017). If the industrial enterprise is not able to find the required material items on the domestic market, it must purchase abroad. In addition to the procurement or transaction risks already mentioned, there are additional ones related to differences in the economic and legal environment, less availability of information, greater geographical distance, or language and cultural barriers. Ružeková and Pavelka (2023) divide them into three groups: territorial risks, market risks and commercial risks.

PRM (Procurement risk management) is the management of procurement risk through reducing the exposure and uncertainty in price, lead time and demand to ensure continue flow of supply (material, skills, capabilities, facilities) with minimum disruption (Hong, Lee, Zhang, 2018). Pajonk considers procurement risk management to be a summary of the activities and tools used in the entire procurement process, which lead to the prevention of risk but also to the reduction of the level of risk and its impacts (Pajonk, 2024).

There are multiple strategies and instruments of procurement risk management such as supplier diversification, backup sourcing with information updating, integrated sourcing and production decision making or hedging strategy. Constantino and Pellegrino (2023) devoted their research to choosing a procurement strategy from single, dual, or multiple sourcing options. Xing and others (2022) focused on operational and financial hedging and their combination, which produced a synergistic effect.

A financial and economic crisis will significantly change the views of risk management not only within SMEs but also in large companies. Companies of all sizes are now taking an initiative-taking approach to risk management, seeking to centralize risk management and develop integrated management systems (Dvorsky et al. 2021). Corporate sustainability of a company is its ability to identify ESG risks and other types of risks, manage them in the short term, and create conditions for corporate sustainable development (CSD) by maintaining and building up the resource potential, using natural assets, and implementing circular and CSR strategies that reflect the interests of the company's stakeholders and are adapted to the environment in which the company operates (Blinova, Ponomarenko, Knysh, 2022). At the production network level, in promising cases, companies may try to approach to waste streams instead of primary input reserves while implementing a production unit or designing a production network/industrial cluster. Companies may even produce higher amounts of main outputs than the market demand to satisfy the waste demand of another company. Then,

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cooperation becomes more critical particularly in collaborative demand forecasting, trust-development, and design issues (Yazan, Fraccascia, 2020).

2 Methods

Industrial market is characterized by a high heterogeneity therefore we conducted qualitative and also quantitative research. In order to examine relationship between procurement risk and sustainability in detail, we conducted semi-structured interviews. Among five respondents were purchasers and managing directors of industrial companies. We investigated how big was the value of purchased materials. Our interviews focused on identifying all types of procurement risks, their factors, and impacts on industrial enterprises. The aim of quantitative research conducted in sixty-seven engineering companies was to find out the most perceived risks in a period of uncertainty. The results of qualitative and quantitative research lead to proving the need of procurement risk management as an assumption of sustainability in industrial enterprises.

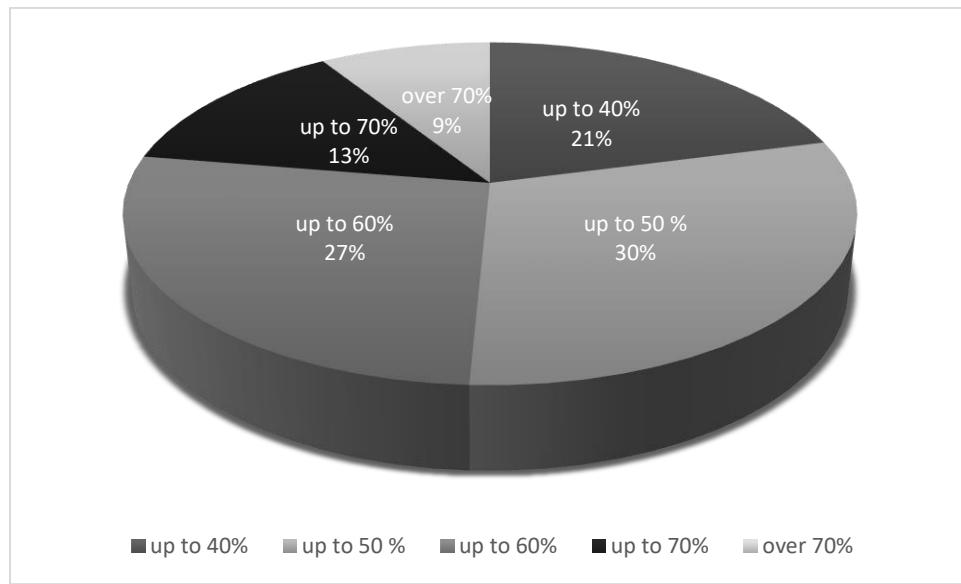
3 Research results

The results of qualitative and quantitative research can be summarized in two areas: importance of procurement in industrial enterprise and procurement risks and their impact on sustainability of industrial enterprise.

3.1 Importance of procurement in industrial enterprise

Depending on the industry and the production process, the value of the purchase can range from 40% to 80% of the value of the manufactured product. The purchase represents certain costs that enterprise must consider when creating the price of the final product. While the procurement of material constitutes the largest value of the final product in an engineering company, the labour costs are low. Vice-versa, in the services, the largest cost item is not the purchased products, but the salary of the employees. What value of the final product in the engineering industry is represented by the purchase of products and services necessary for its production is shown in Figure 1. The value of the purchased material in the value of the final product.

Figure 1 The value of the purchased materials in the value of the final product



Source: Own processing

In 79.1% of Slovak engineering companies, the material purchased represents more than 40% of the value of the final product. In almost half of the enterprises (49.2%), procurement of goods and services accounts for more than 50% of the value of the manufactured product. Fourteen enterprises (20.9%) chose the option up to 40% of the value of the final product. The largest representation was made by companies where the purchasing of material was up to 50%. There were twenty enterprises therefore 30%. This is followed by eighteen enterprises (26.9%) in which the purchase represents less

than 60% of the value of the final product. Enterprises with the largest share of purchases make up only 9% of all enterprises surveyed. For procurement risk management, it is essential to know the share of individual purchased products in the company's overall purchase and their importance in the production process.

Effective and sustainable procurement management starts with a detailed description of the purchased product. Respondents from qualitative research were able to generally characterize products in terms of durability, standard or availability on the market. However, the products must be specified in more detail by experts in the field of construction, technology, and quality. Competent co-workers from other departments of industrial enterprise, such as sales, finance, or production departments, can express their views on defining material needs, the method and time of procurement.

The choice of a supplier is conditioned by the technical side of the product, its availability, price, or procurement costs and communication. A company providing a service in the field of technical production preparation perceives two views of its product, depending on the stage of the product life cycle of its customer. In the case of the product development phase, the customer is aware of the importance of this service provided, but it is interested in the price. If the customer - industrial enterprise has already started production without consultation and generates defective products, what is reducing the sustainability of production, his priority becomes solving his problem as quickly as possible.

3.2 Procurement risks and their impact on sustainability of industrial enterprise

The industrial enterprise purchasing a large number of goods needed for production, therefore company entering a large number of different interorganizational relationships perceives multiple risks from the supplier as well as the customer. These are risks related to the delivery itself, the relationship with the supplier or the market situation. A small business with basic supplier relations sees risks related to the transaction, namely commodity risks and risks of the availability of the required products on the market. Companies buying or selling outside the Slovak Republic, in the case of payment in another currency consider exchange rate loss as the biggest risk. They identified the difference in technical standards used in different countries as important. As shown in Table 1 we can classify the risks into several groups according to their originator or what they concern.

Table 1 Classification of the procurement risks in the industrial enterprise

Classification of the procurement risks in the industrial enterprise	
Group of risks	
Merchandise risks	Delayed delivery
	Incomplete delivery
	Damaged delivery
	Insufficient quality
	Shipping risks
Technical risks	Non-compliance with technical standards
	Changes in customer requirements
Availability risks	Absence of the supplier's production capacity
	Loss of the supplier
	Production delay
Financial risks	Price volatility
	Inflation
Foreign trade risks	Exchange rate risks
	Difference in technical standards
Risks of default	Cancelled delivery
Risks of addiction	Supplier dependency
	Loss of know-how

Source: Own processing

The qualitative research further shows that suppliers perceive technical and merchandise risks, whether their product will meet the customer's requirements and whether it will be compatible with other products entering the customer's production process. They consider failure to pay or delay in payment for the completed delivery. Failure to take over delivery to the customer, dependence on the customer and competition are other factors that suppliers point to.

Most of the mentioned risks are transactional risks. These include commodity or merchandise risks, technical risks, availability risks, financial risks, and foreign trade risks. As relational risks, we can refer to risks of non-fulfilment of obligations and risks of dependence, both on the customer's side and on the supplier's side.

In quantitative research we wanted to know from the interviewed enterprises what risks they encounter most often when procuring products and services necessary to ensure production. Figure 2 shows the perception of procurement risks on Slovak industrial market.

Figure 2 The perception of procurement risks



Source: Own processing

Delayed delivery is considered the most common risk by the enterprises. The number of sixty-six companies expressed their opinion which represents 98.5%. Delayed delivery is related to delayed production, which is considered a risk by 74.6% of respondents. This is followed by insufficient quality, an increase in the price level, non-compliance with technical standards, changes in technical requirements by the customer, incomplete delivery, damaged delivery, cancellation of delivery, dependence on the supplier, the absence of the supplier's production capacity, differences in technical standards when purchasing from abroad, loss of the supplier, exchange rate risks when buying from abroad. The least common is the risk of losing know-how.

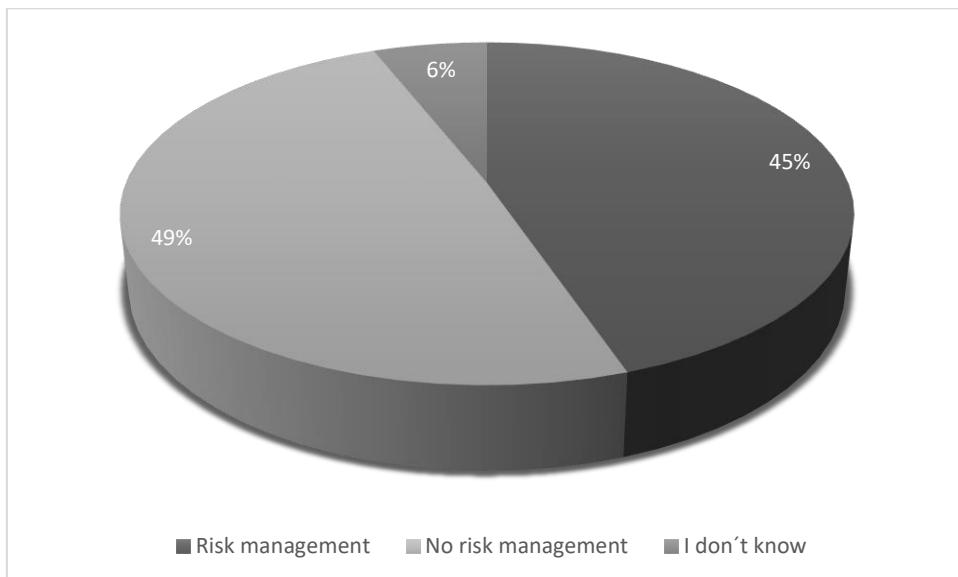
The impact of certain risky situations related to the purchase of products needed for production can mean for the industrial enterprise a deterioration of the conditions of the production process, in the extreme case even the loss of a customer due to failure to fulfil its obligations. In the event of non-fulfilment of the customer's obligation to pay for the delivery, the supplier's company is threatened with secondary insolvency, which may lead, for example, to non-payment of wages to its employees and endangering sustainability of production.

Representatives of the customer's and supplier's companies on the industrial market were able to determine the causes of risky situations. Like the factors of choosing an interorganizational relationship, the causes of risks or we can divide the factors of their perception into several groups. First of all, it is the nature of the product in question, its availability and the overall situation on the suppliers' market, the customer's ability to correctly define the need and the supplier's

ability to find the right solution to the customer's problem. A particularly key factor is the importance of the purchased product for the customer and the value of the order for the supplier. Last but not least is the financial situation of both partners and the competition on the supplier market. The quantitative research shows the following. As the causes of the risk in the purchasing of products and services, enterprises cited unreliability of suppliers, lack of suppliers, insufficient production capacity of the supplier, poor financial discipline, insufficient know-how of the supplier and poor production quality.

The existence of risk management in a company is related to the perception of risk. In the case of micro-enterprises, this perception is influenced by the production process, the procedures for procurement of the necessary material, the wide availability of the required products, which are often standard, and the simple business relationships into which the enterprises enter. The large enterprises are aware of the existence of risks and the possible effects of unwanted situations. Customers do not attach much importance to risk assessment despite being aware of the possible impact of risky situations. In the case of supplier organizations, there is an assessment of the risk relating to the customer's obligations. Risk management is often focused only on internal activities related to the production process, and the management of external risks remains neglected. As we can see in Figure 3 risk management was declared in thirty enterprises, which represents 45%. We noted its absence in thirty-three enterprises. Respondents from four companies could not comment on this question, or they did not know about it.

Figure 3 Risk management



Source: Own processing

The elimination of risks in industrial enterprises where there is no risk management, consists in verifying information and constant communication with the supplier or customers. These are often cases where trust plays a key role. A company that has risk management applied in all business activities, including procurement, production, and sales, uses contractual instruments in its relationship with customers, such as a framework agreement or general conditions of purchase or sale. When managing risks, he is also helped by checking the customer's financial situation and constant communication with the customer.

4 Conclusions

The purchase of products and services for a manufacturing enterprise represents 40-80% of the total value of the manufactured product. While in the past the role of buyers was cost reduction and timely delivery of goods, today purchasing is increasingly considered a strategic function of every manufacturing company, which contributes to the creation of added value of the final product. Purchasing is the real interface between the supplier and the company's internal clients (development, production, quality, sales...). Products and services required for production must meet a number of criteria specified by the purchasing centre. Depending on the industry, these are characters of product (chemical, physical, electrical, optical, mechanical, sensory and others), packaging method, price, delivery time, warranty period, or technical support. To ensure flawless operation in the company, the appearance of risks related to the procurement of products and services must be eliminated to the greatest extent possible. These are risks associated with

the transaction itself, risks resulting from the relationship with the supplier and risks associated with the position of enterprise on the purchase market.

Incorrect decisions of procurement management in conditions of risk largely affect the future of the manufacturing enterprise. Failure to ensure the timely and error-free delivery of products and services necessary for the production of the enterprise can lead to its endangerment. Subsequent failure to deliver products and services to the customer in the required time, quantity, and quality, and thus failure to fulfil one's obligations, will cause dissatisfaction, loss of the customer and, in extreme cases, the collapse of the enterprise. Unfortunately, in most cases, managers take risks without being aware of them, dealing with their level and relying on circumstances that cannot occur. In order to prevent undesirable situations, manufacturing enterprises should focus their attention on risk management. Risk management cannot be understood by the company as a separate part of corporate management, but as part of all internal processes.

The number of procurement risks related to the availability of the material resources can be reduced by using circular economy principles. This is not just about recycling primary materials as we know from the production of steel, glass, paper, or plastics. In terms of sustainability, in the future procurement strategies will be focused on local sourcing or co-procurement. In the context of procurement 4.0, digitalization and AI tools will help purchaser identify risks, analyse them, and make purchasing decision.

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Gender Stereotypes among Future Managers

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Abstract: Gender role stereotypes in our society assign typical characteristics to men and women, which often complement each other as opposites, determining our expectations of individual women and men and our actions towards them in specific situations (Karsten, 2006). Gender inequality has been linked to humanity since ancient times. Sociological research at the beginning of the third millennium (CVVM Research November 2006) found that "gender conservatism", clinging to traditional views and gender roles, still prevails in the Czech Republic.

At the same time, empirical findings suggest that the Czech population is now generally in favour of gender equality in the area of reconciling work and family (i.e. an egalitarian model). But is this really the case in our Czech conditions and withinin Czech universities?

This paper is about the issue of future managers. Generations influencing or contributing to gender equality or inequality. The results summarize ideas about what men and women managers should be, what qualities they should have and what values they should cherish.

The data obtained through a questionnaire survey among students of bachelor's and master's degree programs of the Faculty of Economics of the University of South Bohemia in České Budějovice were evaluated using the semantic differential technique. It was found that the students' view of the female manager as well as the male manager is very balanced. The curves are around the mean values. There was a very slight disparity in creativity, charisma, leadership and planning and activity skills in the evaluation of women managers. On the other hand, there is a marginally noticeable improvement in the view of traits for control ability, tolerance and empathy. For male managers, there was a slight negative trend for some traits. These are control ability, empathy and loyalty, humility, openness and assertiveness, sense of humour and motivation. Slightly positive developments occur for composure, charisma and communication. It was found that students are not influenced by stereotypical ideas about the managerial position. The overall view reveals the balance of opinion of students in all the necessary characteristics of a manager.

Keywords: gender stereotypes, women and men managers, student's generation influencing gender equality or inequality, qualities and values of managers

JEL Classification: M1, M12

1 Introduction

Gender role stereotypes in our society assign typical characteristics to men and women, which often complement each other as opposites, determining our expectations of individual women and men and our actions towards them in specific situations (Karsten, 2006). Gender inequality has been linked to humanity since ancient times. However, the situation has not always been favourable to one particular gender. Matriarchy is characteristic for the prehistoric era. Over time, however, there has been a transition to agriculture and pastoralism. This is the moment of men.

Men, women are stereotypically ascribed certain qualities, abilities and characteristics of "typically feminine" and "typically masculine". Sociological research at the beginning of the third millennium (CVVM Research November 2006) found that "gender conservatism", clinging to traditional views and gender roles, still prevails in the Czech Republic. About 70% of Czech men and women believe that a man should be the breadwinner. Half think that only he should have a career, half think both and half a percent think only the woman should. The demands of women's education and their

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own professional careers are not questioned by most people in our country. However, beliefs about the need for their own careers are weakest in periods of increased demands for childcare and child-rearing.

At the same time, empirical findings suggest that the general preferences of the Czech population today favour gender equality in the area of reconciling work and family, i.e. an egalitarian model (Sirovátka, Hora, et al., 2008).

However, this conclusion is not entirely consistent with the findings on gender representation among managerial positions.

Managerial functions are still dominated by men. Globally, women held only 29% of senior management positions in 2020 (Thornton: Tremmel, Wahl, 2023) and with increasing hierarchical positions in organizations women's representation decreases (Mercer: Tremmel, Wahl, 2020). Women have to use more energy as men while building up their careers.

Gender stereotyping is considered to be a significant issue obstructing the career progressions of women in management especially. The continuation of minimal representation and participation of women in top-level management positions is visible (World Economic Forum, 2017).

Various research studies have produced lists of barriers, which are either the results of stereotype dominating the society or form the part of the labour market, which, as a rule, generates more suitable working conditions for men than women. High levels of demand on time and proficiency are typical for functions of a manager, posing more restraints for women than men. How is to be perceived? There are lots of companies still lagging behind in establishing equal opportunities for women, who are also simultaneously required to meet the role of a mother taking care of her held, household. Under the weight of the circumstances they are forced decline such professions, which could substantially limit them. Mostly, women have to choose from a typically family, or career-bound, option, or adapt to a typically „male“ way of work. And if, despite of all the facts mentioned earlier, women ultimately manage to take the position, their work is much less appreciated than those of the men and are offered posts in lower levels of management (Gazdagová, Fischlová, 2006).

Leaders are mainly seen to have masculine traits and characteristics similar to men and not to women (Koenig et al., 2011). Thus, it is easier for men to move up companies' hierarchies to leadership positions (Eagly and Karau, 1991; Badura et al., 2018), whereas women face a glass ceiling that is hard to break through (Cotter et al., 2001).

Stereotypically, men are ascribed agentic characteristics describing them as aggressive, ambitious, dominant, forceful, independent, self-sufficient, self-confident, and prone to act as a leader. Stereotypes regarding women lie in communal characteristics portraying them as affectionate, helpful, kind, sympathetic, interpersonally sensitive, nurturant, and gentle (Koburtay et al., 2019).

There seem to be changes in leadership stereotypes over time; however, they are rather small (Eagly et al., 2020). Studies analyzing obituaries over a period of several decades found a change in stereotypes ascribed to male and female leaders, indicating that stereotypes of male leaders come closer to stereotypes of female leaders and stereotypes of female leaders come closer to stereotypes of male leaders (Hartl et al., 2013). Leaders are nowadays seen to be more androgynous (Kark et al., 2012) and additionally hold stereotypical feminine characteristics (e.g., individualized consideration in transformational leadership suggesting that leaders should be empathic with employees' needs; (Vinkenburg et al., 2011).

But is this really the case in our Czech conditions and in a Czech university?

This paper is about the issue of future managers. Generations influencing or contributing to gender equality or inequality. The results summarise the ideas of what men and women managers should be, what qualities they should have and what values they should honour. The aim of the paper is to identify and compare possible stereotypical views of women and men in management positions by future managers, represented by university students of economics.

2 Methods

The data obtained by field collection were evaluated using the semantic differential technique. In this particular case, the sample was female and male students of Business Management and Economics study field whose stereotypical beliefs and biases were matched across years. The results are drawn from a thesis entitled "Gender stereotyping in future managers" (Fišerová, 2013). The theoretical background and practical treatment are compared with the current available information in the world literature and thus set in an appropriate framework. Secondary research that complements the

basic research mentioned above is the research of the Institute of Sociology of the CAS, v. v. i. Gender segregation of the labour market (Křížková, Sloboda, 2009).

The students were surveyed in November of the winter semester of 2012. 45 students of Bachelor's studies and 76 students of Master's studies participated in the survey, in total 121 students. The first year of the Bachelor's programme is not included due to the higher instability of the students, which allowed for a more practical comparison of the already more established two years of both the Bachelor's and the follow-up programme. All students were asked to complete the questionnaire anonymously. For optimal evaluation, gender, type of study as well as year of study were required.

The research was focused on identifying and comparing the different stereotypical view of women and men managers through the eyes of future managers, students of the aforementioned field. Comparisons are made both within and between years. For this step, it was necessary to perform a semantic differential.

According to Ferjenčík (2000), the semantic differential is characterized by words and concepts - as abstractions and products of human thinking - existing also in a certain psychological space, which we could call semantic space. To locate a concept - to find out where it lies - will mean, by analogy to physical objects, to find its place in semantic space, in the space of meaning. We know that human life experience is unrepeatable. It is therefore truth-like that the same concept will be located in different places in the semantic space of two people.

Any concept is placed in its own semantic space by considering that concept primarily from three aspects: the evaluative dimension, the potency dimension and the activity dimension.

The most powerful is the evaluative dimension. This can be simplistically characterized as the assessment and (placement of) a concept on the basis of its evaluation as "good" or "bad" or "nice" or "ugly". The means of positioning a concept is through the use of bipolar adjectives (good-bad, happy-sad).

The second dimension is the dimension of potency (or the dimension of power). This is represented by adjectives such as big - small, strong - weak, etc.

The activity dimension is represented by evaluations in terms of such aspects as fast - slow, active - passive, hot - cold.

The methodology of identifying the location of concepts in the semantic space of an individual (the so-called semantic differential - SD) relies on a series of bipolar adjectives representing the three dimensions. With the help of these assets, the subject "evaluates" a given concept by marking the degree to which a given adjective characterizes the concept under consideration. The selection of adjectives for the semantic differential should meet two requirements - representativeness and relevance.

The semantic differential is also viewed from the perspective of the pioneer Peabody. Peabody (1985) developed a measure assessing whether people are evaluated positively or negatively without asking participants directly about their evaluations. To obtain this evaluative component, ratings of two bi-polar adjective pairs describing the same characteristic with opposing evaluations are combined. For example, the first adjective pair is extravagant vs. thrifty and the matching second pair is stingy vs. generous. Thrifty as well as stingy describe a person who spends little money, whereas extravagant and generous describe a person who spends a lot of money. Although, thrifty and generous describe opposites, both are evaluated positively, while extravagant and stingy also describe opposites but are evaluated negatively. Thus, these ratings have an underlying evaluative component which can be determined by combining the ratings of the two matching adjective pairs.

Collecting implicit evaluations might lead to evaluations less influenced by gender stereotypes than explicit evaluations. To this end, the semantic differential of Peabody (1985) with its evaluative component is used in the present paper. Since men and women might differ in their implicit evaluation, gender differences are also examined.

The semantic differential was used for the final scaling of the students' stereotypical gender representations. First, however, it was necessary to construct a questionnaire that was presented to second and third year students of the bachelor's degree type and also first and second year students of the master's follow-up degree type.

The questionnaire includes adjectives corresponding to the position of manager. On each line, a given characteristic is depicted in a positive and negative light. The adjectives are arranged in such a way that the respondent does not answer in a monotonous way (both sides of the questionnaire contain positive and negative adjectives). Those whose values are written in reverse order are highlighted in grey.

The first year of the Bachelor's programme is not included due to the higher instability of the students, which allowed a more practical comparison of the already more established two years of both the Bachelor's and the follow-up programme.

All students were asked to complete the questionnaire anonymously. For optimal evaluation, gender, type of study as well as year of study were required.

3 Research results

With the help of semantic differential, it was found that both undergraduate and graduate students' view of a woman manager is very balanced. Both curves are around the mean values with slight fluctuations towards the more positive ones. There is a very slight disapproval for creativity, charisma, leadership and planning ability and activity. Conversely, a slightly noticeable improvement in the view of traits is for control, tolerance and empathy. Both undergraduate and graduate students agree in their overall view of the female manager. Stereotypical ideas have no place here.

The bachelor and master students' view of the male manager is also balanced. The students' view is also within the middle values

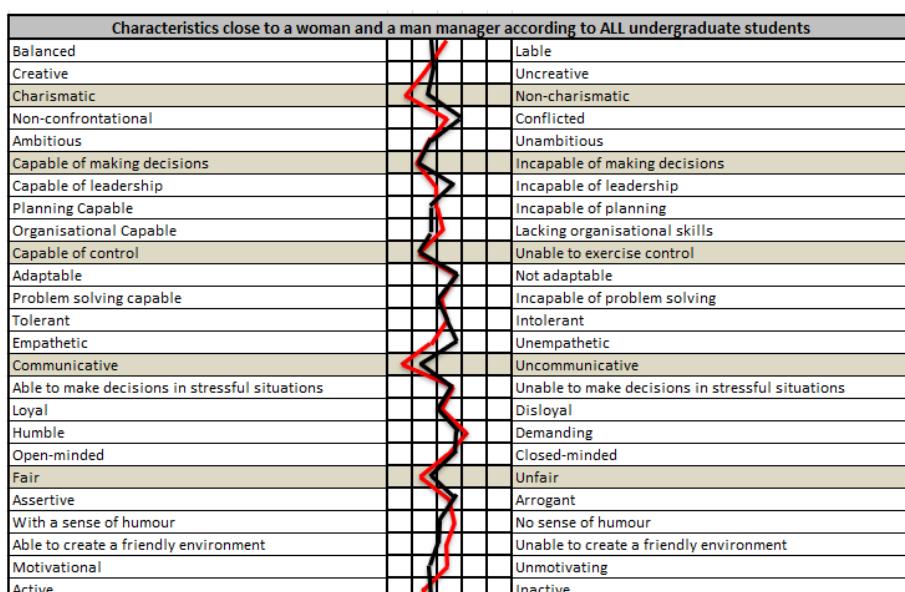
There is a slightly negative trend for some characteristics. These are the ability to control, empathy and loyalty, humility, openness and assertiveness, sense of humour and motivation. Slightly positive developments occur for equanimity, charisma and communication.

Students are not influenced by stereotypical ideas about the managerial position. The overall view reveals a balance of students' opinions in all the necessary characteristics of a manager.

3.1 Summary view of Bachelor students

The red curve, plotted in the graph on this page, represents a female manager. The black curve represents a male manager. This is an aggregate view of all undergraduate students. The questionnaire was completed by a total of 45 students. The graphical representation was done using scales.

Graph 1 Male and female managers in the eyes of undergraduate students



Source: Own processing

In the chart above we see a very balanced view of the male and female manager indeed. It shows that young students do not suffer from strong preconceptions about gender characteristics in relation to performing a managerial function.

The female manager possesses more developed qualities such as charisma, communicativeness and fairness. The curve of male manager is around the mean values of the graph. His better qualities are sense of humor, ability to create a friendly environment and motivation.

The graph shows that the female manager's positive ratings are predominant. The strongest qualities of a woman manager are charisma, communicativeness, decision making ability and fairness. These characteristics replicate the views of both undergraduate classes. Decision-making ability and control are also highly ranked. The remaining managerial skills are also seen positively.

'Demandingness' was rated as the weakest aspect of women managers. Which on the other hand could also be seen in a positive light.

Chart 1 depicting the view of the male manager shows that again qualities such as charisma, decision making and control, communicativeness, fairness play a major role.

In the overall view, we are again more in the positive part of the semantic differential. However, qualities such as conflict, maladjustment, inability to empathise and arrogance are already past the middle.

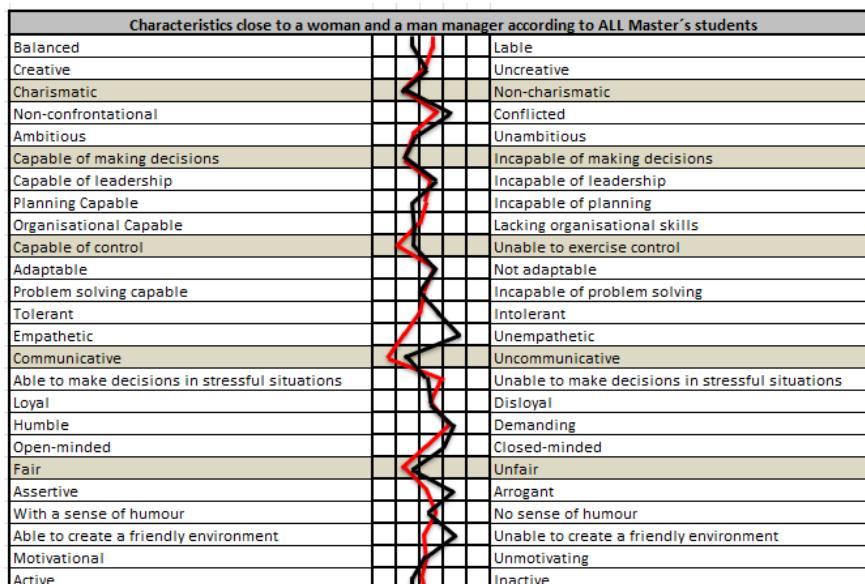
In a preliminary comparison of male and female managers through the eyes of younger students, it can be noted that more negative characteristics were found in the male manager. However, the differences are not so marked.

Basic management skills are equal for both genders. Although the overall picture is indeed very flat, the female manager curve is generally closer to the positive values.

3.2 Summary view of Master's students

The red curve represents a female manager, the black curve represents a male manager. A total of 76 master's students completed the questionnaire.

Graph 2 Male and female managers in the eyes of Master's students



Source: Own processing

The chart above clearly captures a fairly balanced view of the female and male manager, especially in the first half of the chart where the two curves are almost identical. The biggest difference occurs in the ability - empathy, which is inherent in the female manager.

The manager's curve is closer to a positive value only for equanimity and activity. The woman manager excels in the ability to control, communication and fairness.

In the second part of the graph, the curves are already intertwined, but the red curve of the female manager is closer to the left positive part of the graph for most of the time.

The female manager is more in the middle in the eyes of all master's students. Only a few fluctuations can be seen. The strongest qualities of a woman manager are communicative, charisma, decision making, control and fairness.

The borderline qualities are evident as composure, creativity, leadership, planning, adaptability, problem solving, loyalty, openness, assertiveness, sense of humor, ability to create a friendly environment, motivation and activity. Thus, most of the traits occur on the borderline between positivity and negativity.

Negative traits are conflict, maladjustment, inability to make decisions under pressure and demandingness.

For the male manager, again, we are more around the middle values. However, there are more negative characteristics.

Positive qualities, according to the above chart, would include charisma, decision-making ability, communicativeness, fairness and proactivity. Basic managerial skills such as planning ability, organizational skills and control ability are also ranked very well.

Around the mid-range are creativity, leadership ability, adaptability, loyalty, sense of humor, and ability to motivate.

Negative qualities appear to be conflict, "un-empathy", arrogance, demandingness and inability to create a friendly environment.

Again, the view of male and female managers is not very different from that of the students of the follow-up study. For both genders, we are rather around the middle values. Even the positive values are very similar. However, we find more negative characteristics in the male manager.

3.3 Comparison of Bachelor and Master students' perspectives on female managers

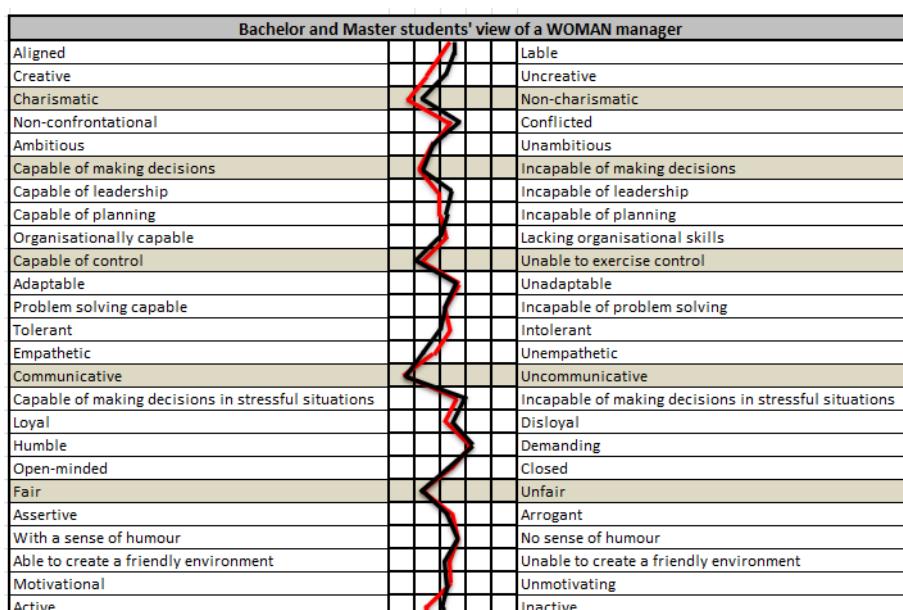
The red curve shows the view of female managers by undergraduate students. The black curve represents the view of all master's students.

The graph on the following page shows that the view of both bachelor and master students on a woman manager is indeed very balanced. Both curves are generally around the mean values with slight fluctuations towards the more positive ones.

There is a very slight disparity for creativity, charisma, leadership ability and planning and activity. But this is really only a very slight upset of negative trends. On the other hand, there is a slightly noticeable improvement in the view of traits for control, tolerance and empathy.

It is gratifying that both undergraduate and graduate students agree in their overall view of the woman manager. There were only slight deviations; stereotypical prejudices about the woman manager have no place here.

Graph 3 A woman manager in the eyes of Bachelor and Master's students



Source: Own processing

3.4 Comparison of Bachelor and Master students' perspectives on male managers

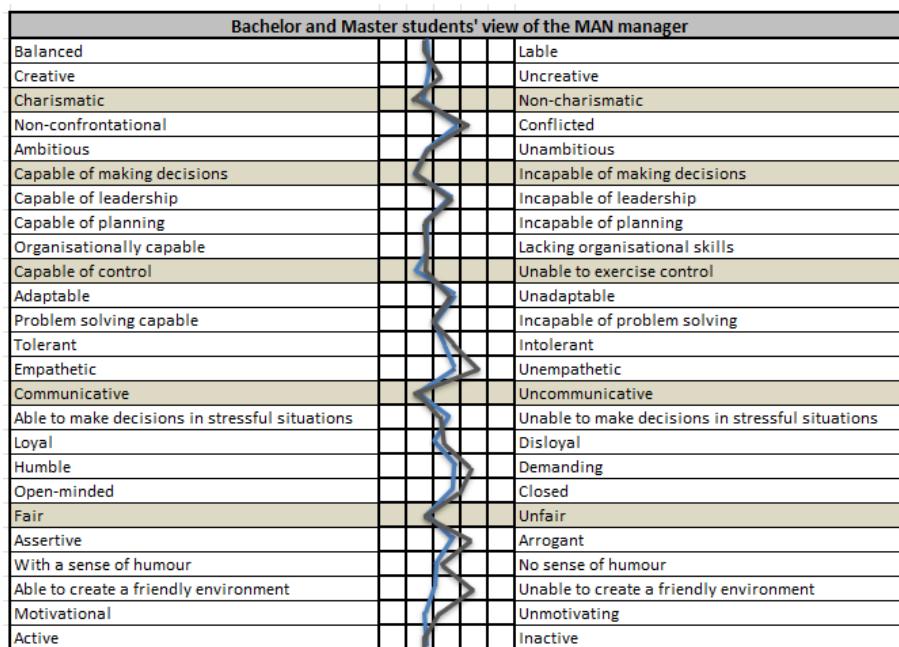
The blue curve captures the view of male managers by undergraduate students. The grey curve depicts the view of master's students on a male manager.

The view of undergraduate and graduate students on the male manager is also balanced, as the graph on the following page clearly shows. The view of male students is also within the middle values of the graph.

On closer examination, we find that the blue curve depicting the view of undergraduate students is slightly negatively trending for some characteristics. These are controllability, empathy and loyalty, humility, openness and assertiveness, sense of humour and motivation. Slightly positive development occurs for composure, charisma and communication.

However, the overall view reveals a balance in the students' opinion in all the necessary characteristics of a manager, including his/her basic skills. Students are also not affected by preconceived notions about the managerial position.

Graph 4 Male manager in the eyes of Bachelor and Master's students



Source: Own processing

3.5 Comparison of Bachelor's and Master's results

The view of both undergraduate and graduate students of a woman manager is very balanced indeed. Both curves are generally around the mean values with slight fluctuations towards the more positive ones.

There is a very slight disparity for creativity, charisma, leadership and planning ability and activity. But this is really only a very slight negative development. On the other hand, there is a slightly noticeable improvement in the view of traits for control, tolerance and empathy.

It is gratifying that both undergraduate and graduate students agree in their overall view of the woman manager. There were only slight variations, stereotypical prejudices about women managers have no place here.

The view of male managers by undergraduate and graduate students is also balanced. The students' view is also within the middle values.

There is a slightly negative trend for some characteristics. These are the ability to control, empathy and loyalty, humility, openness and assertiveness, sense of humour and motivation. There is a slightly positive development in equanimity, charisma and communication.

However, the overall view reveals a balance of students' opinion in all the necessary characteristics of a manager, including his basic skills. Students are not influenced by stereotypical ideas of the managerial position as we see in the table below.

Tab 1 Final comparison Bachelor vs. Master's

Resulting comparison Bachelor vs. Master's students		
Bachelor and Master students' view of WOMEN	Balanced	<i>Both curves in mean values</i>
	slight deterioration	creativity
		charisma
		leadership
		planning
		activity
	slight improvement	control
		tolerance
		empathy
Bachelor and Master students' view of MAN	Balanced	<i>Both curves in mean values</i>
	slight deterioration	control
		empathy
		Loyalty
		humility
		openness
		assertiveness
		sense of humour
		motivation
	slight improvement	equanimity
		charisma
		communication

Source: Own processing

4 Conclusions

The final view of Bachelor and Master's students of the woman manager is balanced. Both curves generally move around the mean values with slight adjustments towards the more positive. Bachelor and Master's students' view of the male manager is also balanced, it also moves within the mean values.

One would expect the view to be distorted. Not surprisingly, although our times are associated with the proclamation of equality between men and women, it is here, for example, that the most publicised pay gap between the sexes performing the same job appears. However, Křížková and Pavlica (2004) also refute the mistaken belief that this is a natural situation, where men are the decisive economic and political force in society, while women are more involved in 'complementary' activities such as creating a social base and raising children.

At the same time, Křížková and Sloboda (2009) make it clear that gender segregation of the labour market is significantly related not only to the wage gap between men and women, but also to the currently rising unemployment in the context of the economic crisis, which has different dynamics and consequences for women and men as a result of segregation, and last but not least is one of the causes of the feminisation of poverty on a local and global scale. Despite of the above mentioned dogmas, the hypothesis has been confirmed. The consensus of stereotypical views of male and female managers doesn't lead without exception to gender preference for specific properties in all classes.

According to the above results obtained using the semantic differential, it is possible to confirm that students of Business Management and Economics do not suffer from stereotypical images of male and female manager. They do not automatically assume that a man will have all executive managerial skills while the woman manager will be lacking in them. Yes, some qualities are confirmed as typical for a woman - empathy, communication, and for men - activity, but the students' opinion develops with the obtained knowledge.

Acknowledgement

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Evaluating Managerial Impact on the Success of Agricultural Enterprises for Sustainable Growth

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Abstract: The success of the company is created primarily by managers. To achieve prosperity, profit, and development, it is necessary for everyone to show a great deal of effort and use it to achieve the set goals. For the best cooperation between employees, a key element is needed, and that is the manager. The manager is the one who gives the company the right direction, sets goals, controls, and makes decisions. The article aims to evaluate managerial impact on the success of agricultural enterprises for sustainable growth and to evaluate the personality of the manager in the selected agricultural enterprise by compares of realized researches in the world and case study from the Slovakia. The point of running a successful agricultural business is to do things for people and with people. Only with such cooperation, support, communication, regular information, and acceptance of individual actors is it possible to create a successful agricultural enterprise on the market.

Keywords: innovation, managerial impact, personality, human resource management, ESG

JEL Classification: G32, G33, C35

1 Introduction

Managers typically exhibit a distinctive personality profile that sets them apart from non-managers. Lounsbury et al. highlight that traits such as extraversion and conscientiousness are prevalent among effective managers, aligning with workplace competencies essential for managerial roles (Lounsbury et al., 2016). These traits not only enhance interpersonal interactions but also contribute to a manager's ability to foster a supportive work environment, which is crucial for promoting employee creativity and innovation (Jong & Hartog, 2007). Moreover, the relationship between personality traits and leadership styles is further elucidated by the findings of various studies. For example, conscientiousness has been shown to predict both democratic and bureaucratic leadership styles, suggesting that managers who are organized and responsible tend to adopt more structured approaches to leadership (Naz, 2022). Besides financial styles, other individual characteristics of managers, including gender, age, experience, and qualification, also play a vital role in distinguishing one manager from another. (I. Naz, 2024). Lotfi et al. found a significant relationship between personality type and performance, emphasizing the importance of aligning leadership styles with the personality traits of team members to optimize performance outcomes (Lotfi et al., 2023). Additionally, the ethical dimensions of leadership are also influenced by personality traits, where conscientiousness and agreeableness are particularly relevant for ethical leader behaviors (Kalshoven et al., 2010). Similarly, research by Hassan et al. supports the notion that personality traits are associated with different leadership styles, which in turn affect a leader's effectiveness (Hassan et al., 2016). Managers play a pivotal role in establishing frameworks that facilitate knowledge transfer and utilization, thereby enhancing the organization's responsiveness and efficiency (Bahrami et al., 2013).

2 Methods

The main goal of the scientific paper to evaluate managerial impact on the success of agricultural enterprises for sustainable growth and to evaluate the personality of the manager in the selected agricultural enterprise by compares of realized researches in the world and case study from the Slovakia. For this purpose, research was carried out in selected agricultural companies from Slovakia with a general director and sales at least 6 millions. In the research paper where applied following methods: management style method, interview, the motivation table method, questionnaire. Management Style method, which among diagnostic methods. It focuses primarily on the way of thinking, choosing the

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path to solving the problem. The main goals of this method are to determine various personality characteristics such as dominance, empathy, independence, organizational skills, communication skills, the ability to manage a team, focus on career progression and, last but not least, to derive a preferred management style. (Evangelu, 2009). Interview, which was perform with head of agricultural enterprise. The "motivation table" method was originally created from a simple children's game, during which it was discovered that people who tend to give similar answers have similar personality types. The method can be used by all individuals with different professional experiences. Using this method, we monitor many characteristics such as openness to new things, creativity, dominance, different types of thinking, empathy, planning, decision-making, independence, communication, etc. In the second part of the evaluation, we focus on the lexicological part of the task, that is, on the words written in the table. We group them on the basis of similarity and derive from them the given characteristics of the observed person. (Evangelu, 2009) Last used method was questionnaire. It is one of the most widespread methods of marketing research. We consider its evaluation to be a relatively quick acquisition of information from a wide range of respondents. Questionnaire was created with 21 closed questions focused on employee satisfaction with the manager. Time schedule of the research was carried out in March – June, 2024 and 29 managers were involved into research from selected agricultural company.

3 Research results

Managerial influence on organizational performance is significant and multifaceted. Research argues that senior and middle level managers contribute largely to the overall performance of an enterprise with their individual characteristics and the competitive rivalry between different managers of a given enterprise (Peeters et al., 2015). To maximize managerial influence, an organization should strive to develop key skills and to implement a value-based approach to performance management that aligns with organizational goals and participates in improving employee and organizational performance (Reeshi, 2023). Manager's leadership styles and experiences have a significant impact on employee performance, job satisfaction and organizational success. Several studies demonstrate the positive effects of effective leadership on various aspects of a company's employees and economic performance. Several researches have shown that different leadership styles affect employee performance and productivity. For democratic and transformational leadership styles, it has been found that there are demonstrable positive relationships between employee and effectiveness. (Ajayi , 2020). Among other things, trans-formational leadership has been shown to stimulate creativity and innovative behavior in employees (Anwer & Hyder, 2024). It is believed that managers who adopt these leadership styles will foster a positive work environment and improve the overall performance of the organization. However, the impact of people leadership on job quality is assessed differently by authors. (Ajayi, 2020) reported a positive relationship between autocratic leadership and employee job quality, while (Soetjipto et al., 2021) found no significant impact of transformational leadership on job satisfaction or work ethic. Hence, we can conclude that the effectiveness of leadership styles may vary depending on organizational context and culture. Effective leaders who prioritize employee well-being, provide a clear vision, and promote a positive organizational culture according to (Buys et al., 2016; Kustiawan et al. , 2022) will achieve higher levels of job satisfaction, employee engagement, and productivity.

The overall success of farms depends on a combination of various factors such as leadership styles, manager's personality, personnel management and strategic alignment of internal and external factors. Important challenges of contemporary agriculture include access to finance, technology adoption, and workforce development, is key-important for fostering agricultural innovation and rural economic growth (Herissuparman et al., 2024). The success of agricultural enterprises is strongly influenced by managerial characteristics and their approach to work. Research argues that the age and education of managers are among the critical roles in farm performance. Younger managers have the prospect of achieving greater success. We consider education as another aspect of success. Managers with university and primary education seem to be more motivated than those with secondary education (Negrão, 2020).

Managerial skills and abilities are key in the success and sustainable growth of agricultural enterprises. Effective management of agricultural operations requires a combination of technical, conceptual and interpersonal skills (Desai et al., 2024). These skills are divided into: planning and decision making, organizational, leadership, communication and interpersonal skills, financial management, problem solving and analytical skills (Desai et al., 2024). The importance of management skills on agricultural enterprises is significant especially in creating sustainable business models. Economic aspects ranging from optimization of production processes, through cost management to market trend analysis rank among the key components of sustainable agricultural business models (Kyfyak et al., 2024). Shen argues that the human factor has a significant positive impact on sustainable business growth (Shen et al., 2021). This brings about the implementation of innovative technologies, diversification of production, optimization of resource use, development of local markets, improvement of risk management and promotion of social development in local communities (Kyfyak et al., 2024). It is

also essential for farm management to adopt a holistic approach that links economic, social and environmental objectives together with risk management, innovation promotion, employee engagement and strategic partnerships (Nemashkalo et al., 2024). With the management skills, farmers can better navigate the challenging industry, optimize resource use and foster innovation, contributing to the growth and sustainability of the agricultural sector (Desai et al., 2024).

Various factors influence the success of farm businesses, including management, knowledge, organisational learning and innovative strategies. In Spain, a successful model of organizational learning has emerged in organic farming, where 25 years of experience has created prosperity and sustainable development (Rios, 2017). Thanks to this integration of the knowledge of experienced farmers with techno-scientists, we can talk about the modernization of the countryside. The success of farms also depends to a high degree on effective personnel management. Aspects of management can be categorized into technical and technological, internal and external groups, each requiring specific management strategies (Kvasha et al., 2020). Agricultural enterprises in Slovakia are increasingly adopting modern logistics trends and innovations to increase their success. The majority (71.6%) of respondents strongly agree with the use of logistics technologies, yet cost remains a significant factor in implementation decisions (Dupal' et al., 2019). Lean logistics is currently the most frequently implemented logistics innovation (Szabo et al., 2021), and there is a growing interest in smart technologies and inventory management innovations. Special attention must be paid to waste management since animal production is often criticized for the negative consequences resulting from its activities, which have a negative impact on climate change. (Kapsdorferová, 2023)

Case Study of Slovak Republic

Based on the literature review, the individual approaches using the methods presented in the methods chapter were applied to investigate in a selected agricultural cooperative in Slovakia.

As part of the Motivation Table method, we presented the team managers with a blank paper and pencil with an assignment to draw a table with 10x10 boxes. They then wrote arbitrary occupations in the first column of each row and the qualities they valued about them in the others. Depending on how the table was drawn and the traits assigned, we determined the personal-trait characteristics of the managers. On the basis of the promptness of work, quick elaboration, we consider most of them as managers open to new ideas and able to adapt very quickly. These qualities are very important for a manager's work in terms of various unexpected situations and their quick resolution. The openness to innovation of the company helps them to implement the latest knowledge in the field. Since the managers under study created their spreadsheet continuously, they are very creative and have no problem with improvisation. The spreadsheet looks neat in the final impression, which shows their consistency and ability to plan. The second phase of the method was lexical and focused on specific characteristics. Based on these, we can infer the characteristics of the managers. The most important characteristics are: honesty, reliability, empathy, goal-orientedness, creativity, communicativeness, education, diligence.

Another research method was the management style method. In this method, managers were presented with model situations and based on their reactions we can infer which management style they are most inclined to.

After presenting 5 model situations to the managers of the cooperative, we analyzed their responses and entered them into a table constructed according to the following criteria: highly helpful behavior, lowly helpful behavior, highly dominant behavior, lowly dominant behavior, introponutive behavior (looks for the blame for failure in oneself), extroponutive behavior (looks for the blame for failure in others), imponutive behavior (looks for the fault in unfavorable circumstances). The rating of the manager's behaviour will be from 1 - 5, where 1 represents the lowest and 5 the highest level of the behaviour.

Tab. 1 Summarized results of managers evaluation (average)

The way the manager behaves	1. situation	2. situation	3. situation	4. situation	5. situation	In total
Highly helpful behavior	4	2	1	5	1	2,6
Little helpful behavior	2	4	4	1	5	3,2
Highly dominant behavior	4	5	5	3	5	4,4
Low dominant behavior	1	1	1	2	1	1,2
Introponutive behavior	1	1	1	1	1	1
Extropunitive behavior	3	4	5	3	4	3,8
Impulsive behavior	3	2	1	4	2	2,4

Source: own processing

Based on the analysis of the results, we can conclude that the monitored managers exhibits the most dominant behavior, which reached the value. This underlines his preferred management style, which most of them stated in the interview - an authoritative management style. The lowest value was achieved by a few dominant behaviors that should not occur in top management. It could be characteristic of more benevolent management styles than a liberal management style, leading a "gardener's association" and so on.

Highly helpful behavior scored 2.6 and low helpful 3.2, representing very similar values. Based on them, we conclude that the observed manager cares about the fulfillment of the set goals, but in some cases he also cares about the well-being of his employees, especially those who have gained trust and respect over a longer period of time. We can also observe certain signs of a democratic management style.

The third area of observed behavior was attribution of blame, it is transferred to the persons directly responsible for the subsequent elimination of subsequent steps to eliminate the consequences of the consequences as a result of the situations that have arisen.

Discussion

According to Peeters (2015), the influence of a manager on the performance of a company is undeniable. Based on this, we have derived certain personality characteristics and behavioral patterns of managers, which tend to predict the prosperity of a company, through our research. From the point of view of leadership, the ideal management style seems to be democratic. This statement is also supported by Ajayi (2020), according to whom there are positive relational forces between employees in the case of democratic leadership. The observed managers have skills such as planning, decision-making. According to Desai (2024), these are key management skills for effective management of agricultural enterprises.

4 Conclusions

A manager is faced with various variables daily that greatly affect the results of his work. He bears great responsibility for his decisions. What makes a successful manager is not only the knowledge, but also the experience that he or she accumulates throughout his or her life. The aim of research was to evaluate managerial impact on the success of agricultural enterprises for sustainable growth and to evaluate the personality of the manager in the selected agricultural enterprise by compares of realized researches in the world and case study from the Slovakia. This research evaluates the impact of managers on the success and economic growth of agricultural enterprises. Managers play a key role in managing the business by using their personality traits, leadership styles and skills. Effective managers are characterized by qualities such as extraversion and conscientiousness, which contribute to creating a conducive work environment and fostering innovation. In the case study in Slovakia, different methods were used to assess the impact of managers on growth in an agricultural cooperative: management style methods, interviews, motivational table methods and questionnaires. The results highlight the importance of managerial characteristics such as openness to new ideas, creativity, consistency and

planning ability. Based on research, we can consider the key managerial qualities that indirectly contribute to positive economic results in small and medium-sized enterprises to be the predominance of a democratic management style, excellent level of communication with employees, B2B, B2C. Other preferred qualities include dominant behavior in cooperation with highly helpful behavior. The study also highlights the importance of innovation to enhance the competitiveness of agro-farming enterprises.

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Exploring the Suitability of Trainee Programs for Generation Z in the Workplace

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Abstract: Generation Z is entering the workforce with distinct expectations that challenge employees. Some companies implement trainee programs to deliver specific learning activities for university graduates, such as job rotation, project management, mentoring or other methods for employee development in a form of a trainee program. However, the relevance of these programs for Generation Z remains in question. A pilot qualitative research study was conducted using a literature review and a mixed-methods approach. The article aims to contribute to the theory of employee development as it relates to Generation Z. Additionally, it offers practical recommendations for companies on how to design training programs that are suitable for today's university graduates, along with identifying key elements of a successful training program for Generation Z in a business environment. Findings from semi-structured interviews, supplemented by Computer-Assisted Web Interviews (CAWI), highlight the motivations of Generation Z and the critical aspects of training programs, particularly in onboarding and their participation during the first year. These findings raise further research questions regarding training methods for Generation Z employees.

Keywords: Training, Graduates, Employee, Company, Business

JEL Classification: J24, M53, O15

1 Introduction

A company can influence its competitiveness through various tools; one of the key elements is its employees (Deloitte, 2024b). For example, onboarding a newcomer can bring new ideas to the enterprise and help develop and adapt to today's challenging environment (Becker & Bish, 2021). Another success factor for a business is talent management (Kral et al., 2022) or employee development (Saadouli, 2015). The company should work with the skills of their employees nowadays to be more competitive worldwide (World Economic Forum, 2023). The specific training method, especially onboarding programs in a business, should reflect the anticipation and needs of the target employee group, especially in the case of Generation Z (Chillakuri, 2020).

Generation Z refers to those born between the mid-1990s and early (Benítez-Márquez et al., 2022; Deloitte, 2024a; Egerová et al., 2021). The main characteristics of this generation include meaningful work, technological proficiency, and an appetite for tackling significant tasks ideally suited to the individual (Bhushan, 2023). Generation Z is not afraid to leave a job if the job does not suit them, they seek the best job where they can apply their skills (Deloitte, 2024a). However, intergenerational differences are natural, and businesses must learn to work with them (Chillakuri, 2020).

A *trainee program* is a highly selective and structured initiative designed to attract, develop, and retain high-potential individuals, often recent university graduates (Kral et al., 2022). For a successful trainee program, the firm should focus on individual development, job rotation, mentoring, and continuous feedback (Prasetyo & Khow, 2022). Companies use trainee programs for graduates in practice, even though they are not addressed much in the academic literature (Kral et al., 2022). Developing employees at different organisational levels is an investment for the firm that needs to be carefully considered (Saadouli, 2015). Retaining talent, especially from younger generations such as Generation Z, will be one of the important challenges for organisations (Kral et al., 2022).

2 Methods

This article aims to determine whether it is still appropriate for companies to offer trainee programs for Generation Z graduates nowadays. Based on a literature search in the international scientific databases Web of Science and Scopus, the following research questions were established:

RQ1: Why should a trainee program in a company be interesting for Generation Z?

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RQ2: How to design a suitable trainee program for Generation Z?

Answers were researched not only in the scientific literature, but also through a pilot survey of trainee or alumni trainee program participants from three different companies.

2.1 Pilot Qualitative Research

The pilot study is based on semi-structured interviews with representatives of the trainee program in three companies. The respondents were between 21 and 23 years of age and belonged to Generation Z. The interview lasted one hour and was conducted in person or through an online meeting. The pilot survey was conducted from July 2023 to October 2024. The following areas were monitored within the pilot survey:

- Overall satisfaction with the trainee program
- Job task complexity, job content
- Communication with superior, inclusive feedback from superior
- Colleagues communication
- Improvement ideas

The profile of each company where the survey was conducted is shown in Table 1. These firms have been operating on the Czech market for more than 15 years and come from different sectors. In terms of the number of employees, they belong to large enterprises.

Table 1 Profile of companies, their trainees participated in the pilot qualitative research in the period July 2023 to October 2024

	Company A	Company B	Company C
Dominant Classification of economic activities (CZ-NACE)	29320 - Manufacture of other parts and accessories for motor vehicles	23190 - Manufacture of other glass, including technical glass	Non-specialised wholesale trade (46900)
Number of employees	500 – 999 employees	1000 - 1499 employees	500 - 999 employees
Institutional sector (according to ESA2010)	11003 - Foreign-controlled non-financial corporations	11002 - National private non-financial corporations	11003 - Foreign-controlled non-financial corporations

Source: Own processing

Company A newly introduced the Trainee Program in July 2023, which has recruited five university students. The program was designed for one year and was inspired by a foreign parent company. In this company, data collection regarding the trainee program was also conducted using CAWI method for one year. The monitoring was based on a scale of one to ten, with ten being the highest satisfaction in a given area and zero being the lowest. The survey started in the program's first month and was followed by a semi-structured interview with the respondent. Further questioning occurred after the completion of approximately three months of the programme, i.e. quarterly. In addition to the scale choices, the respondent was allowed to add verbal comments or to consult on the topics.

Both Company B and Company C have long experience with the trainee program. Their participants were interviewed in a semi-structured interview. For Company B, the respondent had been with the company for over one year. In company C, the respondent was a new participant in the trainee programme who had been with the company for over three months.

This is still a pilot phase of the research to examine whether the outcomes of the in-depth interviews are consistent with the outcomes of the literature search or whether a new research gap emerges. The pilot phase's limitations so far are the limited literature search from two international scientific databases and the low number of interviews, which are limited by time, financial, and human resources.

3 Research results

The literature review showed that the topic of the trainee program concerning the graduate concept has been investigated in scientific fields as diverse as medicine, social sciences, psychology or technical fields, as shown by the search of sources in Web of Science or Scopus. As of 19 October 2024, a total of searches of "Trainee" and "Graduate" into searching fields "Title", "Abstract", and "Author keywords" or "Title, abstract, keywords" included:

- Web of Science: 4495 scientific articles, but only 40 in the category Management or Business;
- Scopus: 7332 scientific articles, but only 121 in the category Business Management and Accounting.

These results show the potential to explore the topic of trainees and graduates more in the business environment. The author's key findings, both from the literature search and the pilot qualitative research, are presented in the following subsections.

3.1 Motivation of Generation Z to participate in the trainee programme in the company

Trainee programs are employee development tools in large, medium, and small companies worldwide, mainly focused on talented students or university graduates (Kral et al., 2022). The benefits of a trainee program include the opportunity to rotate through different jobs, mentoring from an experienced colleague or supervisor, and participation in an interesting project or individually constructed assignment (Bhushan, 2023).

The motivation and needs of the new employee should be identified during the onboarding process (Becker & Bish, 2021). It is crucial for a company to identify the motivation of trainee candidates and manage their expectations for the success of the trainee program (Kral et al., 2022). The semi-structured interviews revealed that there might be different motivations for undertaking a trainee programme among Generation Z, as shown in Table 2.

Table 2 Motivations of Generation Z to a trainee program based on semi-structured interviews between July 2023 and October 2024.

Motivation of Trainee	Statement
To gain specific job experience	<i>Getting practical training in the field, improving organisational skills (Trainee, Company A)</i> <i>Familiarisation with the production and the whole business process, performing practical daily tasks of a specific job position, and increase my professional knowledge (Trainee, Company A)</i>
To fulfil a study obligation	<i>I applied because I wanted to cooperate with the company on my thesis, and also I needed to fulfil the obligatory internship connected with my studies. (Trainee, Company A)</i>
To test "safely" a specific job role	<i>A training program allows me to try out the department without having to leave the company if I am dissatisfied with the job content. (Trainee, Company C)</i> <i>It allows me to see if I would enjoy a similar job role within full-part time job. (Trainee, Company A)</i> <i>It was a great experience and a chance to try working in the industry – which traditional temporary jobs do not allow. (Trainee, Company A)</i>

Source: Own processing

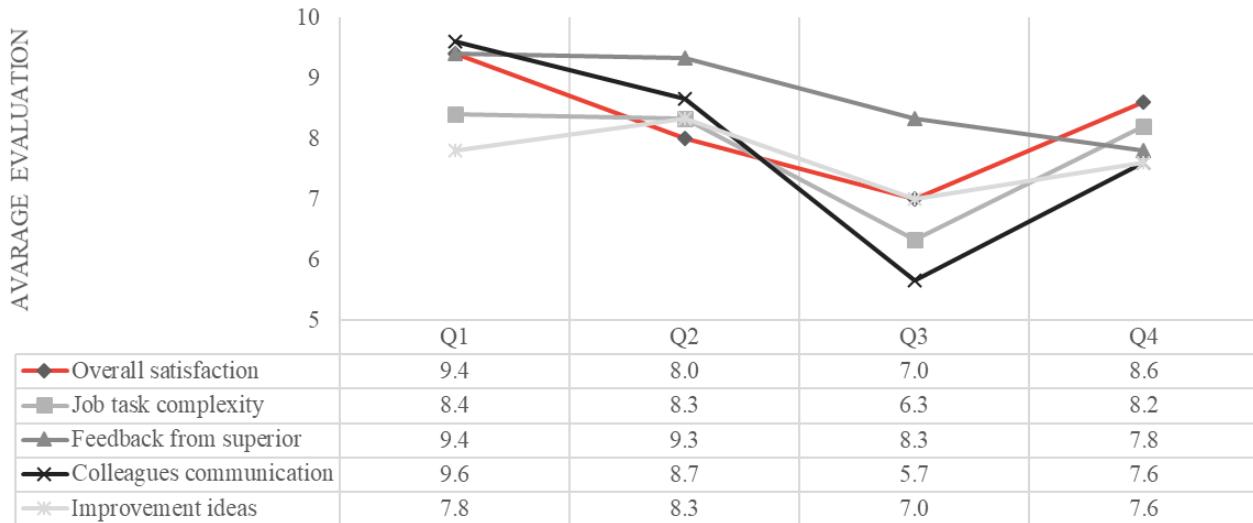
As shown in Table 2, the main motives for Generation Z participation may be to gain work experience and work experience, to meet educational obligations, or even to try out a specific work experience or job role.

3.2 How to design a suitable trainee programme for Generation Z?

Each generation has its own specific employee requirements (Egerová et al., 2021; Yilmaz et al., 2024). For example, Generation Z prefers a people-oriented management style of supportive, empathetic and respectful communication (Yilmaz et al., 2024). The literature review further suggests that generational differences must be addressed in employee development and other areas of the company (Benítez-Márquez et al., 2022; Egerová et al., 2021). For example, among university students in Italy, research has revealed that important values for Generation Z are personal growth, enjoyment, environmental and sustainability concerns, acceptance of disability-related issues, and preference for authenticity rather than a false representation (Tirocchi, 2024).

Krale et al. (2022) found that the structure and position of a trainee program in a company could discourage some graduates, so a company may be losing out on promising talent that it has challengingly selected. Also pilot qualitative research find out that over 70% of trainee program participants remained with the firm, either on a part-time job or going on to a specific job in that firm. However, as Figure 1 shows, participants went through different stages of satisfaction.

Figure 1 Average satisfaction of the trainee program in company A in different quarters on the scale of null to ten, where ten is the most satisfied level, quarterly from July 2023 to October 2024



Source: Own processing

Figure 1 shows the average satisfaction of trainee program participants in the five areas. It represents the trend in time perspective by quarter. Respondents rated their satisfaction on a scale of zero to ten, with ten being the best rating. On average, the values ranged from 5.7 to 9.6, as Figure 1 illustrates. The maximum value of ten was also mentioned several times within each rating. However, a value of two or three also appeared in the evaluation, particularly in the third quarter.

The overall satisfaction of trainees at the programme's start averaged 9.4, with most respondents scoring their satisfaction at 9 or 10. The interviews revealed that respondents enjoyed and went through the first month's onboarding phase. As Generation Z onboarding notes, onboarding starts with the interview (Chillakuri, 2020), and expectations and motivation must be worked on from the start (Kral et al., 2022). However, sensitivity is individual, as the comments below show.

Thanks to the trainee program, I have experience in multiple departments during my university studies, which is a nice combination of a part-time job and gaining practice and expertise. (Trainee, Company A)

The trainee program was more like a temp not very effective or meaningful. The only outcome of my trainee program was a completed requirement for university. (Trainee, Company A)

In terms of the difficulty of the task or job assignment, it can be seen that here, the average satisfaction of the trainee is relatively mainly at a similar level, oscillating around 8.2. The exception is the third quarter, which shows a deterioration of two points in this area, with, for example, following comment:

These were mostly routine jobs, not activities related to creativity and testing abilities or skills. (Trainee, Company A).

According to (Chillakuri, 2020), the job's meaningfulness is important for Generation Z, and individual task setting also plays a big role (Bhushan, 2023). However, according to research by Egerová et al. (2021), Generation Z is not more sensitive to job content than the previous generation. Related to job content setting, especially in conjunction with personal development and autonomy, can be an important factor in trainee satisfaction, as supported by the findings (Chillakuri, 2020).

The trainee programme allowed me personal development, I was given free space for my creativity, and I also valued the involvement in a specific project. (Trainee 1, Company A)

I missed to develop more my English languages skills. (Trainee 1, Company A)

Other important aspect of Generation Z is the importance of the feedback on their work and empathetic guidance (Yilmaz et al., 2024). As shown in Figure 1, satisfaction with communication with the supervisor was high, especially at the beginning of the trainee program, ranging from 9.4 to 9.3 in the first part of the program. However, it gradually

began to decline, after a year it was rated at an average of 7.8. However, finding from the interviews indicates that most supervisors supported trainees and communicated with them regularly whole the time. Thus, it is necessary for managers and supervisors of trainees to maintain a high level of open communication and stay empathetic really whole training program. Constant feedback is very important for Generation Z (Silva et al., 2023).

A different situation emerged in the case of communication with colleagues and other employees. In this case, it became clear during the interview that mostly direct colleagues tried to help the trainee but sometimes there could be some exceptions or problems with other colleagues outside the team. The importance of socialisation in the case of Generation Z is also mentioned by other authors (Chillakuri, 2020; Silva et al., 2023; Yilmaz et al., 2024). As shown in Figure 1, there was a dramatic deterioration on average in the third quarter. It was influenced by a conflict with a colleague and an unaddressed change within the other employees. A misunderstanding of the role of the trainee company by other employees can reduce visibly satisfaction with the trainee program. Therefore, it is also necessary to communicate the program and the role of the trainee in the whole enterprise well so that there is a proper understanding of the program's prestige (Kral et al., 2022).

As a newcomer, the trainee also brings new ideas for improvement (Becker & Bish, 2021). Overall, this area scores an average satisfaction between 7.0 and 8.3. According to Figure 1, this satisfaction averagely increased in the second quarter. The interviews revealed that satisfaction is also related to communication with the supervisor, who is often the recipient of ideas for improvement in the company. The interviewees mentioned no other tool for collecting new ideas.

In the case of the question "Would you recommend this Trainee program to your friends?" it was found that after the end of the program, 40% would recommend the program completely at the level ten, 20% at the level of eight points and rest recommended the training program to their friends at the level of five.

To sum up, key elements of the trainee program for Generation Z include communication with the supervisor, colleagues, and other company employees. Furthermore, the job description is an important factor for Generation Z, less the opportunity to give ideas for improvement. However, these are findings from a pilot qualitative survey with the following limitations.

The relatively few available scientific articles related to trainees and graduates in the business environment limit these findings. Another limitation of this study is the number of scientific databases used or available secondary data and the low number of respondents in the qualitative interviews. This opens new opportunities for future research.

On the other hand, the findings also reveal that Generation Z is still open to trainee programs in the business environment. In particular, if there is good communication with supervisors and other employees combined with an interesting job description, Generation Z will recommend the trainee program to others.

4 Conclusions

The important values of Generation Z include continuous learning and authenticity, as well as empathetic communication and leadership. The companies should reflect these values in the trainee program when they want it to offer to Generation Z. It is also very important for the sustainability of the trainee program to set and communicate expectations correctly and to find out the motivation of each trainee individually at the beginning of the trainee programme or even during the hiring process. Generation Z would like to work meaningfully and have space for self-development. Findings from semi-structured interviews indicate the importance of communication with their superiors, team colleagues or other employees in the company. A well-set job content with a complex task helps the trainee to know his or her potential more easily.

A trainee of Generation Z should be supported during the whole time of the training program by empathetic communication and a suitable task. Then he or she will more probably recommend the trainee programme to his/her friends. One of the important motivations for Generation Z is to gain practical work experience and have the opportunity to try out the job safely. Other trainees of Generation Z could be motivated by fulfilling study requirements such as a compulsory internship or a thesis topic related to studies. It opens the next research gap if there is any connection between university study requirements and successful employee training or even company competitiveness.

Despite the limitations of the research, this article provides further insight into how Generation Z employees and university students can work and develop in enterprises and opens up further potential research questions in this area.

In conclusion, a trainee program in a business can still be a sustainable alternative for Generation Z to develop and gain work experience, as long as the company respects the above mentioned points important for Generation Z.

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Reverse Knowledge Transfer: A Case Study of Selected Business Centres in the CEE Region

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Abstract: The article's main aim is to identify the reverse transfer of knowledge from business centers in CEE to their parent companies. The article uses case studies of selected business centers in CEE. The study includes 4 business centers in selected CEE countries. These countries are Slovakia, Poland, the Czech Republic, Hungary, and Romania. Business centers are currently an important source of information and knowledge for parent companies. Based on our research, it can be concluded that there is no single model of knowledge transfer from business centers in CEE to their parent companies. It can be concluded that there is a transfer of knowledge not only to the parent company but also to other centers within the group. A limitation of our research is the limited number of research objects. In the future, our research can be extended to other centers operating in Slovakia as well as in other countries of Central and Eastern Europe.

Keywords: reverse knowledge transfer, multinational corporation, Central and Eastern Europe, business centers

JEL Classification: L80, L84, D80

1 Introduction

A significant number of global multinational corporations (MNCs) have incorporated shared service centres and business centres into their corporate strategies. These centres may be defined as "organizational units that combine company resources (e.g. human capital, organizational structure and information technology systems) to fulfil support tasks and provide services to internal customers" (Gospel and Sako, 2010). The centre is responsible for monitoring and controlling expenditure, as well as ensuring the quality and timeliness of services provided to internal clients (Moller, 1997). Ulbrich (2003) asserts that it is essential to differentiate between these and centralized and outsourced methods. A shared service centre is defined as a semi-autonomous business entity that oversees integrated support functions for internal clients, encompassing areas such as accounting and human resources (Schultz and Brenner, 2010).

The range of competencies performed by the centres expanded in parallel with the growth in the number of shared service centres in the CEE region. It is crucial to differentiate between business centres and shared service centres. In this context, the term "shared service centre" is used to describe organisational units that provide services with minimal added value. Business centres are defined as centres that perform tasks of a more complex and labour-intensive nature (Rusiňák, 2023). Notwithstanding the equal relevance of the investigated features for business centres, authors in the literature tend to focus primarily on the evaluation of shared service centres from disparate perspectives. One category of foreign direct investment is business centres.

Establishing branches in disparate countries gives the parent company several advantages. One such advantage is the reverse transfer of knowledge. A literature review reveals research that has focused on the reverse transfer of knowledge from branches and subsidiaries. Nevertheless, there was no emphasis on branches in the form of shared service centers or business centers, whose expertise, data, and knowledge would be transferred back to the parent company.

Most of the value creation and competitive advantage observed in MNCs can be attributed to their nature as multinational corporations (MNCs) (Chandler, 1991; Ciabuschi, Dellestrand, & Nilsson, 2015). Subsidiaries were conceptualized as recipients of knowledge and theorized as subordinate to headquarters in several locations (Michailova and Mustaffa, 2012, p. 389). The extant literature on multinational corporations indicates a significant change in the role

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of subsidiaries. Whereas previously they were perceived as mere implementers of headquarters' policies, they are now seen as creators of competitive advantages (Cantwell and Mudambi, 2005)

The existing literature on knowledge transfer has primarily focused on the transfer of knowledge from parent companies to subsidiaries, with less attention paid to the transfer of knowledge from subsidiaries to parent companies (Kogut and Cotta de Mello, 2017). The authors define this opposite flow (from the subsidiary to the parent company) as the backward transfer of knowledge, or reverse knowledge transfer.

In the context of multinational companies, reverse knowledge transfer can be defined as the process of transferring knowledge from multinational research and development centres to parent companies. Reverse knowledge transfer is a process through which knowledge is transferred from a source that is affiliated (subsidiary) to a recipient (headquarters). The recipient receives, assimilates, and applies the knowledge to gain a competitive advantage (Kogut & de Mello, 2017). The reverse knowledge transfer process is not linear; rather, it is complex and reciprocal.

In the literature, it is not possible to find research in which the authors focused on the investigation of the transfer of knowledge from branches in the form of shared service centers or business centers, whose know-how, information, and knowledge would be transferred back to the parent company (Ferenčíková, Krajčík, Váleková, 2024).

In the literature, the authors pay attention to the factors that affect the effectiveness of the reverse knowledge transfer. According to Oh and Anchor (2017), knowledge development ability, willingness, and autonomy are critical factors that influence the backward transfer of local market information within MNC networks. Managerial attention is a key factor in recognizing a potential source of knowledge within a multinational network and is the first requirement for knowledge transfer to take place. Decisions about attention are based in part on knowledge source location, awareness, attractiveness, and strategic importance. MNCs can thus adopt management practices and control mechanisms to influence the attention of executives and achieve higher knowledge flow from subsidiaries (Kumar, 2013). According to Chung (2014), backward knowledge transfer can be enhanced by implementing organizational motivators that support absorptive capacity. In addition, human-resources practices (position definition, appraisal, employee rotation, decentralization, integration, and innovative culture) can stimulate knowledge sharing. The more intensive the systems of the international human resource management system, the more knowledge is transferred from subsidiaries. Søndergaard et al. (2007) identified conditions conducive to knowledge sharing in organizations, including full ownership of subsidiaries, a culture of trust, international human resource management, and frequent management communication.

Based on the above facts, we set the main aim of our article and the research question for our investigation. The article main aim is to identify the reverse transfer of knowledge from business centers in CEE to their parent companies.

Research Question: What is the subject of the reverse transfer of knowledge between business centers in CEE and the parent company?

2 Methods

A significant approach employed in analyzing the empirical section of the study is the qualitative method, specifically the case study technique.

When designing a research project, it is essential to select an appropriate research method. The author employs the case study method when seeking to address the questions "How?" and "Why?". The method is primarily employed in instances where the objective is to examine the extant state of affairs or phenomenon and the behavior of the subject matter under investigation, yet where the possibility of influencing the course of events is absent (Yin, 2014). A case study is defined as an investigation of the particularities and intricacies of a singular case, to understand its operation within the context of significant circumstances (Stake, 1995).

Yin (2014) defines a case study as an empirical method that examines a contemporary phenomenon in its real-life context, particularly when the boundaries between the phenomenon and the context are not delineated. The objective is to gain a comprehensive understanding of the phenomenon and its context (Cavaye, 1996). A case study is a research method that incorporates a variety of research techniques, employing distinct approaches to data collection and analysis. In light of the aforementioned considerations, it can be concluded that the case study is not merely a data collection technique or a standalone design element. It constitutes a comprehensive research strategy (Yin, 2014).

A variety of procedures have been documented in the literature for application in the creation of case studies. In order to process the article research, we proceed in accordance with the methodology proposed by Yin (2014). We augment the procedure above with insights gleaned from the works of prominent scholars such as Stake (1995), Hancock and

Algozzine (2006), and Baxter and Jack (2010). In order to process our research, we primarily adhere to the methodology set forth by Yin (2014).

The design of a case study requires the definition of several key facts at the outset (Yin, 2014) (Table 1).

Table 1 Elements that must be defined at the outset of the research process:

Research question:	What is the subject of the reverse transfer of knowledge between business centers in CEE and the parent company?
Unit of analysis:	business centre situated in one of the countries belonging to the Central and Eastern European (CEE) region
Number of research objects:	4 (the minimum number for applying a case study as a research method according to Yin (2014))
Logical connection of data and assumptions:	representatives of selected business centers have all the necessary information about the conditions and functioning of the center

Source: processed by authors

In selecting the sample for this article research, two sampling techniques were employed: judgmental sampling and convenience sampling. The sample selection method is based on the identification of respondents who have the opportunity to participate in such research. As Richterová (2013) notes, this selection is based on the researcher's judgment, knowledge, and assumptions, through which they identify respondents suitable for specific research. The combination of the methods does not ensure the representativeness of the centres in the Slovak Republic and the CEE region; however, it fulfils the qualitative aspect of the study of the business centre sector.

In selecting the sample for investigation in this article, we focused on centres in the following countries in the case of the investigation of the CEE region as a whole:

- the center in Poland, as the most important country among the CEE countries in terms of the number of inhabitants and the number of centers in the country;
- the center in Romania, which covered Eastern Europe;
- the center in the Czech Republic, which can be classified as one of the most developed countries in the region;
- center in the Slovak Republic, which is the starting country of our research.

Furthermore, this array of centres enables the examination of centres that, in terms of numbers, can be classified among all three types of enterprise, namely small, medium, and large enterprises. Regarding the country of origin of the parent company, the sample encompasses the United States of America and the countries of Western Europe, except Brazil.

3 Research results

Many shared service centres and business centres are in operation in the countries of the CEE region. They are situated in several countries and cities and provide a diverse range of services. From the perspective of the parent company, these entities serve several functions and represent a key tool for gaining a foothold in the European market. The following text presents four case studies of selected business centres operating in selected countries of the region under investigation. A summary of the fundamental data concerning the selected centres is presented in Table 2.

Table 2 Basic information about the selected business centers

	The main activity	Localization	Establishment	Number of employees	Country of origin
BC 1	Financial services, IT services	Poland	2011	1 600	Netherlands
BC 2	services in the field of global solutions, talent mobility	Czech Republic	2006	86	USA
BC 3	services in the field of innovative consulting, marketing, mobility	Romania	2004	1 600	Brazil
BC 4	finance and accounting services	Slovakia	2017	300	Germany

Source: processed by authors

3.1 Business Center 1 (Poland)

Business Centre 1 (BC 1), which is the subject of our study in Poland, was established in that country in 2012. The investors decided to locate the centre in one of the largest Polish cities - Krakow. Currently, the centre offers a much wider range of services. In addition to financial services, it also offers IT and supply chain services. The centre currently employs more than 2,000 people (Online consultation, 2023).

The centre is seen as a strategic centre from the perspective of the parent company. It can also be described as a global business centre. It is a centre that is more important than other centres within the company. Its role is to improve the functioning of processes. It is an operating company that focuses on finding the best solutions within the country. At the same time, it uses the knowledge and skills of the country's inhabitants, achieving economies of scale and centralisation. The heads of department within the centre present the results to a member of the global finance department. He presents the results to the Global Finance Director. The centre is an important part of the overall corporate strategy, but it is important to manage the centre as an independent entity. The center's KPI targets in Poland align with the organization's KPI targets (Online Consultation, 2023).

There is a reverse transfer of knowledge between the center in Poland and the parent company in Amsterdam. Knowledge is also transferred to other centers within the corporation. The center organizes workshops through which they share with other centers and the directorate best practices and improvements in the field of providing financial services. As part of the workshops, they deal with the possibility of introducing procedures from a local point of view (Online Consultation, 2023).

The centre initiates processes for processing, capturing, and identifying data from incoming invoices. From Krakow, processes are initiated for all other centres in Europe. The centre also has a team specializing in the methodology of transferring activities from one location to another or transferring activities from several locations to one centre (Online Consultation, 2023).

3.2 Business Center 2 (Czech Republic)

Business Center 2 (BC 2) is a leading provider of global talent mobility solutions to some of the world's most recognized brands and their employees in 165 countries. The parent company is headquartered in the USA. The main activity of the centre is to provide relocation services to clients around the world. The centre in Prague is one of the three most important centres within the company (Internet source, 2023). The other two main centres are in Singapore and China (Online consultation, 2023).

The Prague centre was established in September 2008. After a short time, the centre in the Czech Republic became the main centre with the largest number of employees. At present, 86 people work in the Prague centre. There is only one centre in the Czech Republic. This is the first subsidiary outside the USA (Online consultation, 2023).

BC 2 has become the mainstay of the MNC's operations and currently employs the largest number of staff of any of the branches. It is a fully functional centre for daily operations, which differs from others not only in size, but also in the number of services it provides. It is also a distribution unit for the whole of Europe. The Prague branch has a logistics department unlike any other in the world (Online consultation, 2023).

Information, coordination, and cooperation between the European offices is based on close links. Regular Zoom meetings serve as a basis for information exchange. All branches use the company's portal, which has been specially designed as a teaching and learning space. This is a place where you can find mandatory training, its plans and schedules, as well as optional supplementary learning materials. Each training session ends with a series of multiple-choice tests, with a minimum pass rate of 90% (Online consultation, 2023).

The Centre regularly contributes to this portal and innovates in the field of education. It updates information and adapts data to current market changes. These are then introduced and used in other centres of the company. In this case, we can observe a transfer of knowledge in the field of training of current and future employees. It is a transfer of information between the centre in Prague and sister centres (Online consultation, 2023).

3.3 Business Center 3 (Romania)

Business Center 3 (BC 3) in Bucharest offers its European clients a unified set of solutions through the thoughtful use of the human factor, processes and technologies. These solutions combine innovative consulting, marketing, mobility, personalised campaigns and artificial intelligence services. They maintain their competitiveness by investing in

technological innovation, partnerships, global acquisitions and the recruitment of highly skilled professionals. The centre in Bucharest was built in 2004 (Official website, 2024).

From the parent company's point of view, the centre can be seen as the operational centre of the whole company. It is seen as the main headquarters for the whole company because of the performance (especially in development) that the centre achieves. The country represents an advantageous strategic position from which it is possible to penetrate other markets in Europe and Asia (Online consultation, 2023).

When it comes to the cooperation between BC 3 and the parent company in Brazil, it is worth mentioning the different cultures of the two countries. They work together to achieve the goals they have set. They look at these goals from a "European point of view". A strategy that can be applied in Brazil cannot be applied to the same extent in a European country. The company's management is flexible in this area and understands the need for strategy changes in the European context. However, they maintain a European orientation in areas where it is necessary. As part of their cooperation, there is an exchange of selected employees. Mutual visits to workplaces are carried out, which contribute to a better understanding of processes and the subsequent setting of various policies and objectives by the parent company (Online consultation, 2023).

The centre in Romania is also heavily involved in process and product innovation research and development. This knowledge is then transferred back to the parent company in Brazil. Again, Brazil is a different market with a different culture. However, some customers are similar to the European culture, and it is therefore possible to implement best practices from Romania in the parent company. In the field of research and development, centres in Romania have developed, for example, smart lockers for the transfer of the rights of the final owner of a given parcel, or portals for end users or the management of Stefanini services in Romania (Online consultation, 2023).

3.4 Business Center 4 (Slovakia)

The BC 4 consists of 300 employees providing finance and accounting services. A diverse team of 16 nationalities speaking 25 languages, together with the global functions that the centre provides to its clients, creates innovative and integrated business solutions for the whole world (Official website, 2024).

The centre has been operating on the market of the Slovak Republic since 2017. The motive that led the parent company to build the centre was efficiency, including simplification of processes and automation. In this way, it was possible to concentrate processes that were previously carried out in different countries around the world in one place (Online Consultation, 2023).

From the parent company's point of view, the Business Centre fulfills several functions: providing financial services, tax services, automation, and robotics. The development of skills and the increasing added value provided by employees has led to the creation of a centre of excellence in some processes. In general, the Business Centre aims to improve processes and become a business partner for other countries (Online Consultation, 2023).

In the Slovak Republic, Covestro specialises in providing accounting services. The company is constantly improving and streamlining its processes in this area. In the centre they are intensively engaged in robotization and automation of accounting processes. In this way, they have managed to fully automate some routine accounting activities. The processes successfully introduced and implemented in BC 4 were subsequently presented and implemented in other centres within the Group. The automation of selected processes was introduced either globally or individually, for example in the Shanghai Business Centre, which carries out activities for Asia (Online Consultation, 2023). In the case of this centre, knowledge transfer can be observed mainly to other centres performing the same or similar activities.

4 Discussion

The business centres examined in this article have a strategic role from the perspective of the parent companies. They contribute to the overall strategy of the company and to the achievement of financial objectives, and they participate in the reporting and other activities of the company. In the context of the relationship between the centre and the transnational enterprise, we identified the reverse transfer of knowledge from the centre to the parent enterprise or to other centres within the enterprise.

In the context of multinational corporations, subsidiaries have proven to be important sources of knowledge and competence. This is also confirmed by Sinai and Heo (2022), who argue that MNCs need to effectively collect and implement knowledge from their geographically dispersed network of subsidiaries in order to ensure competitiveness in the global business environment. Table 3 provides an overview of the forms of backward knowledge transfer in the centres in the countries studied.

Table 3 Realization of the reverse transfer of knowledge in selected business centres

	Realization of the reverse transfer of knowledge
BC 1 (Poland)	<ul style="list-style-type: none"> Sharing of best practices and improvements in the provision of financial services Workshops to introduce procedures in local conditions Specialized team for the methodology of knowledge transfer and know-how
BC 2 (Czech Republic)	<ul style="list-style-type: none"> Access to the educational space Education of current and future employees Transfer to the parent company and subsequently to other centers within the MNC
BC 3 (Hungary)	<ul style="list-style-type: none"> Processes and procedures and innovation of products (services provided) Transfer to parent company (Brazil) Intelligent lockers for transfer of end owner rights, portals for end users
BC 4 (Slovakia)	<ul style="list-style-type: none"> Knowledge in the field of robotization and automation of accounting processes Knowledge transferred to the parent company Introduction of knowledge in other centers within the corporation

Source: processed by authors

Based on our research, we cannot unequivocally confirm reverse knowledge transfer as defined by the authors Kogut and de Mello (2017). According to them, the backward transfer of knowledge is the reverse flow of knowledge (from the subsidiary to the parent company). In our investigation, we identified knowledge transfer not only to the parent company, but also to other centres within the company. Our research confirms the finding of Birkinshaw et al. (1998); Pearce and Papanastassiou (1999) that the trend towards reverse knowledge transfer is in line with the wider recognition that foreign subsidiaries can serve as sources of innovation. In the cases we have studied, business centres in the regions of Central and Eastern Europe represent subsidiaries that are sources of knowledge for MNEs. In doing so, they contribute to the creation of competitive advantage for the firm (Ambos, et al., 2006).

Our research also confirms a and Phene, (2004) that parent companies can also play a role in channelling knowledge to the relevant MNE unit, thus organising knowledge transfer processes in their own network. Business centres create know-how which they present to the parent company. This know-how and knowledge is then transferred from the parent company to other centres within the group.

5 Conclusions

The original intention of multinationals in establishing business centres in different countries around the world was to reduce costs and ensure greater efficiency. In this way, they contributed to maintaining their competitiveness in the global market. With the passage of time and the increasing specialisation of business centres, it is possible to observe the creation of such activities within business centres, which are subsequently subject to knowledge transfer.

The study of knowledge transfer has received considerable attention in the literature. Authors look at this phenomenon from different angles and define it in different ways. However, the existence of reverse knowledge transfer from subsidiaries in the form of business centres has not been sufficiently explored.

No single model of knowledge transfer from the business centre to the parent company can be identified based on our research.

- Knowledge is created and subsequently transferred in various areas (education system, rationalization of routine activities, or creation of innovative procedures and processes).
- The knowledge transfer we have identified cannot even be understood in the same way as the reverse knowledge transfer is defined in the literature. In the cases we studied, knowledge transfer is clearly not only to the parent company. Knowledge generated by the business centres is subsequently transferred to other branches within the group. It is therefore a horizontal transfer of knowledge and know-how.

The limitation of the article is the limited number of research objects. In the future, our research can be expanded to include other business centers in the studied countries as well as business centers in other countries of the Central and Eastern European region.

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Session:
Economic Performance and Sustainability

Digitalization as a Path to Sustainability: Ecological, Economic and Social Aspects of the Creative Industry in Slovakia

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Abstract: This study explores the impact of digitalization on the sustainability of creative industries in Slovakia and the Visegrad Group (V4), focusing on ecological, economic, and social dimensions. Through a mixed-method approach combining qualitative trend analysis and quantitative correlation studies, the research identifies digitalization as a driver of resource efficiency, innovation, and economic independence. However, challenges such as increased energy consumption, e-waste, and digital inequities persist. The findings highlight the need for green technology adoption, improved digital infrastructure, and inclusive policies to ensure balanced and sustainable development, leveraging digitalization's transformative potential for the creative sector.

Keywords: Creative industry, Digitalization, Eco-friendly business models

JEL Classification: L82, Q56, O33

1 Introduction

The creative industry plays an increasingly key role in national economies worldwide, and Slovakia is no exception. Over the last decade, the sector has experienced significant growth, driven by digitalization, which has transformed content creation, distribution, and consumption. Digital tools and platforms have enabled Slovak creators to explore new forms of artistic expression, reach global audiences, and reduce production costs. However, this transformation also brings challenges, particularly in terms of sustainability. The ecological, economic, and social implications of digitalization need careful evaluation to ensure long-term sustainability in the creative sector.

In this article we examine the impact of digitalization on the creative industries within the V4 countries - Slovakia, Czech Republic, Poland, and Hungary - by comparing their ecological, economic, and social dimensions. While digitalization brings significant opportunities for innovation and growth, it also poses challenges related to energy consumption, e-waste, and social inequalities. By comparing these trends across the V4, we aim to identify shared patterns and unique differences within the group, offering policy recommendations that can foster sustainability in the digital transformation of their creative sectors.

2 Methods

The term "creative industry" encompasses a wide range of economic activities that involve the generation, creation, and commercialization of intellectual property, cultural content, and creative expression. According to the United Nations Conference on Trade and Development (UNCTAD), creative industries include sectors such as advertising, architecture, arts, crafts, design, fashion, film, music, performing arts, publishing, and software development, among others. These industries thrive on individual creativity, skill, and talent, while also contributing to economic and social well-being.

In the context of this study, the definition of the creative industry is aligned with the European Union's Cultural and Creative Sectors (CCS) framework, which emphasizes the dual economic and cultural value of these sectors. Key characteristics of creative industries include high levels of innovation, significant contributions to employment and GDP, and their capacity to shape cultural identity and social cohesion. This study specifically focuses on the ecological, economic, and social aspects of digitalization within Slovakia's creative industries, examining its impact through both qualitative and quantitative lenses.

This study adopts a comparative mixed-method approach to analyze the effects of digitalization on the creative industries' sustainability in Slovakia, Czech Republic, Poland, and Hungary. The research methodology combines

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qualitative and quantitative techniques to offer a comprehensive view of digitalization's impact across ecological, economic, and social dimensions within the V4.

Qualitative analysis of industry trends: We conducted an in-depth examination of trends in content creation, distribution, and emerging business models within the V4 creative industries. This involved analyzing industry reports, governmental documents, and academic literature across all four countries. We also reviewed sustainability metrics, such as energy consumption, resource efficiency, and digital business practices.

Quantitative correlation analysis: We gathered statistical data on employment in the creative sectors and government expenditure from national statistical office in Slovakia and Eurostat. Correlation analysis was performed to examine the relationship between employment trends and government financial support of Cultural sector in each V4 country from 2019 to 2022. This was conducted using Pearson's correlation coefficient to assess the strength of relationships.

Case study methodology: To assess practical implications, we selected a case study from Slovakia's film, music, and visual arts industries. This case study was chosen based on their prominent adoption of digital tools and their measurable environmental and economic outcomes. We examined how these sectors have adapted to digitalization and its impacts on sustainability.

3 Research results

3.1 Ecological Aspects

Digitalization in the creative industry has led to significant reductions in the need for physical materials, helping to lower the industry's carbon footprint. The shift from physical to digital media, such as music streaming and e-books, reduces the ecological impact associated with producing and transporting physical goods. However, digitalization introduces its own environmental concerns.

The growing demand for cloud-based services, streaming platforms, and digital content creation tools significantly increases energy consumption. According to the International Energy Agency (IEA), data centers and networks account for about 1-1.5% of global electricity use, with this number expected to rise. Slovakia's developing digital infrastructure may struggle to keep up with this demand, especially if renewable energy sources are not fully integrated. Rapid obsolescence of digital devices used by creatives (e.g., computers, cameras) contributes to the rising problem of e-waste. Slovakia generated over 52,000 tons of e-waste in 2021, a figure that has been growing by approximately 6,000–7,000 tons annually. This represents an ecological challenge that digitalization introduces, which must be mitigated through recycling programs and energy-efficient technology.

3.2 Economic Aspects

Digitalization offers substantial economic benefits for Slovakia's creative industry. It has allowed creators to adopt new business models, such as direct-to-consumer sales, online subscriptions, and crowdfunding. These digital platforms reduce creators' dependency on traditional intermediaries, offering them greater autonomy and the ability to reach international markets.

In 2021, the creative industry contributed 1.55% to Slovakia's GDP, employing approximately 2.9% of the workforce. Despite this growth, the percentage of employment fell slightly in 2023 to 2.7%, in part due to the economic effects of the pandemic. While digitalization creates economic opportunities, access to the necessary tools remains uneven across Slovakia. The digital divide, especially between urban and rural areas, remains a significant challenge. In 2022, 90.7% of Slovak households had internet access, but this was still below the EU average, limiting economic opportunities for creators in underserved regions.

In recent years, Slovakia's film industry has embraced digitalization, particularly following the pandemic. In 2022, the industry hit a record high with the production of 50 films, up from 44 in 2019. This shift was driven by digital technologies enabling more efficient production workflows and the rise of home-based consumption through streaming platforms. However, this also increased the demand for energy-intensive data storage and streaming services, underscoring the ecological trade-offs of digitalization. Films such as *Nightsiren* by Tereza Nvotova are emblematic of this transformation, highlighting how digital tools are reshaping film production and distribution in Slovakia.

3.3 Social Aspects

The social impact of digitalization in Slovakia's creative industry is twofold. On one hand, digitalization democratizes access to creative tools and platforms, enabling a broader range of individuals to participate in the creative economy. On the other hand, it risks exacerbating social inequalities. There is a noticeable gap in digital literacy, especially among older populations. In 2023, only 23% of Slovaks aged 45–74 reported having basic digital skills, compared to 98% of individuals aged 16–44. This skills gap limits the ability of older creative professionals to fully leverage digital technologies, making it harder for them to adapt to the changing landscape.

Marginalized groups, such as ethnic minorities and those from lower-income backgrounds, are at risk of digital exclusion. Without access to technology and training, these groups may miss opportunities created by digitalization. Ensuring that digital platforms and tools are accessible to all members of society is essential to promoting social equity in the creative sector.

3.4 Correlation between the population employed in the creative industries and the General government expenditure by function (COFOG)

Table 1 Employed people in creative industry and General government expenditure by function between years 2019 – 2022 in Slovakia

Slovakia		2019	2020	2021	2022
Employed people (in thousands)	Men	38,3	35,6	37,3	38,9
	Women	35,5	35,8	37,6	37
	Total	73,8	71,4	74,9	75,9
General government expenditure by function (COFOG) (in millions EUR)	Total (annually)	526,6	472,2	475,8	540,7

Source: Own processing

Table 2 Correlation between employed people in creative industry and General government expenditure by function between years 2019 – 2022 in Slovakia

Correlation (SK)	SK - A	SK - B
SK - A	1	
SK - B	0,604223	1

Source: Own processing

In Slovakia, both employment and government expenditure on cultural services have shown consistent growth from 2019 to 2022. Employment increased steadily, with the total number of employed people rising from 73.8 thousand in 2019 to 75.9 thousand in 2022. Government expenditure on cultural services also followed an upward trend, starting at 526.6 million EUR in 2019 and reaching 540.7 million EUR in 2022, despite a dip in 2020. Our correlation analysis for Slovakia showed a moderate positive correlation (0.604223), indicating that an increase in cultural sector employment is associated with an increase in government spending on cultural services.

Table 3 Employed people in creative industry and General government expenditure by function between years 2019 – 2022 in Czech Republic

Czech Republic		2019	2020	2021	2022
Employed people (in thousands)	Men	91,6	99,1	107,6	99,1
	Women	101,2	103,9	102,1	95,2
	Total	192,8	203	209,7	194,3
General government expenditure by function (COFOG) (in millions EUR)	Total (annually)		1437,7	1402,6	1461,2
					1700,7

Source: Own processing

Table 4 Correlation between employed people in creative industry and General government expenditure by function between years 2019 – 2022 in Czech Republic

Correlation (CZ)	CZ - A	CZ - B
CZ - A	1	
CZ - B	-0,42422	1

Source: Own processing

The Czech Republic showed the highest employment numbers in the cultural sector, with a total of 192.8 thousand employed in 2019, increasing slightly to 194.3 thousand in 2022. However, despite this increase in employment, government expenditure on cultural services fluctuated and, in 2022, stood at 1700.7 million EUR, marking the highest point in the analyzed period. The correlation analysis, surprisingly, revealed a negative relationship (-0.42422) between employment and cultural expenditure, suggesting that despite an increase in workforce, spending did not grow proportionally. This inverse relationship may reflect a shift in budget priorities or structural factors affecting cultural policy.

Table 5 Employed people in creative industry and General government expenditure by function between years 2019 – 2022 in Poland

Poland		2019	2020	2021	2022
Employed people (in thousands)	Men	273,3	257,3	246,5	269,9
	Women	302,1	307	320,3	333,7
	Total	575,4	564,3	566,8	603,6
General government expenditure by function (COFOG) (in millions EUR)	Total (annually)		3887,8	3543,3	3280,8
					3605,9

Source: Own processing

Table 6 Correlation between employed people in creative industry and General government expenditure by function between years 2019 – 2022 in Poland

Correlation (PL)	PL - A	PL - B
PL - A	1	
PL - B	0,275794	1

Source: Own processing

Poland demonstrated a fluctuation in both employment and expenditure on cultural services. Employment dipped slightly from 575.4 thousand in 2019 to 566.8 thousand in 2021, followed by a recovery to 603.6 thousand in 2022.

Similarly, government spending on cultural services dropped in 2021 to 3280.8 million EUR but rebounded to 3605.9 million EUR in 2022. The correlation analysis showed a weak positive correlation (0.275794), indicating a slight alignment between employment and expenditure, though the relationship is not particularly strong.

Table 7 Correlation between employed people in creative industry and General government expenditure by function between years 2019 – 2022 in Hungary

Hungary		2019	2020	2021	2022
Employed people (in thousands)	Men	87	95,1	75,3	75,9
	Women	76,9	79,6	91,1	87,7
	Total	163,9	174,7	166,4	163,6
General government expenditure by function (COFOG) (in millions EUR)	Total (annually)		1664,2	1772,7	1564,4
					1840,6

Source: Own processing

Table 8 Correlation between employed people in creative industry and General government expenditure by function between years 2019 – 2022 in Hungary

Correlation (H)	H - A	H - B
H - A	1	
H - B	0,141638	1

Source: Own processing

Hungary's employment in the cultural sector remained relatively stable throughout the period, with total employment fluctuating slightly around 164 thousand. Government expenditure, however, showed a more pronounced upward trend, rising from 1664.2 million EUR in 2019 to 1840.6 million EUR in 2022. The correlation analysis for Hungary indicated a very weak positive correlation (0.141638), suggesting that changes in employment had little to no effect on government spending in this sector.

Table 9 Correlation between employed people in creative industry and General government expenditure by function between years 2019 – 2022 in V4 as a group

V4 Total		2019	2020	2021	2022
Employed people (in thousands)	Men	490,2	487,1	466,7	483,8
	Women	515,7	526,3	551,1	553,6
	Total	1005,9	1013,4	1017,8	1037,4
General government expenditure by function (COFOG) (in millions EUR)	Total (annually)		7516,3	7190,8	6782,2
					7687,9

Source: Own processing

Table 10 Correlation between employed people in creative industry and General government expenditure by function between years 2019 – 2022 in V4 as a group

Correlation (V4)	V4 - A	V4 - B
V4 - A	1	
V4 - B	0,343624	1

Source: Own processing

For the V4 region, the correlation analysis yields a moderate positive correlation (0.343624), indicating that there is a general relationship between employment levels in the cultural sector and government expenditure on cultural services, though this relationship is not particularly strong. This moderate correlation suggests that while increasing employment in the cultural sector may be accompanied by higher government spending, other factors, such as economic conditions, political priorities, or the distribution of funds within cultural services, also play significant roles in shaping cultural budgets.

The upward trend in both employment and expenditure across most V4 countries reflects a growing recognition of the importance of the cultural sector in these nations' economic and social frameworks. However, the varying correlation strengths across the individual countries highlight the diversity in how each nation approaches cultural policy and investment. Slovakia's stronger correlation implies a more direct relationship between cultural employment and spending, while the Czech Republic's negative correlation indicates that cultural spending may not necessarily follow employment trends.

4 Conclusions

Digitalization holds significant potential for advancing sustainability in the creative industries of the V4 countries by promoting innovation and new economic opportunities. However, this shift also brings shared challenges, such as rising energy consumption, e-waste, and the persistent digital divide between urban and rural areas. From an ecological perspective, digitalization in creative industries has led to reduced reliance on physical media, such as printed books and CDs, which lowers the overall carbon footprint of these industries. However, it introduces significant environmental challenges, including energy-intensive digital infrastructure and rapidly growing e-waste. For example, the shift toward cloud services and streaming platforms increases the energy demand, which, without the integration of renewable energy, amplifies ecological risks. In Slovakia, the steady annual increase in e-waste generation reflects the need for systemic recycling programs and the adoption of energy-efficient technologies to mitigate these negative effects. Economically, digitalization has empowered creative professionals to adopt new business models, such as direct-to-consumer platforms, crowdfunding, and subscription-based content. These models offer independence and global market access but also expose inequalities in digital infrastructure and accessibility. Rural areas in Slovakia face pronounced disadvantages due to limited digital connectivity, highlighting a persistent urban-rural divide. Moreover, the moderate correlation between government spending on cultural services and employment in the cultural sector indicates the importance of sustained public investment to enhance economic resilience. Policies that invest in infrastructure and provide targeted support to underrepresented creators are essential for fostering economic equity within creative industries. The social impact of digitalization is twofold. While it democratizes access to creative tools and platforms, it also risks exacerbating social inequalities. Slovakia's older generations and marginalized communities are disproportionately excluded from the benefits of digitalization due to limited digital literacy and access to technology. These gaps not only hinder individual creators but also limit the broader societal contributions of the creative economy. Governments must address these disparities through comprehensive digital education initiatives and inclusive policy frameworks. In the broader socio-economic context, creative industries occupy a pivotal role at the intersection of culture, innovation, and sustainability. The challenges highlighted—such as energy consumption, e-waste, economic disparities, and digital exclusion—are interconnected with systemic socio-economic structures. To ensure sustainable growth, the V4 countries, including Slovakia, must adopt a regional framework that prioritizes:

- Environmental responsibility through green technology and efficient recycling.
- Economic growth driven by equitable access to digital resources and platforms.
- Social inclusion achieved via widespread digital literacy and education.

By fostering collaboration across the V4, these countries can collectively address shared challenges, build resilience, and fully harness the transformative potential of digitalization. Enhanced cooperation in digital infrastructure investments, energy efficiency strategies, and inclusive policies will enable the creative industries to thrive sustainably in a rapidly evolving digital landscape.

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Comparative Analysis of E-commerce Development in Sweden and Finland within Urbanization Contexts

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Abstract: The pandemic caused by COVID-19 created many challenges to the society. In order to protect the health of individuals, governments introduced many restrictions. One of the most common ones was social distancing. As a result, the consumption in physical stores was very limited and thus shifted into the e-commerce sector. This study aims to analyze the development of e-commerce sector in Finland in comparison to Sweden based on the available urbanization segmentation on Eurostat. The research method involves collection and analysis of data available at Eurostat. The results of the study suggest that due to the COVID-19 pandemic and the resulting government restrictions, there was a different development of the e-commerce sector in Finland than in Sweden. Finland recorded a greater increase in e-commerce turnover in suburb and rural areas whereas Sweden noted more significant increase in the e-commerce sector in individuals living in cities. Moreover, the outcome indicates that even after the most significant pandemic times has passed, the number of purchases performed via e-commerce platforms has remained at a higher level than during the pre-pandemic times. Hence that, there is an increasing tendency in the number of purchases performed via e-commerce platforms, which is the case for both investigated countries. Consequently, it could be assumed that due to the change in the customer purchases which were at first performed via online platforms due to the necessity of protection of health, created a new habit in customers who prefer to perform purchases via e-commerce platforms even in the present.

Keywords: E-commerce; globalization; economic crisis; COVID-19 pandemic

JEL Classification: L86, R11, R58, O33

1 Introduction

The early twenty-first century witnessed rapid technological advances that drove economic growth in the second decade. However, this growth faced a major challenge with the emergence of the COVID-19 pandemic caused by the SARS-CoV-2 virus. The onset of this global health crisis brought unprecedented turbulence to the world market, affecting all economic actors in a way rarely seen in modern history. The pandemic caused significant disruption to health systems around the world and generated widespread panic and uncertainty. These conditions led to a disruption of traditional market mechanisms, gradually leading to what is now known as the pandemic economic crisis. The pandemic economic crisis differs from previous economic downturns in its unprecedented scale and global impact. Although similar crises have occurred in the past, the current crisis has unique characteristics. Factors that previously supported strong economic growth, such as technological progress and a strong labour force, have come under strain. The pace of technological convergence has slowed, and the workforce is ageing, reducing its effectiveness in supporting growth. In addition, world trade has reached a saturation point, further complicating the economic situation (IMF, 2021). In the years leading up to the COVID-19 pandemic, there were already signs of economic strain, as underlying problems were often postponed rather than addressed. This environment of procrastination created a breeding ground for recession. As such, the current crisis is not only the culmination of existing problems, but also the manifestation of long-standing vulnerabilities within the global economic system (Kalamen et al. 2023).

E-commerce underwent a seismic shift before and after the COVID-19 pandemic. Even before the crisis, online retailing was on a steady upward trajectory, driven by changing consumer preferences and advances in digital technology.

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However, the pandemic acted as a catalyst, accelerating the adoption of e-commerce by several years in a matter of months. Following the introduction of lockouts and welfare measures, consumers turned to online shopping out of necessity, leading to a surge in demand for goods and services delivered directly to their homes. As a result, e-commerce not only became a lifeline for businesses struggling to survive the economic impact of the pandemic, but also fundamentally changed consumer behaviour, creating a new normal in which online shopping is an integral part of everyday life (Guthrie et al. 2021). Industry reports and consumer surveys show that the pandemic has accelerated a trend towards e-commerce that had been observed before the crisis (Kim, 2020). The fear of the pandemic has notably influenced consumer perceptions of the economic and environmental benefits of e-commerce platforms (Tran, 2021). Some authors predict that the digitalization of the marketplace and the habits learned during the pandemic may bring about structural changes to consumption as individuals maintain their modified behaviours once the pandemic ends (Kim, 2020; Sheth, 2020), such as those observed in China in 2002–2003 during the SARS pandemic (Clark, 2018). Even before the COVID-19 pandemic, e-commerce had been growing steadily as a proportion of total retail sales worldwide. In many developed countries, it was between 10% and 20%. During the pandemic, however, e-commerce growth accelerated significantly as lockouts and security concerns prompted consumers to shift their shopping habits online. In some regions, the share of e-commerce rose to more than 30% of total retail sales. These figures varied considerably from country to country, with more digitally advanced economies tending to have a higher share of e-commerce. During the peak of the coronavirus crisis (March–April 2020) when many countries worldwide introduced lockdown measures, e-commerce share in total retail sales saw proportions that were not seen before. In the United Kingdom, where an already mature e-commerce market exists, e-commerce share saw as high as 31.3 %, before stabilizing in the subsequent periods. In the most current period (as of January 31, 2021), United Kingdom, United States and Canada were the leading countries where e-commerce had a higher share as a proportion of total retail, at 24, 17, and 15 %, respectively (Chevalier, 2023).

2 Theoretical background

In the course of transition from the old economy to the new one, e-commerce has eliminated the problem of time and space which in return has lowered costs in production process. Thus, e-commerce has become a dynamic factor in the new economy. OECD (2001) defines e-commerce in two scopes sorted as broad and narrow ones. According to the broad definition, e-commerce is the purchase or sale of goods between the businesses, households, individuals, governments and other public and private organizations over computer networks. Narrow definition on the other hand is almost same as the broad definition of the exception that the instrument of trade is limited with the internet. Totonchi (2012) argues that e-commerce is production, advertisement, sale and distribution of goods and services on open network environment (internet) or via closed network environment (intranet). In frame of the definitions, e-commerce is the trade of physical goods over open and closed networks.

In the existing literature, studies focusing on macro-level determinants of e-commerce adoption are few, most of this research mainly emphasizes individual and organizational environments (Delone & Mclean, 2004; Grandon et al., 2011; Chiu et al., 2014). Although individual and firm level factors are important, they do not explain significant differences in e-commerce adoption among countries. Moreover, because of sampling constraints, the generalization of the results reported in the existing research that examine macro-level determinants of e-commerce adoption is rather limited. Particularly under the circumstances caused by COVID-19 pandemic and the pressure of increasingly advancing technologies, social media and online platforms have been created to saturate the customer needs and on the other hand companies take an advantage of the opportunities online space provides (Pollák, Markovič, 2021).

The advent of the internet has challenged traditional notions of urbanization, leading to a shift towards a new trajectory where the urbanization of the population diverges from the urbanization of the land. This contradiction, manifested in the significant expansion of built-up urban areas compared to the growth of China's urban population since 2000, has highlighted inefficiencies and social problems such as unaffordable housing. However, the development of e-commerce has enabled a new approach to urbanization, enabling the two-way movement of goods between rural and urban areas and the provision of basic services at residents' doorsteps. This decentralized model challenges the traditional concentration of population and industry in large cities and offers opportunities for small towns and rural areas to develop into urbanized regions under the decentralization model (Sheng et al., 2014).

The traditional pattern of urbanization, characterized by peasants migrating to cities in search of work during industrialization, has left rural areas struggling with social problems such as abandoned farmland and deserted populations. However, scholars recognize that in populous countries such as China, India and Mexico rural areas will continue to retain significant populations due to factors such as agricultural, land ownership and food security concerns

(Li X, 2014). The influx of rural people into cities not only depletes rural resources and cultural heritage, but also weakens agricultural base. In response, a new approach to urbanization is emerging, called *in situ urbanization*, which is driven by e-commerce and focuses on districts as spatial units. This approach seeks to strike a balance between agricultural modernization and the development of modern services, emphasizing the importance of stable agricultural development as a cornerstone of rural prosperity. Rural areas adopt different strategies, such as strengthening agricultural modernization, combining the primary and tertiary sectors or striking a balance between different sectors (Chu X and Li H, 2013). The main objective is to ensure sustainable rural development while harnessing the innovative potential of e-business to create new models of rural prosperity. Although there has been a growing scholarly interest in e-commerce development management. Recently, some Chinese studies have paid attention to the influence of e-commerce on rural development and rural life. The rapid development of e-commerce has led to the booming of Taobao villages, the number of which dramatically increased from 3 in 2009 to more than 2100 in 2017 (Lin, 2019). Taobao village is a cluster of rural e-tailers, where at least 10% of rural households engage in e-commerce or at least 100 online shops are open in the village.

Despite the primary attention of researchers in the field of drivers of e-commerce adoption to urbanization differentiation, there is a number of global country-level studies that can be identified in the literature (Ahluwalia, 2020). They rely on aggregate indicators representing the socio-economic characteristics of different countries and often focus on a study of the role of cross-cultural differences, which, for example, are considered using the approaches similar to Hofstede (Hallikainen, 2019). Another important aspect to e-commerce adoption is efficient use of resources based on more effective and transparent communication processes. An interactive communication between the parties can also bring a benefit of providing vital information to customer on one hand and to the enterprise on the other which stimulates information flow needed for effective business especially in the times when economy is impacted by shows such as COVID-19 pandemic (Saruç et al., 2013).

3 Methods

This study aims to analyze the change in the shopping behavior of individuals living in Sweden and Finland since breakout of the COVID-19 pandemic until the post pandemic time by the use of Eurostat data. Eurostat is the statistical office of the European Union which has a mission to provide high-quality statistics and data on Europe. Furthermore, it produces European statistics in partnership with National Statistical Institutes and other national authorities in the EU Member States.

For the purposes of this paper, the data used for performing an analysis of the shopping behavior are taken from the digital economy and society dataset with a further specification to information and communication technologies (ICT) usage in households and by individuals. The data are gathered by the EU survey on the use of Information and Communication Technologies in households and by individuals conducted on a yearly basis by the National Statistical Institutes and are based on Eurostat's annual model questionnaire. This questionnaire is updated each year to reflect the evolving situation of ITC. It collects data on the access to ICT, on the use of the internet, e-government, e-commerce, internet of things and green ICT. The statistical units of the survey are individuals aged between 16 and 74.

This article presents a selection of the dataset regarding the online purchases with the specification of the information society indicator specific to the types of individuals based on the urbanization type. For the purposes of this paper, the below reports have been selected to demonstrate the main e-commerce shift in the customer behavior:

- Internet purchases by individuals (until 2019),
- Internet purchases by individuals (2020 onwards).

In order to be able to understand the evolving trend since the spread of COVID-19 in Europe, it is crucial to use both reports. For the purposes of the paper, firstly it is important to understand if the two reports are comparable and if there are any significant changes which may impact the study. To perform a precise analysis of the dataset the team of scholars has firstly analyzed the set of specifications used in both reports available at Eurostat. Having said that, below we present the main criteria used:

1. Geopolitical entity is specified to the countries of Sweden and Finland;
2. The time period is specified from the year 2017 until 2023;
3. Individual type is specified to individuals living in cities, individuals living in towns and suburbs, and individuals living in rural areas;

4. Unit of measure is specified to percentage of individuals;
5. Information society indicator is specified to last online purchases in 12 months.

Since these set of criteria is identical in both reports, it enables the studied dataset to be comparable and to analyze the evolving situation in Sweden and Finland since pre-pandemic time until the present.

4 Research results

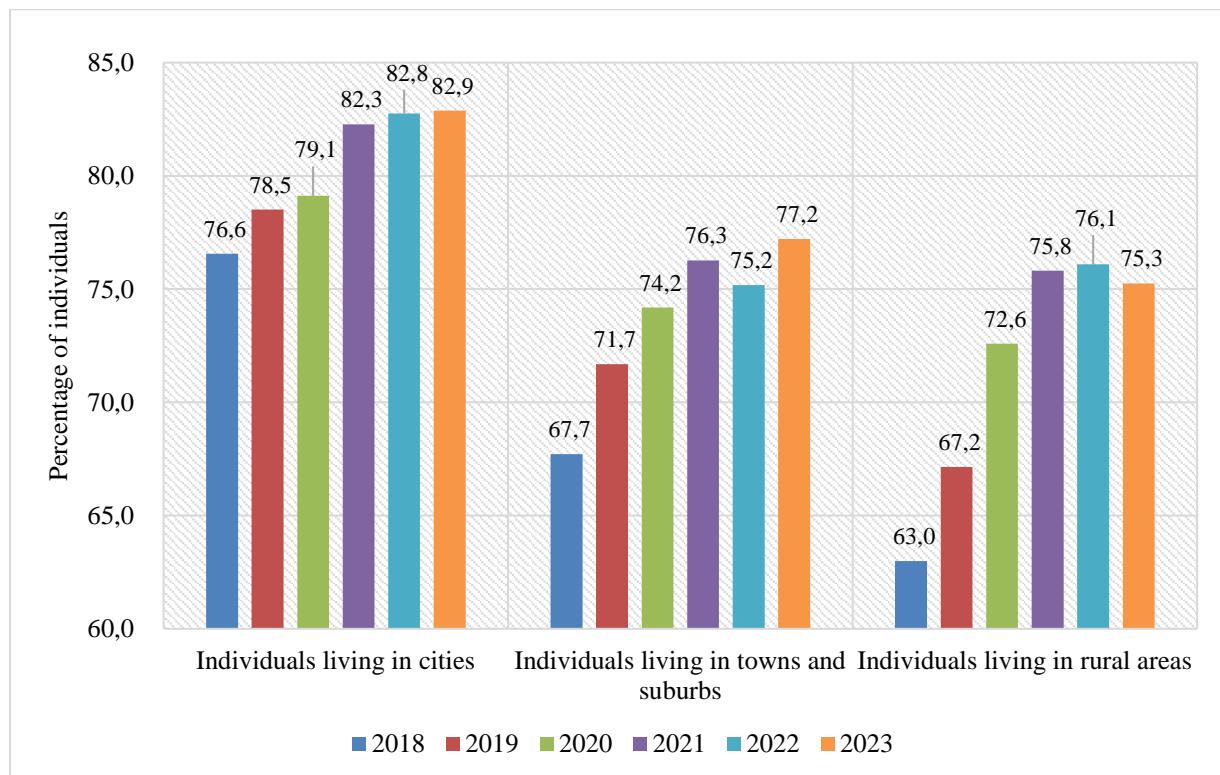
Since the outbreak of COVID-19, there have been several government restrictions that needed to be enforced. During the epidemic, many countries including Finland and Sweden adopted a policy of blocking and limiting social contact, social distancing was a common government restriction with the main goal of protecting individuals and limiting the spread of the pandemic. This greatly affected the possibilities to shop in physical stores on one hand and strengthened the possibility to shop online on the other. Thus, many e-commerce platforms were influenced by the pandemic situation and subsequently this had an impact on customer behavior. Due to that, one could assume that the nature of business has changed to some extent. The main factors that have undergone a significant transformation due to the COVID-19 pandemic is the number of customers using e-commerce platforms.

Based on the above and on the basis of data available at Eurostat, the shift in purchasing behavior can be demonstrated in Figure 1 below. The given data are narrowed down to the geographical area of Finland. In order to understand the development of the situation before, during and after the pandemic from a time series perspective, the years from 2017 to 2023 were selected for the purposes of this study. The statistical units of the survey are individuals aged 16 to 74 years, further distributed based on the urbanization of society, and thus the distribution of the population into:

- Individuals living in cities,
- Individuals living in cities and suburbs and,
- Individuals living in rural areas.

Based on these criteria, the collected dataset on internet purchases by individuals and/or households of individuals living in Finland are presented in Figure 1 below.

Figure 1 Online purchases of Individuals living in Finland based on Urbanization of the Society



Source: Authors based on Eurostat Data

Figure 1 presents the percentage of individuals that performed a purchase of goods and services via online e-commerce platform between the years 2018 to 2023 in the territory of Finland. For the purposes of clear data visualization, the x-axis shows the development in time from 2018 to 2023 which is split as per urbanization differentiation. The y-axis shows the percentage of individuals who purchased good and services online. For a better visualization, the y-axis is set from a minimum of 60 percent to maximum of 80 percent. Moreover, the data in Figure 1 express the percentage of individuals in absolute percentage points and thus present the absolute value according to the database available at Eurostat.

As can be seen from Figure 1, an increasing trend is noted in the number of consumers who purchased goods or service online across all the urbanization categories specified by Eurostat. The time period of the COVID-19 pandemic spread could be marked around the first quarter of the year 2020 in Finland as the first cases started to be noted around this time period. Thus a change in the way business activities were performed has been influenced in regards to the newly introduced government restrictions such as social distancing. Due to that, one could assume that there has been a change in the purchasing behavior of customers which is presented by a shift in the purchase of goods and services from brick-and-mortar stores towards e-commerce platforms or online shopping.

Figure 1 demonstrates that in terms of infrastructure, whether the consumer lives in an urbanized city, in a suburban village or in rural areas, the COVID-19 pandemic had a similar impact on the consumer behavior of all residents. This simply means that the government restriction and social distancing was applicable everywhere in the same manner which caused a shift in the way business activities were performed, more and more towards the online e-commerce platforms. Regarding a group of individuals living in cities the biggest increase of 3.1 percentage points can be seen between the years 2020 and 2021. In the other years the increase or decrease was oscillating around 1 percentage point, apart from the increase between the years 2018 and 2019 where an increase of 2 percentage points was noted. A group of individuals living in towns and suburbs noted a consecutive increase in terms of absolute percentage points, between the years 2018 and 2019 by 4 percentage points as well as 2019 and 2020 by 2.5 percentage points and even followed by further increase of 2.1 percentage points between 2020 and 2021. Similarly, a group of individuals living in rural areas noted an increase in online purchases between the years 2018 and 2019 by 4.2 percentage points followed by further increase of 5.4 percentage points between the year 2019 and 2020 in absolute percentage points and an additional increase of 3.2 percentage points between the years 2020 and 2021. As a result, it can be assumed that a more significant increase in online purchases is seen in the group of individuals living in towns and suburbs and also in rural areas compared to individuals living in towns. Furthermore, since 2019 it can be seen that a crucial increase occurred in the group of individuals living outside of cities, in case of individuals living in towns and suburbs in the absolute amount of 2.5 percentage points and in case of individuals living in rural areas in the absolute amount of 5.4 percentage points. If we compare this to the individuals living in cities, there is also an increase noted nevertheless in the absolute value of 0.6 percentage points. As a result, one could assume that a more significant increase is noted in the population living outside of cities.

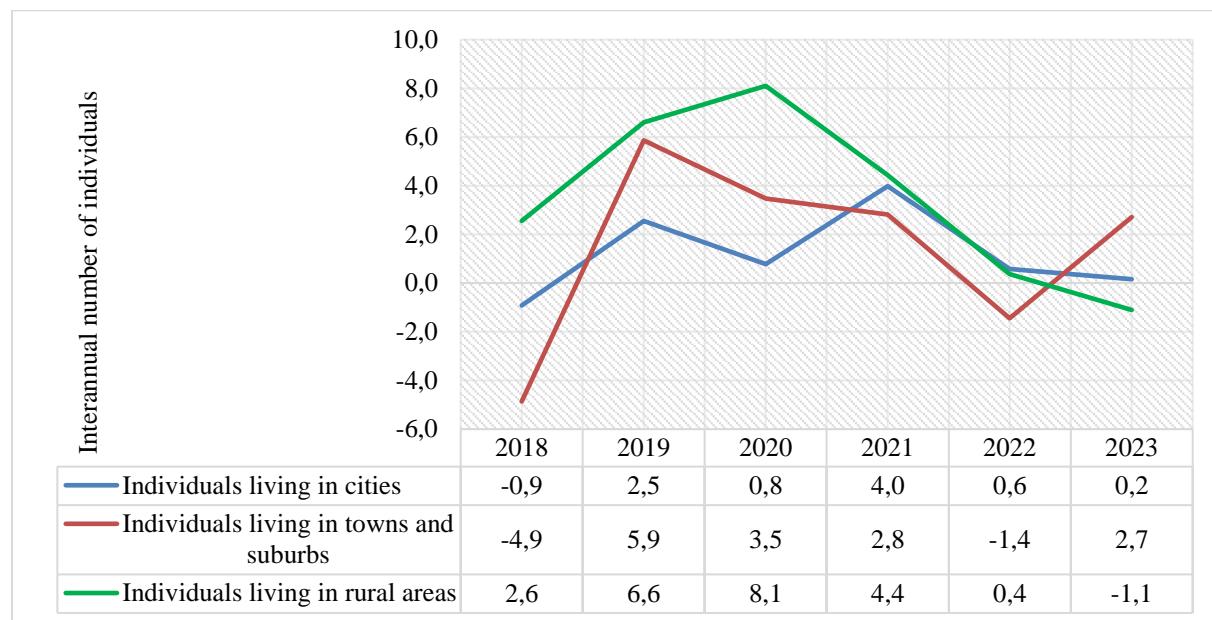
Moreover, even after the pandemic waves have passed, in 2022 and 2023 we can see that the percentage of individuals who make online purchases has remained above the level of pre-pandemic times, regardless of the customer environment in which they live. Due to that, we could assume that since COVID-19 pandemic began to be spread in the geographical area of Finland there is an increase in purchases performed online and thus one could assume a change in the customer behavior.

In order to be able to better interpret the evolution of the change between the years, a further calculation of the interannual percentage change has been calculated. Since we dispose with the data of individuals who ordered goods or services on a yearly basis, we can calculate the percentage change between the given years. The result would be expressed as percentage and demonstrates the amount of change happening between the two selected years and is calculated in the following way:

$$[(\text{Number in later time} / \text{number in earlier time}) - 1] * 100$$

Based on the above, the results of the interannual percentage change calculation can be seen on the Figure 2 below.

Figure 2 Year-on-year percentage change in Internet Purchases by Individuals of Finland according to Urbanization



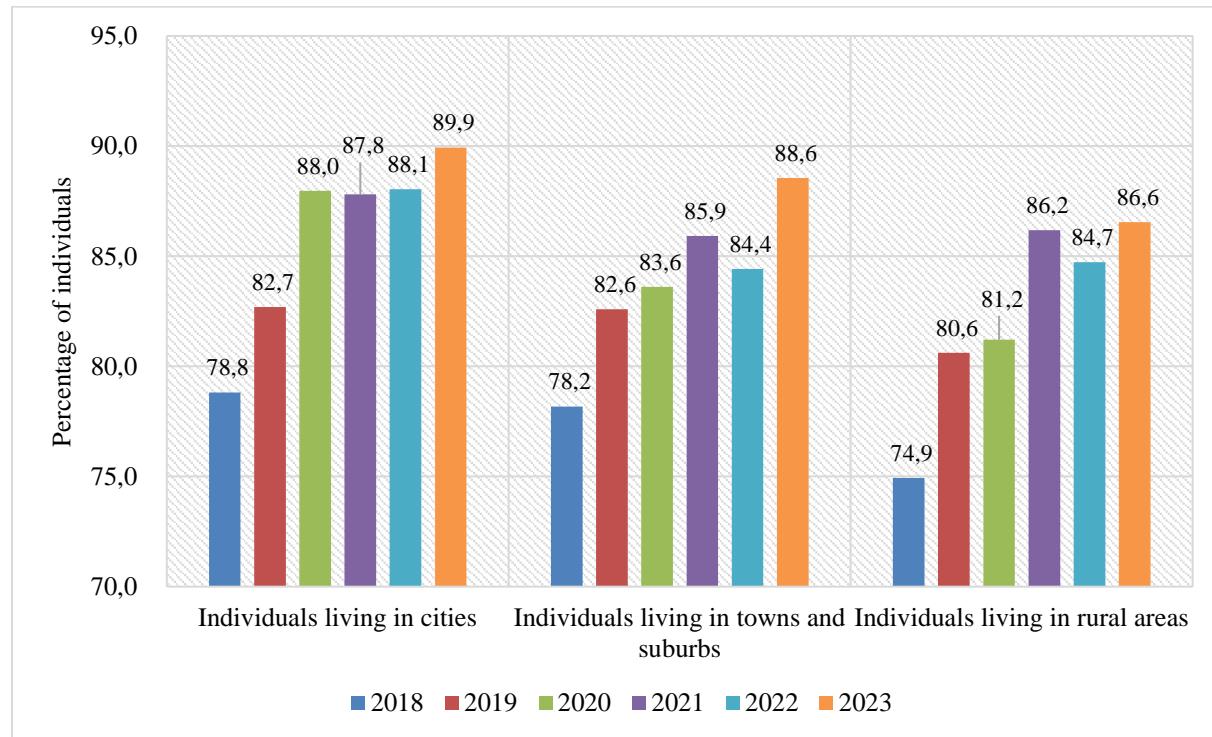
Source: Authors based on Eurostat Data

In the context of the earlier presented data on Figure 1, which expressed absolute percentage values, the data on Figure 2 shows the percentage change between two time periods. In this case, the percentage change is used to compare statistical data during the years 2018 to 2023 and expresses how much change has occurred between individual years.

In relation to the previous data, we can see that the biggest interannual percentage increase differs based on the group of individuals according to the urbanization differentiation. As suggested based on the earlier data, individuals living in cities note the most significant interannual increase between the year 2020 and 2021, an increase of 4.0 percentage points. In comparison to that, we can see that in terms of individuals living in towns and suburbs the increase is higher and in the value of 5.9 percentage points between 2018 and 2019, followed by 3.5 percentage points between 2019 and 2020 and 2.8 percentage points between 2020 and 2021. Similarly, number of individuals living in rural areas recorded also a more significant increase than a group of individuals living in towns and that is 6.6 percentage points between the years 2018 and 2019, followed by further increase of 8.1 percentage points between 2019 and 2020 and an additional increase of 4.4 percentage points was recorded between the years 2020 and 2021. Due to that, it can be assumed that since the COVID-19 pandemic a more significant increase of the online purchases can be noted in population living in towns and suburbs or rural areas in comparison to individuals living in cities in the geographical area of Finland. In general, we can see that the trend is mainly positive which means that year over year there is more and more individuals who perform purchases online via the use of e-commerce platforms.

Further analysis of the data available on Eurostat is focusing on the geographical area of Sweden, other parameters remain unchanged. The statistical unit is individual aged 16 till 74 years and from time perspective the years from 2017 till 2023 are investigated. The evolution of the shopping behavior of individuals is presented on Figure 3 with the split based on the urbanization differentiation as presented earlier in the paper.

Figure 3 Online purchases of Individuals living in Sweden based on Urbanization of the Society



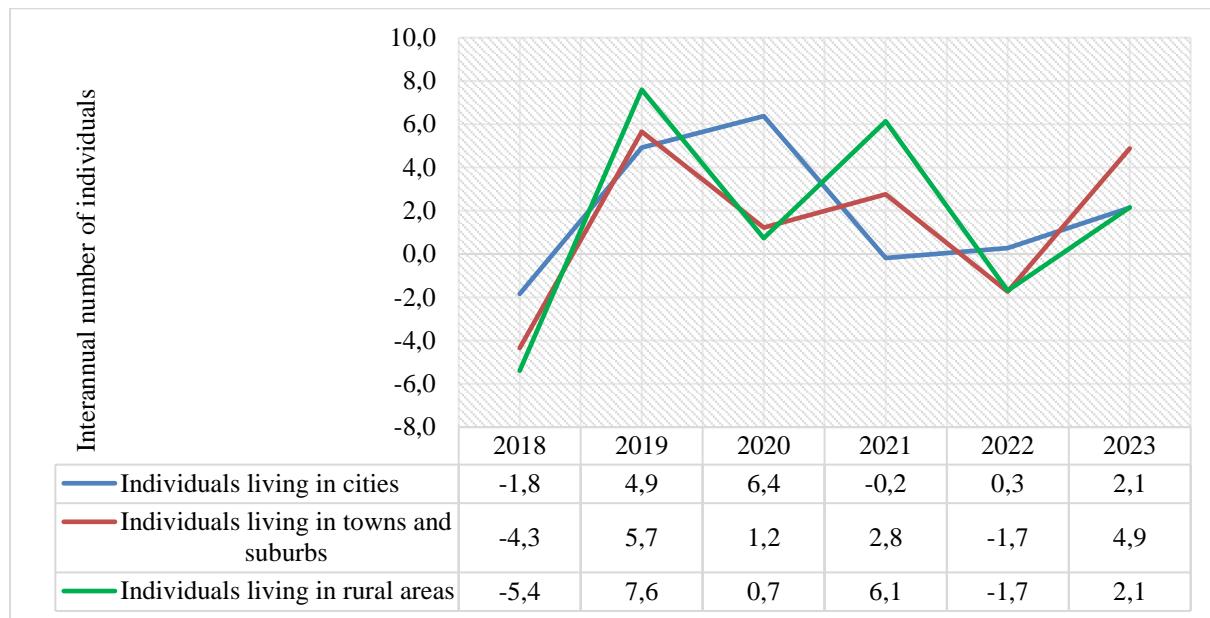
Source: Authors based on Eurostat Data

Figure 3 presents the percentage of individuals that performed a purchase of goods and services via online e-commerce platform between the years 2018 to 2023 in the territory of Sweden. For the purposes of clear data visualization, the x-axis shows the development in time from 2018 to 2023 which is split as per urbanization differentiation. The y-axis shows the percentage of individuals who purchased good and services online. For a better visualization, the y-axis is set from a minimum of 70 percent to maximum of 95 percent. Moreover, the data in Figure 3 express the percentage of individuals in absolute percentage points and thus present the absolute value according to the database available at Eurostat.

Having seen the absolute percentage point data displayed on Figure 3, we can observe that since COVID-19 breakout, since 2019, a higher percentage point increase is noted in the group of individuals living in cities in comparison to the population living in towns and suburbs or rural areas. The number of individuals who performed online purchases and are living in cities has risen by 5.3 percentage points between the years 2019 and 2020. Afterwards, the percentage remained around 88 percentage points with very little changes until the increase of 1.9 percentage points recorded between the years 2022 and 2023. The evolution of online purchases in Sweden was not the same in the group of individuals living in towns and suburbs or in rural areas. The recorded increase between the years 2019 and 2020 was within 1.0 percentage points in the individuals living outside of cities. In terms of individuals living in towns and suburbs there was an increase however, only in the value of 1.0 percentage point and in case of the group of individuals living in rural areas the increase is in the value of 0.6 percentage points. Consequently, the population living in towns and suburbs recorded a more significant increase later on, between the years 2020 and 2021, in the value of 2.3 percentage points. Similarly, regarding the individuals living in the rural areas, a more significant increase can be seen between the years 2020 and 2021 in the amount of 5.0 percentage points.

In order to be able to better interpret the evolution of the change in Sweden between the years, a further calculation of the interannual percentage change has been calculated and the results are presented on Figure 4.

Figure 4 Year-on-year percentage change in Internet Purchases by Individuals of Sweden according to Urbanization



Source: Authors based on Eurostat Data

In the context of the earlier presented data on Figure 3, which expressed absolute percentage values, the data on Figure 4 shows the percentage change between two time periods. The percentage change is used to compare statistical data during the years 2018 to 2023 and expresses how much change has occurred between individual years.

Figure 4 demonstrates the interannual percentage change evolution of the online purchases in Sweden made by individuals according to urbanization differentiation available at Eurostat. The year-on-year percentage change since the COVID-19 pandemic breakout or between the years 2019 and 2020 is positive in all the groups of individuals. However, a more significant increase can be seen in the group of individuals living in cities in the value of 6.4 percentage points. As can be seen, the group of individuals living in towns and suburbs recorded 1.2 percentage point increase and the group of individuals living in rural areas registered 0.7 percentage point increase. Due to that, it can be assumed that a more significant increase in the online purchases was noted in the group of individuals living in cities between the years 2019 and 2020. In case we would proceed to the next years interannual comparison, the situation is reversed and the group of individuals living in cities noted a decrease of 0.2 percentage points. However, the population living outside of cities noted an increase and even more significant than in the previous year's interannual comparison. In terms of individuals living in towns and suburbs, the increase between the years 2020 and 2021 is 2.8 percentage points and in case of individuals living in rural areas the increase is 6.1 percentage points. As a result, it can be assumed that the population living in the cities in Sweden had a more significant increase in the online purchases between the years 2019 and 2020 and in comparison, the number of online purchases performed by people living outside of cities had more significant increase during the years 2020 and 2021.

5 Conclusions

To summarize, in general it can be assumed that COVID-19 had an impact on the number of purchases performed via e-commerce platforms in Sweden as well as Finland. Based on the available data it can be interpreted that the number of online purchases has increased in both countries and across all the available types of urbanization. In case we would like to compare the latest available data at Eurostat, meaning the data from 2023 with the pre pandemic time in the year 2019, we can see that in terms of absolute percentage points there is an increasing trend in both countries, however with slightly different evolution based on urbanization differentiation available at Eurostat. In case of the population living in Finland and in cities, we can see that the increase between the years 2019 and 2020 was not so significant and a more significant increase in the online purchases occurred year after, between the years 2020 and 2021. Afterwards we do not record any essential changes, the number of purchases remained roughly stable with a total increase of 4.4 percentage points between the years 2019 and 2023 in absolute terms. In case of individuals living in Finland in towns and suburbs, the evolution was slightly different as apart from a significant increase between the years 2019 and 2020 of 2.5 percentage points, there was another increase of 2.1 percentage points which followed a year after. In total, the percentage of individuals who

performed online purchases between the years 2019 and 2023 has risen by 5.5 percentage points. In case of individuals living in Finland in rural areas even higher increase is recorded, between the years 2019 and 2020 an increase of 5.4 percentage points followed by 3.2 points between the years 2020 and 2021. In total, a group of individuals living in rural areas recorded an increase of 8.1 percentage points which can be assumed to be the most significant in Finland.

In case of the population living in Sweden, we have seen both, increase and also decrease in the number of purchases performed online. However, the population of Sweden living in cities recorded a more significant increase between the years 2019 and 2020, an increase of 5.3 percentage points which remained mainly stable for the following years. In total Sweden noted an increase of 7.2 percentage points between the years 2019 and 2023 which in comparison to Finland can be seen as considerable. In case of population of Sweden living in towns and suburbs, the increase between the years 2019 and 2020 was not as significant as between the years 2020 and 2021, where an increase of 2.3 percentage points was noted. In terms of comparison of pre-pandemic times with present, the group of individuals living in towns and suburbs recorded in absolute terms an increase of 6.0 percentage points which can be seen as having less affect in comparison to the group of individuals living in cities. To finalize, the population of Sweden living in rural areas shows similar trend as those living in towns and suburbs, with more significant increase in online purchases between the years 2020 and 2021, an increase of 5.0 percentage points. In total, the online purchases have increased by 5.9 percentage points.

As a result, it can be assumed that the COVID-19 pandemic had slightly different evolution of the trend of online purchases in Finland and in Sweden. The population of Finland demonstrates a more significant increase in the online purchases in the population living in towns and suburbs and rural areas whereas the population of Sweden shows a more significant increase in the population living in cities. Additionally, in terms of individuals living in cities, the population of Finland shows a greater increase between the years 2020 and 2021 whereas the population of Sweden sees a greater increase in online purchases between the years 2019 and 2020. In the studied period of time, the trend of online purchases in general could be assumed to have an increasing tendency due to the fact that the number of internet purchases remained above the level of pre pandemic times in both countries.

In terms of e-commerce sector, these implications can be crucial for successful e-commerce strategy implementation. Factors such as delivery time, delivery locations, potential delivery costs etc. need to be evaluated for different countries within the different conditions described above. Regarding the e-commerce platforms or businesses operating in e-commerce sector, the business strategy needs to take into account the market potential to be able to create an adequate and realistic business plan. This study serves as a base for the business decisions operating in e-commerce sector in Finland and Sweden. Based on the earlier described analysis, the business strategy of individual company can be developed taking into account the market potential. Having this knowledge, the business plan is able to estimate realistic outcome in terms of sales or turnover based on the demand for online purchases.

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Do Labor Market Institutions Matter for Unemployment?

Aleš Franc¹, Radek Náplava²

Abstract: This paper examines the impact of labor market institutions on unemployment rates in OECD countries during the period 2000-2019. Using panel data and fixed effects estimation, we analyze how institutional variables such as minimum wage, union density, wage bargaining coordination, unemployment benefits, and active and passive labor market policies affect overall unemployment rate, long-term unemployment, and youth unemployment. Our findings challenge the traditional deregulation paradigm by showing that most institutional rigidities, when examined in isolation, do not exhibit significant effects on unemployment rates. The only consistently significant relationship was found between passive labor market policies and all types of unemployment, suggesting a positive correlation. These results contribute to the existing literature by demonstrating that the relationship between labor market institutions and unemployment is more complex than often assumed and depends on broader institutional context and interactions. Our findings support the argument that a "one size fits all" approach to labor market reform may not be appropriate and that institutional arrangements need to be analyzed holistically, taking into account country-specific contexts and potential complementarities between different institutions.

Keywords: labor market institutions, unemployment, OECD countries, panel data analysis, institutional complementarities

JEL Classification: J50, J64, C23

1 Introduction

Labor market institutional arrangements exhibit substantial heterogeneity across countries and over time. Previous research has identified several key institutional factors, including unemployment benefit systems, active labor market policies, wage-setting mechanisms (encompassing wage bargaining centralization, union density, and collective bargaining coverage), labor taxation including social security contributions, and employment protection legislation (Betcherman 2012, Flraig and Rottman 2012). The economic literature attributes these institutions a pivotal role in explaining divergent unemployment patterns across OECD countries since the 1970s, particularly the disparities between the United States and continental Europe.

During the 1990s, prominent international institutions (OECD and IMF) advocated extensive labor market deregulation as the primary instrument for addressing high unemployment (OECD 1994, IMF 2003). These recommendations were grounded in numerous empirical studies suggesting that institutional rigidities adversely affect labor market outcomes (Krugman 1994, Nickell 1997; Scharpf 2000, Nickell 2003). Consequently, countries experiencing high unemployment faced pressure to implement comprehensive structural labor market reforms to enhance flexibility, including working time flexibility, wage flexibility, reassessment of employment protection legislation, and unemployment benefit system reform (see e.g. Freeman 2005). This perspective is further supported by Lehman and Muravyev (2010), who, examining transition economies, conclude that labor market institutions significantly influence its outcomes and that deregulation can enhance economic performance, while emphasizing the importance of considering interactions between various institutions and policies.

However, the deregulation paradigm lacks consensus in empirical literature. The relationship between labor market institutions and unemployment may be considerably more complex than the simple proposition that rigidities automatically generate higher unemployment. Baccaro and Rei (2007), for instance, question the significance of institutional factors, arguing that monetary policy stance plays a more decisive role in unemployment outcomes. Other scholars, while acknowledging institutional factors' influence (Hall and Soskice 2001; Baker et al. 2003; Bassanini and Duval 2009), maintain that these cannot be examined in isolation. The effects of individual institutional variables must

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be analyzed not only in their mutual interactions but also within the broader institutional framework of each country (Flaig and Rottmann 2012; Ferragina and Filetti 2022). Additionally, Obadić et al. (2023) challenge the efficacy of a "one size fits all strategy," advocating for labor market policies tailored to individual EU member states' needs. Their findings indicate an absence of labor market convergence within the EU, even among geographically proximate countries. The authors identify convergence clubs, though these exhibit internal heterogeneity and resist characterization by traditional criteria.

This paper aims to investigate the impact of selected institutional variables on labor market outcomes in advanced OECD countries. Beyond the general unemployment rate, we examine long-term unemployment and youth unemployment rates (ages 15-24). Through panel regression analysis, we seek to examine whether the deregulation hypothesis holds or if the relationship between institutional variables and labor market outcomes is rather multifaceted.

2 Methods

Our analysis focuses on OECD countries during the period 2000-2019. The time frame of the paper is constrained by the availability of data. Institutional variables were chosen based on a thorough literature review. Given the substantial amount of missing data, the employment protection legislation variable had to be excluded from the model. Econometric model incorporates the following institutional variables:

- minimum wage relative to median wages of full-time workers ("Min. wage")
- trade union density as a percentage of employees ("Union density")
- level of coordination in wage bargaining ("Level of coordination")
- net replacement rate in unemployment in percentage ("Net replac. rate")
- active measures LMP as a percentage of GDP ("Active LMP")
- passive measures LMP as a percentage of GDP ("Passive LMP")

Each specification includes three control variables: labor productivity measured as output per hour worked ("Labor productivity"), economic performance over time ("GDP growth"), and the rate of price level growth measured by the consumer price index ("CPI"). The data are sourced from publicly available OECD and World Bank (inflation) databases. Supplementary data on wage bargaining coordination levels are drawn from the Visser database (2013). Due to additional missing observations, we are working with an unbalanced panel dataset. Table 1 presents the descriptive statistics characterizing our dataset.

Table 1 Descriptive statistics

Variable	No. of observations	Mean	Std. dev.	Min	Max
Unemployment rate	724	7.754972	4.040458	1.9	27.8
long-term un. rate	721	31.52672	16.92008	0.223714	73.49994
Youth un. rate	707	17.36957	8.869543	3.658333	59.36666
Labour productivity	638	1.6151	2.401112	-8.51568	19.88084
GDP growth	740	2.630331	3.109792	-14.8386	25.17625
CPI	760	2.840754	4.013938	-4.44755	54.91537
Min.wage	569	0.495054	0.113083	0.287	0.921
Union density	682	27.63827	20.47336	4.5	93.3
Level of coordination	678	2.356932	1.335584	1	5
Net replac. Rate	624	83.86058	7.586301	61	99
Active LMP	506	0.518439	0.377653	0.01	2.04
Passive LMP	520	0.807231	0.625477	0.05	3.15

Source: Own processing

To achieve our research objective, we employ Ordinary Least Squares (OLS) with country-fixed effects. The choice of OLS with fixed effects is intuitive given that the number of countries exceeds the time dimension of our dataset.

Moreover, it allows us to control for and absorb unobserved heterogeneity that is time-invariant. The resulting regression model takes the following form:

$$\text{Unemployment rate} = \beta_0 + \beta_1 \text{Labour productivity}_{it} + \beta_2 \text{GDP growth}_{it} + \beta_3 \text{CPI}_{it} + \beta_4 \sum \text{institutions}_{it} + \omega_i + \varepsilon_{it},$$

where the dependent variable is the respective unemployment rate (general, long-term, and youth), labour productivity, GDP growth, and CPI are control variables. Institutions_{it} encompass the individual institutional variables under investigation, ω_i represents country-fixed effects, and ε_{it} is the unobserved error term. To improve the robustness of our results, all models are estimated with standard errors robust to heteroskedasticity and autocorrelation.

3 Research results

The results for all countries are presented in Table 2 below. The table is divided into three panels: PANEL A, PANEL B, and PANEL C. Each panel captures a different dependent variable, with the overall unemployment rate being explained first (PANEL A), followed by the long-term unemployment rate (PANEL B), and finally the youth unemployment rate (PANEL C). A consistent finding across all three unemployment concepts is the robust positive association with the passive LMP variable. This implies that more expansive social welfare systems and increased passive benefits may extend job search periods, and contribute to elevated levels of long-term unemployment.

Table 2 Regression results

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
PANEL A: Dependent variable: unemployment rate							
Labour produc-	0.335*** (3.08)	0.245** (2.67)	0.328*** (4.19)	0.328*** (3.44)	0.317*** (4.15)	-0.0206 (-0.23)	-0.0514 (-0.50)
GDP growth	-0.442*** (-5.51)	-0.329*** (-5.25)	-0.399*** (-6.75)	-0.412*** (-6.56)	-0.328*** (-5.01)	-0.0148 (-0.17)	0.0547 (0.50)
CPI	-0.314 (-1.40)	-0.322*** (-2.75)	-0.209 (-1.40)	-0.328* (-1.73)	-0.176 (-1.64)	-0.277 (-1.52)	-0.210* (-1.85)
Min.wage	-10.42 (-1.35)						5.749 (0.91)
Union density		0.167* (1.82)					0.0866 (0.69)
Level of coordi-			-0.891 (-1.28)				0.242 (0.58)
nation							
Net replac. Rate				-0.0236 (-0.35)			-0.0406 (-0.72)
Active LMP					1.731 (0.99)		-1.861 (-0.65)
Passive LMP						5.223*** (5.77)	6.171*** (5.36)
Constant	14.32*** (3.71)	3.392 (1.19)	10.79*** (5.88)	10.75* (1.80)	7.167*** (6.26)	3.938*** (4.05)	2.633 (0.47)
Observations	450	538	587	559	456	466	256
F	7.991	8.898	12.01	11.36	8.935	26.05	33.68
r2	0.159	0.181	0.178	0.160	0.152	0.380	0.521
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
PANEL B: Dependent variable: long-term unemployment rate							
Labour produc-	-0.138 (-0.91)	-0.213 (-1.39)	-0.108 (-0.97)	-0.204 (-1.47)	-0.131 (-0.82)	-0.813*** (-3.09)	-0.909** (-2.73)
GDP growth	0.685*** (5.52)	0.725*** (4.74)	0.645*** (5.70)	0.657*** (4.64)	0.725*** (5.75)	1.448*** (6.47)	1.561*** (5.71)
CPI	-0.963** (-2.74)	-0.771** (-2.58)	-0.592* (-1.89)	-0.949** (-2.73)	-0.728** (-2.09)	-0.830* (-1.98)	-0.699 (-1.65)
Min.wage	-2.329 (-0.15)						36.68 (1.49)
Union density		0.143 (1.02)					-0.125 (-0.50)
Level of coordi-			-2.128 (-1.16)				-0.433 (-0.35)
nation							
Net replac. Rate				-0.0925 (-0.42)			-0.235 (-0.71)
Active LMP					0.802 (0.13)		-10.45 (-1.42)
Passive LMP						10.48***	12.50***

						(4.99)	(4.00)
Constant	35.17*** (4.67)	27.01*** (6.23)	37.24*** (8.36)	41.31** (2.23)	31.77*** (9.00)	24.32*** (10.80)	33.42 (1.44)
Observations	447	547	596	566	459	469	256
F	14.98	10.45	12.96	8.778	17.59	24.31	16.81
r2	0.129	0.118	0.137	0.118	0.121	0.306	0.403
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
PANEL C: Dependent variable: youth unemployment rate							
Labour productivity	0.598*** (2.86)	0.512*** (2.83)	0.600*** (3.87)	0.593*** (3.27)	0.614*** (4.21)	-0.0298 (-0.17)	-0.0247 (-0.13)
GDP growth	-0.934*** (-5.26)	-0.732*** (-5.54)	-0.873*** (-6.64)	-0.877*** (-6.31)	-0.732*** (-5.81)	-0.141 (-0.79)	-0.0130 (-0.07)
CPI	-0.697* (-1.93)	-0.672*** (-2.84)	-0.536* (-1.98)	-0.749** (-2.35)	-0.502** (-2.39)	-0.595* (-2.04)	-0.463* (-1.97)
Min.wage	-12.58 (-0.87)						12.60 (1.17)
Union density		0.191 (1.22)					0.0338 (0.18)
Level of coordination			-1.254 (-0.91)				0.634 (0.72)
Net replac. Rate				0.00820 (0.05)			-0.0789 (-0.60)
Active LMP					0.985 (0.32)		-5.232 (-0.81)
Passive LMP						9.936*** (4.93)	11.70*** (4.81)
Constant	27.10*** (3.79)	13.40*** (2.78)	23.00*** (6.69)	19.54 (1.37)	18.36*** (8.67)	11.04*** (5.60)	10.67 (0.90)
Observations	450	529	575	553	452	463	256
F	7.354	8.436	11.42	11.11	14.77	25.77	41.87
r2	0.186	0.178	0.199	0.191	0.167	0.371	0.481

Source: Own processing

Other institutional variables that could potentially limit labor market flexibility are not significant in explaining unemployment. The minimum wage does not have a statistically significant impact on any type of unemployment. This may suggest that concerns about the negative impact of the minimum wage on employment may not be justified, at least at the aggregate level. On the other hand, there is no consensus in both theoretical and empirical literature regarding the impacts of minimum wages on unemployment (see e.g. Boeri and van Ours 2021 or Holmlund 2014).

While the net replacement rate might be expected to influence unemployment outcomes, our analysis reveals a surprising lack of a statistically significant relationship. This contrasts sharply with the strong influence of passive labor market policies. This finding suggests that the overall design and implementation of the unemployment benefit system, including factors such as eligibility criteria, duration, and conditionality, may be more critical than the level of benefits in shaping labor market outcomes.

The union density indicator shows only a weak positive relationship with overall unemployment in Model 3 when excluding other institutional variables. This may be because they do not capture the actual extent of collective bargaining, legislative support for collective bargaining, and thus may underestimate the real economic impact of trade unions.

The level of coordination of bargaining does not have a statistically significant impact on any type of unemployment. Although the coefficients are negative, which would suggest that higher coordination may reduce unemployment, this conclusion cannot be confirmed due to the lack of statistical significance. Theoretically, higher coordination could lead to the internalization of wage bargaining externalities and thus to better labor market outcomes, but the data do not clearly support this assumption.

Active labor market policy also does not have a statistically significant impact. Although the coefficients are mostly positive, they are statistically insignificant. A possible explanation may be the delayed effect of these measures or their varying effectiveness in different contexts.

The results may suggest that the significance of some institutional rigidities of the labor market, when examined in isolation, may be overestimated, which is in line with the findings of Baker et al. (2003) and Bassanini and Duval (2006). Their impact may manifest itself rather in interaction with other factors or their impact may depend on a broader

institutional context. The length of the time period, during which the influence of the macroeconomic environment may prevail, also plays a role.

4 Conclusions

The presented analysis, examining the impact of institutional factors on diverse unemployment rates in OECD countries between 2000 and 2019, yields several significant findings that contribute to the ongoing discourse on the role of labor market institutions. The results suggest that the relationship between labor market institutions and unemployment is more complex than assumed by the traditional deregulation paradigm. While passive labor market policy shows a consistently strong positive relationship with all examined types of unemployment, other institutional variables did not demonstrate statistically significant effects.

This finding challenges the simplistic notion that institutional rigidities inevitably lead to higher unemployment rates. The absence of statistically significant effects for minimum wage, union density, and the level of bargaining coordination may indicate that these factors operate in conjunction with broader institutional contexts rather than in isolation. Our findings thus corroborate the arguments of scholars who advocate for a holistic approach to analyzing labor market institutions and question the efficacy of universal deregulation policies. Furthermore, our results suggest that a comprehensive understanding of the relationship between institutions and labor market outcomes necessitates consideration of not only the interplay among institutions but also the specific country context.

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The Digital Era and Employer's Expectations of Employees in the IT Sector

Marek Hlásny¹

Abstract: The scientific study will focus on the digital era and its reflection in the theoretical background of employers' expectations of employees in the IT sector. At the same time, we will also present selected results of the research that was conducted as part of the project UK/1135/2024 Employers' Job Expectations of Employees in the IT Sector in the Digital Era.

Keywords: digital era, employees, employers, job expectations

JEL Classification: G32, G33, C35

1 Introduction

Digital transformation as part of the digital era, according to Urbaniec (2023), is affecting changes in employee-employer relationships. These implications include shifts in job security and job flexibility, as well as alternative work arrangements in the digital economy, with both positive and negative consequences for employees and employers. The digital era is defined by several authors (November, 2012; Kergel, 2023; Callan, 2024; Taplin, 2023, Frenkel, 2024) as the era of humanity's existence under the enormous influence of the Internet, digital technologies, virtual reality, etc. The digital era is directly affecting many areas of people's lives, in the workplace, this includes employers' expectations of employees directly in the IT sector.

Employers' job expectations of employees in different industries have been studied by many authors (Kantane et al., 2015; ManpowerGroup, Oláhová, 2023; Roy, 2023; Treľová and Hlásny, 2023a,b and others). Kantane et al. (2015) define these job expectations: Computer skills, previous experience, responsibility, professionalism, loyalty, reliability, punctuality, negotiation skills, persuasion, initiative, imagination, entrepreneurial spirit, employee who seeks, tries and proposes innovations, with a high degree of resilience, employee with effective time management, planning and organising skills of the employee, analytical and quick in decision making, pro-client orientation, coordination skills, flexible to travel (with a driving license), Employee able to multitask, self-motivated and proactive, dynamic, employee with logical thinking, good memory, ability to assimilate information quickly, results-oriented, enthusiastic and willing to learn, high level of communication skills and cultivated demeanour, dynamic and performance-oriented employee with knowledge of English and other foreign languages, positive work attitude (colleagues, work tasks, customers and clients, suppliers...). In summary, it can be stated that - regardless of the sector of employment - employers expect employees to have a positive attitude at work, adequate communication skills, professionalism, self-motivation, reliability, responsibility, good work ethic, integrity, adherence to health and safety rules, and compliance with deadlines, flexibility, loyalty, learning from mistakes, efficient use of working time, pride in work, professional self-confidence, respect, ability to be a team player, positive (re)presentation of the employer, participation in one's own professional development, willingness to help, self-control, handling crisis situations, handling stressful situations, etc.

According to Miller (2024), the information technology (IT) sector includes companies that manufacture software, hardware, or semiconductor equipment, as well as companies that provide information technology-related services. Thus, the three main industry groups within the IT sector are software and services, technology hardware and equipment, and semiconductors and semiconductor equipment. These three industry groups are further subdivided into sectors and sub-sectors. Employers' job expectations of employees in this specific sector are shown to be influenced by this.

Rommegger et al. (2024) focused on the recruitment of Generation Z IT professionals (those born between the mid-1990s and early 2010s), which they argue present unique challenges for organizations in the rapidly evolving digital era. The authors used a cluster analysis approach to gain insight into the expectations of employers and workplaces of Generation Z IT professionals, enabling organizations to develop targeted strategies to effectively attract and employ digital talent. Analysing the expectations of 370 current IT students across the sample, three distinct groups were identified: prestige-seekers driven by achievement, autonomy-seekers driven by challenges, and security-seekers driven

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by money. We show how each cluster prioritizes different employer and workplace characteristics and illustrate ways in which organizations can tailor their recruitment strategies for each cluster. The authors provide valuable insights into the preferences and motivations of Generation Z IT professionals and provide practical recommendations for organizations seeking to build a talented digital workforce by integrating Generation Z IT professionals.

Kantane et al. (2015) write that the world is changing at a rapid pace and businesses, companies and organizations need to keep up with the times. Thus, the importance of work motivation and innovation is undeniable. Employers need to turn their attention to all employees, even the youngest in age. Kantane et al. (2015) conducted two studies. Qualitative research using content analysis as a research method, in which they analysed 100 online recruitment advertisements for entry-level positions with a required university degree. Employer requirements collected from the advertisements were divided into technical and personal characteristics and then analysed. The second study focused on identifying the expectations of younger generations in the job market. Questionnaires were sent to universities from different geographical areas and two focus groups to identify the expectations of the young generation of employees. One of the main findings of the research is that there is a mismatch between what employers and young employees want. The main dissatisfaction among young people relates to the importance that employers place on work experience, even for jobs and positions where it was not needed. It also appears that academic performance does not matter in the job market because employers do not make decisions based on academic performance, but rather on the previous work experience and charisma of the job applicant. This has already led to the neglect of academic tasks and will lead to a further decline in student engagement in academic courses and activities.

Prokhorov, Tsaryk, and Fainglozs (2024) examined employers' expectations of students' generative AI skills. The research notes that knowledge of using generative AI (GenAI) products will be needed in their professional careers and will contribute to professional growth. The authors found no scholarly publications that examined students' views on employers' expectations of students' skill levels in generative AI. Based on a survey of 689 students from one Ukrainian university, this study examines students' perspectives on employers' expectations of their ability to select and apply generative AI products. The results are compared with a survey of teachers at this university, as well as with a survey of students at Latvian universities. The study also used methods of comparative analysis, descriptive statistics, and econometric methods. We found that only 54% of students believe that employers will soon expect university graduates to have the knowledge and skills to select and use GenAI products effectively. We also examined differences in student responses based on discipline, mode of study, program of study, age, gender, and use of GenAI in the educational process. However, a statistically significant association was only found between students' views on whether employers will expect AI knowledge from potential employees and how students will use AI in their learning process. Based on expectancy-value theory, Prokhorov, Tsaryk, and Fainglozs (2024) draw an important conclusion that serves as a signal to university administrators and educators: to better prepare students for the demands of the labor market, they need to be appropriately motivated and incentivized to use GenAI already in the preparation of candidates for IT practice.

2 Methods

Research used methods such as analysis, literature search, synthesis, comparison, evaluation, valid and reliable questionnaire of own provenance as a research tool.

As part of a scientific research project, we conducted research on employers' expectations of employees in the IT sector in the digital era. The research population consisted of a total of 301 respondents. The research population consisted of a total of 301 respondents from employers in the IT sector, by gender we can divide the research population into 222 males and 79 females. Statistical evaluation was carried out using SPSS 22 software. We used a questionnaire which contains the following 7 dimensions:

Dimension 1 Business acumen and entrepreneurial mindset of managers in the IT sector in the digital era.

Dimension 2 Strategic thinking of managers in IT sector in digital era.

Dimension 3 Communication, representation, and collaboration skills of managers in IT sector in digital era.

Dimension 4 Ability to solve problems and new situations of managers in the IT sector in the digital era.

Dimension 5 Self-control, self-motivation, and internal independence of managers in the IT sector in the digital era.

Dimension 6 Change management of managers in the IT sector in the digital era.

Dimension 7 Leadership of managers in the IT sector in the digital era.

Respondents answered on a scale of 5 maximally important - 1 minimally important.

3 Research results

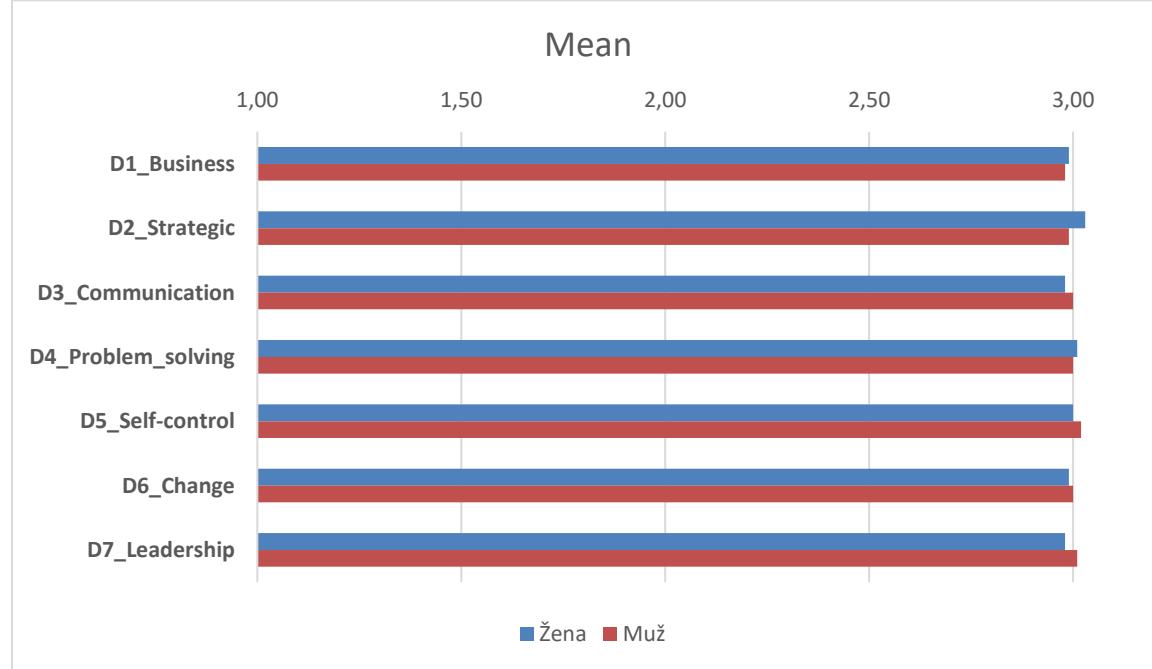
We established a research question and several hypotheses. In this study, we report the results of independent T test for each dimension by respondents' gender in Table 1. and in Figure 1. In H1, we hypothesized that there would be a statistically significant difference in employers' job expectations of IT employees in the digital era for each dimension based on the respondents' gender variable.

Table 1 Independent T test for each dimension by gender of respondents

	T	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
						Lower	Upper
D2_Strategic	-0.634	299	0.527	-0.04709	0.07429	-0.19329	0.09911
D1_Business	-0.326	122.165	0.745	-0.02506	0.07689	-0.17727	0.12714
D4_Problem_solving	-0.246	299	0.806	-0.01545	0.06291	-0.13925	0.10835
D6_Change	0.100	299	0.921	0.00613	0.06143	-0.11476	0.12701
D3_Communication	0.240	164.598	0.811	0.01490	0.06214	-0.10779	0.13759
D5_Self-control	0.422	299	0.673	0.02831	0.06710	-0.10373	0.16036
D7_Leadership	0.608	299	0.544	0.03950	0.06497	-0.08837	0.16736

Source: carried out research

Figure 1 Average rating of dimensions by gender of respondents



Source: carried out research

The results by respondents' gender show that the average expectations of employers in each dimension are not statistically distinguishable, thus the stated hypothesis 1 is not confirmed, in our research set we did not find a statistically significant difference in the job expectations of employers from employees in the IT sector in the digital era for each dimension based on the variable of respondents' gender. This means that in our research set, both women and men in the

position of employers in the IT sector do not have statistically distinguishable job expectations, which respondents ranked as follows:

Dimension 2 represents the Strategic Thinking of Managers and its components that the respondent employers in the IT sector consider most desirable.

Dimension 4 represents the Ability to solve problems and new situations of managers in the IT sector as the second group of the most desired skills of employees in the IT sector.

Dimension 5 represents Self-control, Self-motivation, and Intrinsic Independence of managers in the IT sector as the third most desirable group of characteristics of employees in the IT sector.

Others include Dimension 1 Business acumen and entrepreneurial mindset of managers in the IT sector and Dimension 6 Change management of managers in the IT sector in the digital era.

Dimension 3 Communication, Representation and Collaboration Skills of IT Sector Managers and Dimension 7 Leadership of IT Sector Managers were identified as less desirable by IT sector employers - regardless of gender.

Regarding the obtained results, it should be noted that the average rating of the questionnaire dimensions according to the gender of the respondents showed minimal differences, which proves not only the relatively accurate formulation of the dimensions and their components, but also the relatively uniform job expectations of employers in the IT sector from employees in the context of the digital era. Knowing the expectations of employers in this specific segment, which we assume to be a realistic representation of the current needs of the labour market in this sector, a space is created for their implementation through key competences. Their building, development and updating should become the subject of (self)education, institutionalized education, vocational education, and training in secondary and higher education, within the system of dual education or company practice, as well as part of the professionalization of individual professions and lifelong (self)education.

4 Conclusions

As Laczko (2024) writes, the current situation in the IT sector suggests that artificial intelligence will bring more jobs rather than take them away. Nor is the new technology currently contributing to solving the labour shortage problem. On the other hand, there are surveys and figures which suggest that the deployment of these new technologies is not currently contributing to unemployment growth, nor is it solving the current problem of the shortage of skilled labour. Evidence of this can be seen in the information technology sector in Slovakia, which is ahead of other sectors in the introduction of artificial intelligence. According to a survey by Manpower Group, 56 per cent of IT companies surveyed are already using it fully or at least partially. In any case, there is a need for theoretical, conceptual, and empirical analysis of labour relations in the digital economy, which are manifested, among other things, in flexible or non-standard forms of employment, contract work and a radical shift from position-based to skills-based work. Practitioners also want to understand, Urbaniec (2023) reminds us, the ongoing changes in employment relations and the emergence of new forms of work because of the digital transformation. Representatives of labour market institutions involved in the implementation of new forms of work and employer-employee relations in Industry 4.0 will also gain valuable insights.

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Some Questions Regarding Economic Growth in a Global Environment of Uneven Demands

Eva Kislingerová¹, Antonín Šmejkal²

Abstract: The global economic environment offers extraordinary opportunities to leverage comparative and absolute advantages, leading to significant changes in labor productivity and the efficiency of economic cooperative links. Although all participants in global markets generally benefit from these processes, the distribution of benefits is uneven, provoking social resistance to globalization despite data confirming its overall contribution. The pressure to implement measures against climate change introduces a new factor that fundamentally impacts the existing economic order.

The article compares statistical data on labor productivity growth, environmental measures, and their impact on international trade. It considers the differences in wage levels, exchange rates, raw material availability, transportation costs, and regional tax policies. The research focused on identifying key factors influencing changes in the division of labor and industrial sectors among global regions.

The results show that support for renewable energy sources and the varying pace of climate measure implementation significantly disrupt the existing economic balance. There are only two possible paths: either developed countries abandon key industrial sectors with potential strategic and defensive consequences, or it will be necessary to adopt new rules for foreign trade, such as through ecological tariffs and restrictions, or to relax climate goals. This analysis highlights the need to balance environmental requirements and economic stability.

Keywords: deindustrialization, climate change, renewable resources, industry.

JEL Classification: G32, G33, C35

1 Introduction

Globalization is a process whose economic essence lies in maximizing comparative and absolute advantages. However, there are many economic, cultural, social, and societal definitions of the globalization process. A framework overview of these definitions, particularly the development of the theory of globalization as the maximization of the use of comparative and absolute advantages, which we will further explore, is provided in the studies by Kislingerová (2023) and Kislingerová et al. (2024, especially pp. 31-69).

For this work, it is sufficient to summarize that this perspective on globalization primarily draws from certain aspects of the works of Immanuel Wallerstein (2000, Wallerstein et al. 2013). It particularly references his neo-Marxist theses about the finitude of capitalism and his definition of capitalism as a system maximizing profit. Additionally, it incorporates the anti-globalist visions of Samuel Huntington (1996) regarding the clash of civilizations based on shared cultural and religious characteristics, as well as the globalization concepts of Francis Fukuyama (1992), which emphasize the superiority of liberal democracies as systems that ensure optimal competitive and market conditions.

Based on the conclusions of these otherwise contradictory theories and works, the aforementioned studies construct a thesis on economically infinite globalization, which is deepened by the creation of continually new comparative and absolute advantages, depending on changes in logistics, technology, shifts in the significance of various resources (both mineral and others, such as educational resources), and many other factors. Within the created model, the political and social risks of limiting globalization, arising from differences in cultural and social models, particularly from the divergence of political and power structures, stand in contrast to economic infinity. The potential for globalization would indeed be infinite if the process included only liberal democracies as a state power system that offers the greatest space for markets and free enterprise. However, since this is not a realistic assumption, especially not in the current state, the existence of asymmetrically empowered, individualized state entities within globalization processes continually raises

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questions about the strategic feasibility of maximizing comparative and absolute advantages. Examples of such risks include the COVID-19 pandemic and the associated logistical crisis, the energy crisis related to price manipulation of gas by the Russian Federation, and, of course, the war in Ukraine.

Beyond this fundamental framework, as outlined in the mentioned studies, we can also consider contexts such as the activities of OPEC, since this supranational cartel essentially distorts the market and, thus, the competitive environment in oil extraction, which is in stark contradiction to the maximization of comparative and absolute advantages. OPEC's decisions create an environment that, while market-driven in many respects—where prices are set based on supply and demand—results in a supply condition influenced by cartel agreements, leading to distorted price information. Other distortions arise from trade restrictions and embargoes, such as those on oil from the Russian Federation or Iran. Conversely, an anti-market element emerges from the artificial reduction of demand, driven by efforts from many primarily developed countries to limit fossil fuel consumption as much as possible. Certainly, further examples can be added over time. For instance, China's pressure against Taiwan and the security risks associated with this situation lead to various embargoes, tariffs, and other barriers to free trade.

Regarding the theories of comparative and absolute advantage, references are made to earlier authors (Smith 1776, Ricardo 1817), emphasizing the dynamics of both phenomena. This primarily concerns the continuous circulation of advantage distribution, the variability of their available mass, and the differing changes in efficiency offered. Simply put, a decrease in logistics costs can lead to the creation of new comparative and absolute advantages, and technological changes can provoke similar effects. Good examples include fracking in oil extraction or the robotics and automation of large-scale industrial production. Other standard phenomena, among many others, include the discovery of new areas for mineral extraction.

Thus, this summarizes the globalization framework as described in the aforementioned studies and briefly elaborated upon in this work. However, the studies also suggest (albeit without deeper analysis) that various circumstances, particularly multi-speed measures aimed at mitigating global climate change, may significantly influence the challenges of globalization. It is precisely this aspect of the situation that we will now focus on in more detail.

2 Methods

We will refer to the current world, in terms of individual national climate protection policies, as a world of uneven demands. We will further examine how these potentially existing uneven demands affect efficiency and productivity in individual countries and whether they can exert a similarly strong or even more significant influence compared to traditional reasons for changes in absolute and comparative advantages.

It is crucial to emphasize that we will continue to view globalization not as a one-way process but as a variable structure that continuously changes and evolves based on numerous circumstances. This also implies that it can be a reverse process.

2.1 Principle of uneven demands

The situation of uneven demands has become a relatively widely discussed topic, particularly in relation to the energy crisis, the creation of energy dependence of advanced Europe on resources from the Russian Federation, and most notably with the inflation wave from 2021 to 2023. The issue of differing dynamics in decarbonization has intersected with the other mentioned factors and has been the subject of discussions on multiple levels. It has become a political topic that has undeniably had a strong impact on the social sphere and is one of those issues that polarise European societies. Different paces of decarbonization are automatically accepted as a fact within political and social discourse without any more precise evidence being provided. Moreover, there has been no attempt to quantify the actual impacts of faster decarbonization realistically or to analyze its relationship with other causes of economic difficulties in European countries.

The working hypothesis states that:

- Firstly, (relatively) small producers of hazardous emissions implement extensive measures at an extraordinary pace, which are very demanding and costly in terms of both immediate and long-term expenses. At the same time, the largest (absolutely) polluters carry out measures at a slow pace that have a significantly smaller overall scope. Moreover, similar extensive actions are promised only in a relatively distant future (regarding economic changes).

- Secondly, this differing pace of implementing changes leads to different impacts on individual economies, thereby resulting in further redistribution of comparative and absolute advantages on a global scale.
- Thirdly, the differing paces of decarbonization and the associated costs in this area lead to a loss of competitiveness for European producers, which is the primary reason for this phenomenon.

In the initial phase, it is necessary to define what is meant by areas with differing paces of decarbonization in this context. With considerable simplification, we can say that the first group of countries represents the European Union, while the second includes China and other rapidly growing economies (typically India). Somewhere in the middle of these extremes lies the economy of the United States.

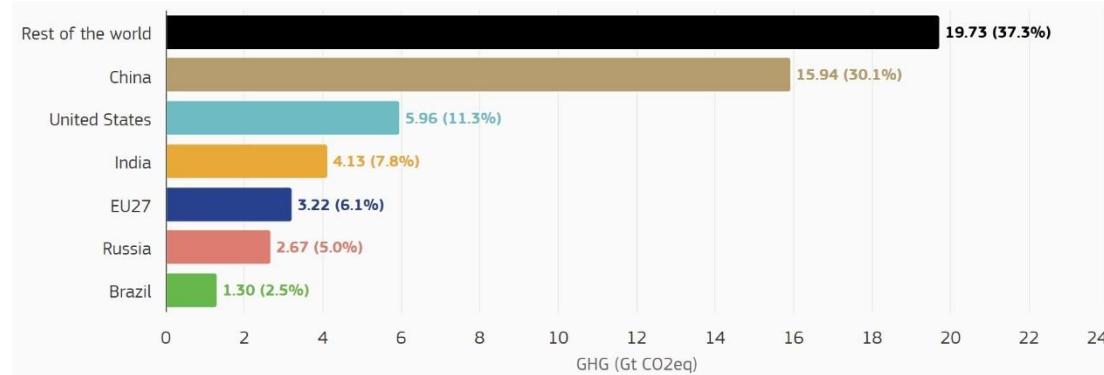
On this basis, we can then begin further investigation of the situation and, if the hypothesis is confirmed, formulate and possibly quantify certain consequences stemming from its validity and describe possible scenarios for future developments. However, it is crucial first to provide evidence of the unevenness of demands, as although this is taken as an automatic fact, it still needs to be substantiated.

2.2 Path to evidence of unevenness

First, clarifying which parameters to monitor is essential to ensure the data are comparable and relevant. From the perspective of the presumed existence of unevenness and the need to halt global climate change—where we assume sufficient scientific consensus on the causes—it is not critical to consider pollution production per capita or pollution intensity. What is truly important is the absolute data, specifically the total volumes of pollution. The climate impacts of pollution do not depend on the fact that Luxembourg is the largest European polluter per capita but rather on the reality that Germany is the largest polluter in absolute terms within Europe, while globally, China and the United States lead.

Therefore, the significant data are the total figures reported for greenhouse gases in equivalents of tonnes of CO₂ (CO₂eq). The fact that pollution per capita is higher in one country than in another is a relatively insignificant aspect of the situation. Even if Luxembourg, which produces nearly 20 tonnes of CO₂ equivalent per capita annually (by far the highest in the EU), were to reduce its total emissions from about 11 million tonnes of CO₂ equivalent to zero, it would have no rational significance compared to China's production of around 18 billion tonnes of CO₂ equivalent.

Figure 1 GHG emissions and contribution of the six largest emitting economies and the rest of the world in 2023 (in Gt CO₂eq and percentage of the global total)



Source: European Commission, Joint Research Centre (2024). Note: A total of 150 countries have declared their readiness to participate in achieving climate goals by adopting public pledges or laws aimed at carbon neutrality; these countries account for 89 percent of global emissions.

The percentage data in the graph relate to the total volume of global annual greenhouse gas emissions, which is approximately 53 billion tonnes of CO₂ equivalent (CO₂eq). If we focus solely on CO₂, China's contribution to pollution is around 27 to 28 percent. In scientific climate discussions, the distinction between total greenhouse gas emissions and CO₂ emissions is certainly significant; however, from our perspective, it is less critical, as CO₂ constitutes an overwhelmingly dominant part of the problem, barring a few exceptions. Nonetheless, we will consistently refer to greenhouse gases as a whole in terms of CO₂eq.

The overall and verbally expressed commitments of countries that have signed up for climate goals are comparable. Typically, these involve reducing CO₂eq emissions by half or a similar value from a chosen reference point by a specified

time, followed by further reductions in subsequent periods, and achieving independence from fossil fuels by another specified deadline.

It is therefore clear that if there is a problem in this area, it lies in the differences in the chosen time frames and the relative flexibility in selecting reference points.

2.3 Problem of time horizons and reference point

Now, we will compare the commitments of key countries and regions regarding emission reductions and carbon neutrality in broad strokes. However, we will pay particular attention to the situation in China, as it is the largest polluter and primarily an economy that continues to dynamically expand its coal-fired power plants, which is fundamentally at odds with its declared climate goals.

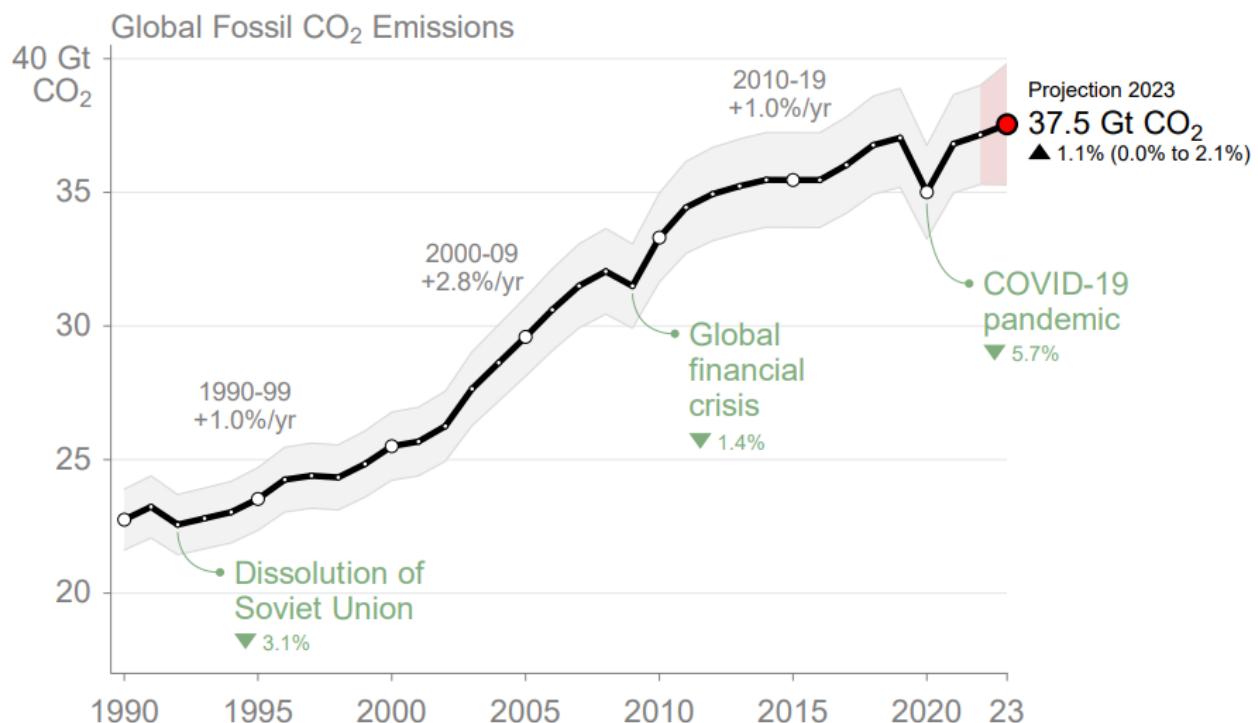
China

The European public and political representatives openly suspect the world's largest polluter is unwilling to meet commitments in the fight against climate change. The issue, in principle, lies more in how the rest of the world has accepted China's approach during the negotiations of international agreements (particularly the Paris Agreement) and its emphasis on its own pace rather than having concrete evidence of non-compliance with commitments.

Under the plan known as 30/60, China has committed to reduce emissions per unit of GDP by 65 percent from 2005 levels by 2030 and achieve carbon neutrality by 2060, meaning it will produce only as much CO₂eq as it can eliminate concurrently.

The first commitment is exceptionally mild compared to other countries, as it is linked to GDP. Firstly, there is a significant transformation in the economy's structure compared to 2005, where sectors with high added value, in line with global trends, are gaining strength, while the influence of industries, particularly metallurgy, heavy engineering, and other highly polluting activities, is declining. Therefore, reducing emissions per unit of GDP is a process that occurs partially without major (targeted) investments or demanding measures, as it is a natural consequence of economic restructuring. This process is somewhat analogous to the similar transformation in the Czech Republic in the 1990s.

Figure 2 Global Fossil CO₂ Emissions



When including cement carbonation, the estimates for 2022 and 2023 amount to 36.4 ± 2 GtCO₂ and 36.8 ± 2 GtCO₂ respectively. The 2023 projection is based on preliminary data and modelling. Source: Friedlingstein et al. 2023; Global Carbon Project 2023.

Secondly, it is possible to achieve targets even without a real reduction in CO₂ and other greenhouse gas emissions simply by significantly transforming the country's energy mix. This is undoubtedly occurring, as evidenced by China's substantial increase in its commitments regarding the installed capacity of photovoltaic and wind power plants. In this regard, it is clearly a global leader, and its future plans are undeniably ambitious. Nevertheless, massive construction of thermal power plants continues, which the Chinese leadership justifies by the need for a robust energy security framework amidst the dynamically growing share of renewable resources. China currently operates nearly 3,200 facilities of various sizes and capacities, with new sources of 48 GW installed capacity coming online in 2023, and various reports indicate that further constructions have been approved, potentially at least at a similar level, if not higher. However, it is a fact that in 2023, solar power plants with an installed capacity of around 100 GW, wind power plants with 65 GW, and hydropower plants with 10 GW were also launched.

For these and other reasons, China remains the driving force behind the growth of greenhouse gas emissions. However, Figure 2 reflects only the status of CO₂, which is why the total figure differs from what we see in Figure 1. On the other hand, China is also among the countries most severely affected by climate change, with rising temperature extremes in the central provinces being particularly concerning. Climate change has also impacted the power generation sector in recent years, with hydropower production significantly declining due to drought. It is also important to note that the quality of the local environment still lags far behind hygiene standards in many regions and has serious repercussions on the population's health. This situation is leading to growing discontent in the increasingly affluent Chinese society. Thus, the country's leadership must contend with broad measures and numerous local crises.

Regarding the term "carbon neutrality," the year 2060 is set a decade later than for developed countries, which currently refer to the United States, the European Union, and Japan. Despite frequent reports about accelerating the development of renewable resources, specialized institutions monitor China's progress with skepticism, often deeming its plans insufficient in final assessments. Nevertheless, in the latest updates to relevant documents, China has committed to reaching peak greenhouse gas emissions before 2030, whereas previous versions cited a date shortly after 2030. There have also been significant increases in commitments regarding reforestation.

In summary, China's pace and the demands of broad measures to support remedial actions are roughly ten to fifteen years, and in many respects more than twenty years, behind those of developed countries. Therefore, the state and businesses bear significantly lower costs to mitigate climate change. The ostentatious reliance on coal-fired power plants, combined with extremely low coal prices (the country has some of the largest reserves in the world), results in an overall low level of energy raw material prices.

In comparison to developed countries, two significant differences are evident. The first is the substantially lower costs for the state, but especially for the business sector, in reducing emissions. Because of how China has framed its targets and chosen advantageous reference points and criteria, it is not currently compelled (and the same applies to business entities) to implement extensive measures to support decarbonization. In particular, it is not obliged to undertake "low outcomes in many areas" measures, which are very capital-intensive. Thanks to the dynamic construction of modern coal-fired power sources, it will be possible in the coming years to decommission the oldest coal plants with the highest environmental impacts as the capacity of renewable sources increases.

The second is the maintenance of low electricity prices, as the dynamic construction of coal-fired power plants (easily permitted and even supported by the state) creates (likely intentionally) a certain oversupply of energy. The promotion of renewable resource development further supports this. As a result, prices remain quite low, essentially representing a method of state management of the entire energy sector through incentives for resource construction and other levers to control the energy market.

This creates a significant cost difference for European businesses, as they bear the burden of investments necessary to meet ecological limits and overall environmental legislation and additional costs in the form of substantially higher energy prices. Expressing this difference in financial terms is a very challenging task and would require a considerably more extensive study. Nonetheless, we will attempt to explore this difference.

A potentially important factor in the postponement of targets and the subsequent implementation of individual steps could be that Chinese enterprises and the state are, due to this delay, taking measures to reduce emissions when technological readiness is higher. It can be assumed that this likely means higher efficiency at lower costs.

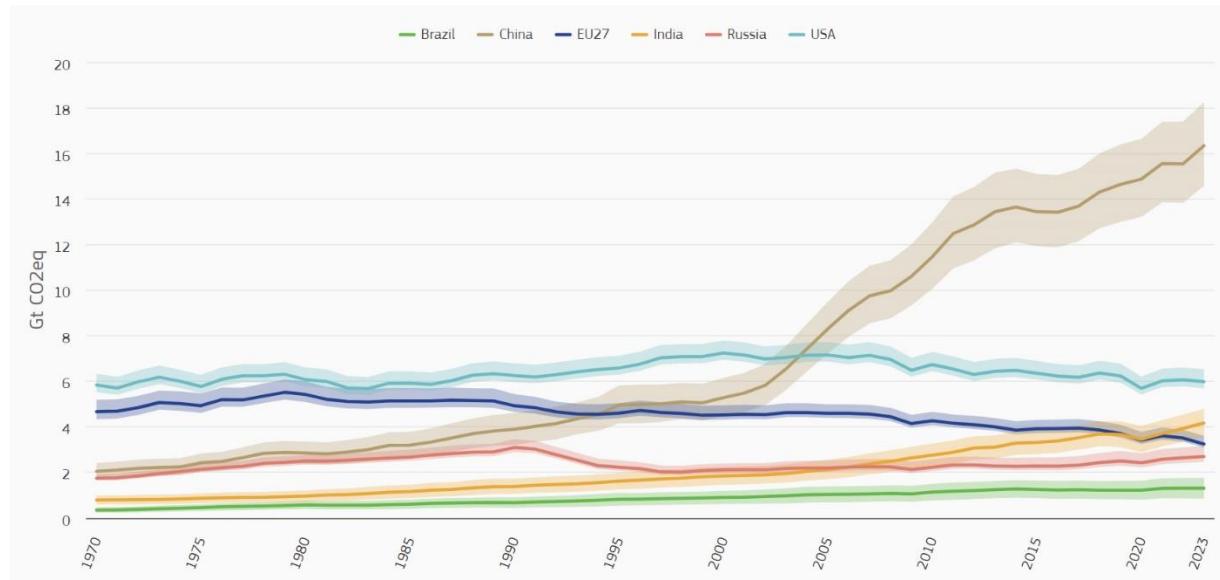
United States

Regarding the largest world economy and the second-largest polluter, the approach to the Paris Agreements and climate commitments in general is changing with the current administration. However, the existing commitments are framed as a 50% reduction in greenhouse gas emissions compared to 2005, the year when the country produced a record volume of CO₂eq, and achieving net-zero carbon neutrality by 2050. This represents a very similar approach to that promised by the European Union and some other developed countries. One could say that the USA has adopted a certain standard for the speed and depth of change.

The following graph vividly illustrates China's extraordinary position in terms of environmental pollution and its contribution to greenhouse gas emissions. The gap from other countries is striking. In particular, the curve of absolute emissions growth for China is entirely unmatched by any comparison.

However, it is also worth noting developments in India. It is important to highlight how the absolute emissions values produced in the European Union and the United States significantly converged around 1973 before diverging again. The Union evidently demonstrates a higher capability for emission reductions than the American economy, but this should not be regarded as a clear and indisputable success.

Figure 3 GHG emissions in top emitting economies and estimated uncertainty (coloured bands), 1970-2023 (in Gt CO₂eq)



Source: European Commission, Joint Research Centre (2024).

European Union

The commitment of the European Union is structured similarly to that of the United States, yet in some respects, it is stricter. For 2030, the Union has promised a reduction of as much as 55% compared to the peak emissions levels recorded in 1990. This distant reference point is, however, advantageous. In the 1990s, emissions declined, likely due to improvements in power plant technologies and possibly a reduction in demand.

Table 1 Commitments of major greenhouse gas polluters

	Share of global emissions	Net-zero	Commitment 2030	Other commitments
China	29.95 %	2060	–65 % emissions on one unit of GDP compared to 2005	
USA	13.69 %	2050	–50 % of annual emissions compared to 2005 (peak production)	
EU 27	8.15 %	2050	–55 % of annual emissions compared to (peak production)	
India	6.67 %	2070	–45 % emissions on one unit of GDP compared to 2005	50 % electricity from non-fossil sources by 2030
Russia	4.75 %	2060	–30 % of annual emissions compared to (peak production)	
Japan	3.12 %	2050	–46 % of annual emissions compared to 2013 (peak production)	
South Korea	1.81 %	2050	–40 % of annual emissions compared to 2018	
Iran	1.76 %	—	Not ratified; –4 % of annual emissions compared to current state	
Indonesia	1.61 %	2060	–31.89 % of annual emissions compared to current state, end of illegal logging	Conditional target : –43.20 % annual emissions compared to current state
Saudi Arabia	1.57 %	2060	–278 Mt CO ₂ eq compared to current state; it corresponds to change of –19% to +24% of annual emissions compared 2019	
Canada	1.67 %	2050	–40 % to –45 % of annual emissions compared to 2005	
Mexico	1.33 %	—	–35 % of annual emissions compared to current state	Conditional target : –40 % annual emissions compared to current state
Brazil	1.27 %	2050	–50 % of annual emissions compared to 2005 (peak production)	
JAR	1.22 %	2050	350 to 420 Mt CO ₂ eq annually in 2030; ; it corresponds to emission change of –18% to –31% compared to r. 2010	
Turkey	1.12 %	2053	–41 % of annual emissions compared to 2012	
Australia	1.08 %	2050	–43 % of annual emissions compared to 2005	
Great Britain	1.0 %	2050	–68 % of annual emissions compared to 1990 (peak production)	

Source: <https://faktaoklimatu.cz/studie/2021-reserse-zavazky-statu>

India, Russia, Japan

For illustrative purposes, we will also mention the commitments of three other countries in ranking the largest emissions producers. India has promised carbon neutrality by 2070, Russia by 2060, and Japan by 2050. By 2030, India has committed to reducing greenhouse gas emissions per unit of GDP by 45% compared to 2005. This is a rather soft promise that may not necessarily imply a reduction in the absolute volume of emissions; in this regard, India's approach is somewhat similar to that of China. Russia has committed to a 30% reduction in greenhouse gas emissions compared to the peak in 1990, with significant methane leaks during natural gas extraction presenting a major issue for the Russian Federation. Additionally, the threat of extremely large methane leaks due to permafrost thawing in Siberian and Far Eastern regions has become a further complication, likely linked to global warming. Japan's commitment entails a reduction in annual greenhouse gas emissions by 46% compared to the levels from 2013 when production peaked.

2.4 Outline of the decarbonization cost model

A comparison of the described climate commitments of the largest polluters, as captured in Table 1, clearly indicates that, in terms of actual (absolute) volumes of greenhouse gases and the speed of their reduction, there is a significant disparity between developed economies, primarily between the European Union and the United States, and other economies. The examples of two rapidly growing economic systems, China and India, are also illustrative for other nations.

It is evident, however, that it would be possible to address this issue within a theoretical cost model at least broadly. Given the considerable difficulty in quantifying the real costs of decarbonization, it would have to be a unit model, thus not directly linked to specific monetary amounts. Moreover, due to the fundamental differences between the economies being compared, it is clear that we must work with ratios relative to the respective GDP rather than some general value.

A brief note on the issue of defining the costs of decarbonization: this is an extremely complex problem that best emerges when at least roughly describing the circumstances that need to be considered. For our purposes, we will categorize costs based on who bears them at any given moment (noting that ultimately, consumers always bear the final burden).

Costs for the state and municipalities include:

Direct investment subsidies for the construction of renewable sources, subsidies for the operation of renewable sources, subsidies for the introduction of circular, zero-emission, or low-emission technologies, subsidies to households and producers for mandated investments (typically boilers), reduction in tax revenues from non-subsidised (phased-out) sources, costs of developing distribution networks (according to an agreed division with other participants), expenditures to support research, development, and innovation in the area of a zero-emission economy, potential costs associated with addressing unemployment and retraining workers linked to the carbon economy.

Costs for private business entities include:

Higher energy prices, costs for the development of the transmission system (passed on), mandated expenditures for investments and modernisations that do not increase production or reduce costs, costs for obtaining services to secure subsidies, environmental taxes, overall increase or inability to reduce tax burdens, mandated investments in mobility, costs for strategic research, retraining of workers, recruitment of workers with higher qualifications.

Costs for consumers include:

Prices of products influenced by higher energy prices, environmental taxes, overall increase or inability to reduce tax burdens, unavailability of certain preferred products, mandated investments in real estate (heating, insulation), mandated investments in mobility, costs for retraining to remain in the job market.

This represents a diverse mix of both large and small costs, one-off and long-term, and in some cases, costs that are forcibly shared (for example, through energy prices). Additionally, this list is undoubtedly not exhaustive. It would also be appropriate to offset the results by the undeniable benefits that the transition from carbon-based energy brings. These benefits certainly include improved health and increased life expectancy, which generally leads to lower costs for health systems. Individual countries sometimes publish certain (partial) estimates of the costs of achieving the goals of the Paris Agreement; however, these figures are often incompatible with one another, typically derived through entirely different methodological approaches, and it is generally unclear what scope of total costs they actually cover. It is essential to note that comparisons cannot be made based on these figures.

The intended model therefore resigns from detailed tracking of these expenditures and potential benefits and will be conceived on a completely different basis. This work only informs about the ongoing state of model preparation rather than its final form, and should be understood as a discussion document regarding the model's conceptual framework.

The basic thesis is as follows: It is appropriate to use the state of the European Union and the relevant commitments in the form of emissions reductions and achieving carbon neutrality as the basis for conceptualizing relationships between individual countries.

It is assumed that the EU's plan for reducing emissions by 2030 will serve as a value (theoretical expenditure) of 100. The key question is what value to assign to the goal of achieving carbon neutrality by 2050. Using a value of one hundred again seems inappropriate, not least because part of the second commitment will be realised within the framework of the first. To determine this number, it will be necessary to assess the potential of the relevant area (in this case, the EU) concerning CO₂ capture and potentially CO₂eq. This is one of the tasks that will need to be resolved in the next phase of model preparation. For the EU, we are currently working with a value around 50, which is based on the relationship between the 2030 target and the 2050 target, the potential for afforestation, and other values.

Next, it is necessary to create a temporal model for each area. This means capturing the current state (how much of the task is currently fulfilled), appropriately reducing the initial value (100), and then determining costs in subsequent periods up to the end of the timeframes, with 2030 being a common point, while the goals for carbon neutrality are framed differently in terms of timing.

This will establish a basic framework for comparing the different areas, specifically for the European Union. A similar procedure will follow for each country or area thereafter. In this task, determining the value for the 2030 target and for the carbon neutrality target is again seen as the most challenging aspect. It will be necessary to assess and calculate these parameters: the volume of emissions reductions by 2030 and their comparison with the volume of emissions reductions in the EU. This will be particularly complex for countries that do not have an absolute emissions target but aim for a ratio of emissions to GDP (primarily China and India). Pricing and other circumstances must also be considered. Nevertheless, it appears that in the case of China, the costs required to achieve the 2030 target will be roughly at a level of around 20, which is merely one-fifth of the costs of the European Union. However, this is a very preliminary calculation, mentioned

here primarily for informational purposes. A similar approach will also be applied to the carbon neutrality target, where it will again be necessary to reconsider the relationship to the potentially fulfilled 2030 target, the possibilities for capture and support for capture, and the time frame the examined country or area has set for meeting the goal. In the case of China, preliminary calculations suggest a figure higher than that of the European Union, as the 2030 target is dramatically less demanding. This is estimated to be around 70 points. However, this is very significant; this value is spread over a period of ten years, meaning the annual costs will be calculated over 30 years rather than 20 years, as with the EU. It is therefore highly probable that due to this dilution, the cost unit for the Chinese economy will fall below the cost unit for the European economy.

3 Conclusions

Previous work on the model suggests that if current climate targets are maintained, China's actual costs will remain at around twenty percent of those of the European Union over the coming decades. The primary burden of this unevenness will fall on the European industrial sector. The outcome could only be further deindustrialization of the European Union rather than just in individual countries. An alternative would be to reassess climate targets, or one could discuss changing the methods for achieving them, as is suggested in the context of the so-called Draghi report.

The issue requires further examination, particularly in refining the roughly outlined model for calculating cost disparities. However, the fact that Europe bears what appears to be an unmanageable burden of costs compared to other parts of the world (including the United States, which has not been addressed in this study) is evident even without the model itself. The model is intended solely to quantify the problem.

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Exploring Challenges in SDGs with Focus on the Complementarity of Sustainable Growth, Equality, and Consumption

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Abstract: The urgency of achieving the United Nations Sustainable Development Goals (SDGs) is evident, yet progress remains insufficient in key areas such as decent work and economic growth, reducing inequality, and responsible consumption and production. This paper explores the systemic obstacles hindering progress in these areas, with a focus on factors such as low wages, constrained consumption, and inefficient resource allocation. The study seeks to examine these barriers through an analytical framework aimed at identifying their root causes and implications. The findings underscore the interconnectedness of economic and social dimensions of inequality, consumption, consumption footprint and circularity and offer insights for addressing these challenges. By synthesizing the results, the paper provides a foundation for future policy recommendations and highlights the need for targeted interventions to ensure sustainable development.

Keywords: Sustainability, Economic Growth, Inequality, Consumption, SDGs

JEL Classification: D12, I32, O44, Q56

1 Introduction

Although relationships between sub-objectives can be neutral, such neutrality is rare in the economic, and especially socio-economic, sphere. Most objectives are therefore rather complementary, though some sub-objectives may be mutually exclusive. However, it is not possible to determine ex-ante what the relationships between the sub-objectives will be. This paper thus aims to examine the relationships between SDG sub-goals, with a focus on growth, consumption, and equality. The assessment will consider these relationships not only from an environmental-economic perspective but also from a socio-economic perspective, accounting for the sustainability of production, consumption, and the impacts of income inequality.

The environmental impacts of production and consumption are examined either in relation to the life cycle of products, where impacts are allocated to final consumers (Sanye Mengual and Sala, 2023), or in relation to the production process itself, where impacts are allocated to producers (Li et al., 2023).

To assess the environmental impacts of household consumption, a consumption footprint indicator covering five consumption domains was proposed. Castellani et al. (2021) evaluated its values using the Environmental Footprint 3.0 method. Razzaq et al. (2021) further analysed the relationship between material footprint and infrastructure development through green innovation, globalization and resource depletion. Adewumi et al. (2024) chose institutional influences as another aspect of evaluation, using data from 27 EU member states between 2014 and 2023, they concluded that while circularity-based entrepreneurial activities can improve economic welfare, effective management of the consumption footprint is essential for optimization. However, the assessment and partial conclusions may differ following the use of European or national data due to the so-called outsourcing of environmental impacts, as found by Nuss et al. (2023) based on an analysis of European and German consumption statistics from 2010-2018. Moreover, based on beta- and sigma-convergence values obtained from the analysis of data from 2014-2018 in EU countries, Markowski et al. (2023) conclude that CEE countries are moving away from other EU countries in most indicators in terms of sustainable production and consumption or their negative environmental impact.

Based on the current indicators of circular economy or circularity in general, Muñoz et al. (2024) propose a holistic approach to assess circular strategies through the construction and use of the so-called 9R circularity index. In doing so, they respond to the lack of harmonisation of the growing number of tools developed for assessment and subsequent decision-making, e.g. following Valls-Val et al. (2022). Similarly, Colasante et al. (2022) also proposed a new index

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under the name of the New Circularity Index following the processing of data from 28 EU countries from 2014-2018. As a further level of circularity assessment, Okumura (2022) developed a model of product reuse efficiency, based on optimal product durability, end-of-life collection rates, and the number of reuse cycles. Recycling scenarios in relation to landfilling in the context of EU directives have also been addressed by Agovino et al. (2024). Based on an analysis of the literature, Kapoor et al. (2023) concluded that progress in monitoring circularity in cities and regions will require stakeholders to test only a very small number of indicators and sets of indicators in the context of circularity, which are both relevant and practical for effective monitoring.

2 Methods

This paper aims to analyse Challenges in achieving so-called sustainable development goals (SDGs) while focusing mainly on growth, equality and consumption. Given one of the goals was to assess sustainability, the rate of circularity was also included in the analysis. There are many ways to express the circularity rate, in this paper, it is presented as circular material use rate. It measures the proportion of materials that are recovered and fed back into the economy, thus conserving primary raw materials within the overall material usage. It is important to mention what form of other data was used. There are many methods to measure and express inequality. For example, the Gini coefficient, however, in this paper the method top20down20 ratio was used. For which, from now on in the paper, the general term "inequality" is used. Simply put the top20down20 measures, how many times is the income of the top 20 % greater than the one of the bottom 20 %. The consumption footprint indicator is very complex and has many forms, in this paper the single weighted score is used. It calculates the consumption footprint by summing the environmental impacts of various categories, adjusting each by a global normalization and weighting factor to create a single composite score. It is expressed as a value per inhabitant. As for housing expenditure, it is measured as a percentage of household total expenditure on the final consumption, broken down according to the Classification of Individual Consumption by Purpose (COICOP). To be exact, specifically category 04 - Housing, water, electricity, gas and other fuels.

To assess the relationship between these variables, data for all 27 countries from the European Union were used. The time period used for this paper is 2010 – 2022. All the data except the Gross National Income (GNI) per capita in purchasing power parity (PPP), were taken from Eurostat. The GNI per capita (PPP) data were taken from the World Bank database. The whole statistical analysis was conducted in the statistical software R. Mainly using a linear regression model, which was used to assess the relationship between all the variables. To further understand these relationships, we then included the lagged variables in these models. Using lag 1 and lag 2, we were able to assess the direction of the relationship and the behaviour of these relationships deeper. In other words, using lagged variables allowed us to explore whether past values of one variable impact other variables in subsequent years and vice versa.

$$reg_model <- lm(variable\ 1 \sim variable\ 2, data = data_combined) \quad (1)$$

$$model_lag <- lm(variable\ 1 \sim lag(variable\ 2, 1), data = data_combined) \quad (2)$$

The example of the difference in a linear model with and without using lagged variables can be observed in formulas (1) where there is no lag included and in formula (2), where is lag of value 1 used. The value 1 represents the lag of 1 year and in this example the model_lag tests whether variable 2 in year n has any impact on variable 1 in year n+1. After conducting the first part of the analysis, the relationship between the explanatory variables—inequality and housing expenditure—and the dependent variable, consumption footprint, was analysed using a multivariate linear model. An interaction term was included to investigate how the level of inequality moderates the effect of housing expenditure on the consumption footprint, revealing that higher inequality is associated with lower housing expenditure. Before the paper focuses on the hypotheses themselves, brief attention needs to be devoted to the properties of the variables being examined in the paper. These properties are summarized in the descriptive statistics table, which includes values such as mean, median, standard deviation, or minimum and maximum values.

Table 1 Descriptive statistic of variables analysed in the paper

Variable	Mean	Median	Std. Deviation	Min	Max
Inequality	4.76	4.36	1.17	3.03	8.32
Housing Expenditure	22.39	22.5	4.03	12.0	31.5
Consumption footprint	0.94	0.94	0.20	0.54	1.42
Circularity	8.66	7.0	6.32	0.6	29.0
GNI per capita	46 486	43 028	15 819	21 515	95 715

Source: Authors calculations

Authors of the paper formed three hypotheses that were all tested using the methods mentioned. Linear model in software R provided a needed test to assess whether there is a relationship and if there is one, then whether this relationship is statistically significant. To assess whether the relationships are statistically significant, standard measures were used, specifically a 5% significance level, which corresponds to a 95% confidence level. All three hypotheses were conducted as null hypotheses that typically assume no relationship exists. The first null hypothesis was conducted as follows:

(1) Null hypothesis (H0): *"There is no significant relationship between housing expenditure and inequality."*

The reason for testing this relationship was to determine whether housing expenditure constitutes a larger share of income in countries with higher or lower levels of inequality. This analysis was then extended to examine whether the countries with the lowest levels of inequality are those with the highest or lowest GNI per capita. This relationship between inequality and GNI per capita can be observed in Figure (1) – see results. The second hypothesis focuses on the relationship between consumption footprint and the rate of circularity. The second null hypothesis stands as follows:

(2) Null hypothesis (H0): *"There is no significant relationship between the consumption footprint and the rate of circularity."*

This relationship is especially interesting to analyse because the results may not come as expected. One might anticipate that a higher rate of circularity would correspond with a reduced consumption footprint. It is however much more complicated relationship because the level of circularity is determined by the manufacturers while the consumption footprint depends on the consumers. Their level of responsible consumption determines the level of consumption footprint. In addition, it should be mentioned that despite the efforts of some companies to increase circularity, the consumption footprint may also increase until consumers realise the importance of responsible consumption. It is therefore important to believe that this positive relationship will tip into a negative one in the future, with increasing levels of circularity and decreasing consumption tops. As for the third and last hypothesis tested in this paper, this hypothesis again revolves around circularity, this time with inequality. The third null hypothesis stands as follows:

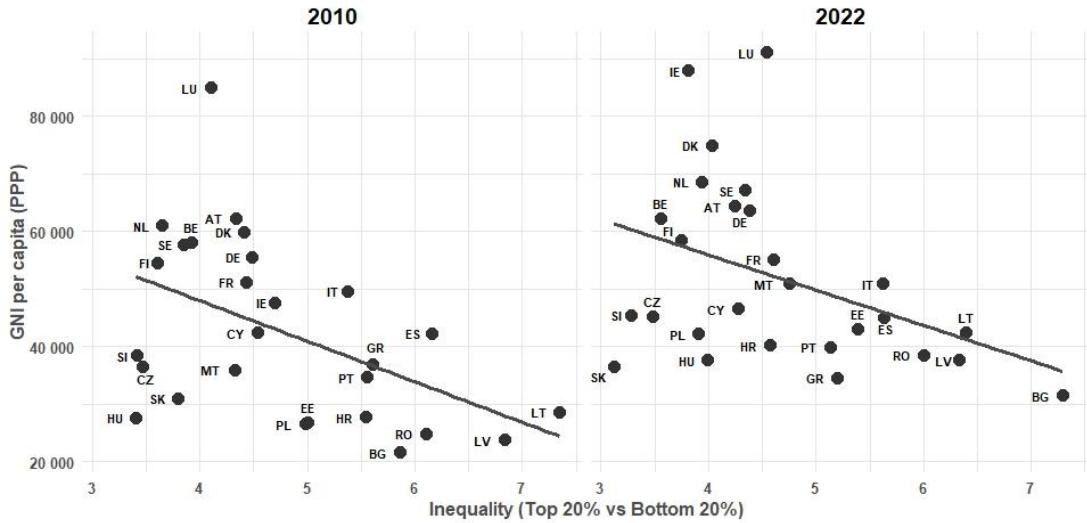
(3) Null hypothesis (H0): *"There is no significant relationship between the rate of circularity and inequality."*

The possible connection between inequality and the rate of circularity is as important as interesting to analyse, because of the importance of both variables. Circularity is gaining more and more attention and importance nowadays. Similarly, there is an emphasis on reducing inequality, so that if, for example, lower inequality is shown to promote higher levels of circularity, this could be considered a very interesting finding. All three hypotheses were developed with reference to the Sustainable Development Goals (SDGs), with a focus on equity - represented in the data as inequality, consumption - represented by housing expenditure, responsible consumption - using the consumption footprint, and sustainability through the circularity rate.

3Research results

Based on the established hypotheses mentioned in the methods, an analysis was conducted. The first hypothesis tested deals with the relationship between housing expenditure and inequality. The results of testing this hypothesis show a statistically significant negative relationship between these two variables. In other words, the analysis suggests that lower inequality is associated with a higher percentage of household income spent on housing expenditure. This conclusion might seem logical, as one could assume that less developed countries are less unequal because there are fewer entities whose income significantly surpasses that of others. At the same time, we might also expect that these countries would logically need to spend a larger portion of their income on housing.

Figure 5: GNI per capita (PPP) and inequality (Top20% down20%), 2010 and 2022



Source: Authors calculations

However, what is surprising is that when we look at the inequality structure of the countries in the analysed dataset in relation to income per capita, we see that countries with lower inequality are, in fact, among those with the highest income per capita (see Figure 1). Moreover, this relationship remains consistent over the entire period between 2010 and 2022. This finding shifts the interpretation of the original findings, suggesting that in the countries with lower inequality in the dataset, there is higher income per capita and likely a higher standard of living. Consequently, in these countries, higher housing demand could lead to higher prices, meaning that residents need to allocate a larger portion of their income to housing expenditure. However, it is important to point out that the countries in the dataset are all relatively highly developed countries, all from the European Union. The results may differ when developing countries with very low income are included. The exact results of the data analysis concerning not only this first hypothesis can be seen in Figure 2, which also includes the results of the analysis for hypotheses 2 and 3. To conclude on hypothesis 1, it should not be missed that the coefficient of the effect of inequality on housing expenditure increases with the use of lags 1 and 2, which in other words means that the effect of inequality in the following two years persists and may even become stronger with a longer time lag, since, for example, the value of the coefficient for inequality in year n and housing expenditure in year n+2 is -0.6474.

Table 2 Overview of the results from testing hypotheses

Relationship	Coefficient	Std. err.	p-value	R-squared
Housing expenditure ~ Inequality	-0.5480	0.1780	0.00223	0.02485
Consumption footprint ~ Circularity	4.860	1.690	0.00429	0.02314
Inequality ~ Circularity	-0.0597	0.0092	3.57e-10	0.1067

Source: Authors calculations

As for the second hypothesis, the results of testing relationship between consumption footprint and the rate of circularity are very interesting to say the least. As already indicated in the methods section, this relationship appears to be very complicated however the analysis finds statistically significant strong positive relationship between the two variables. Again, using lag 1 and lag 2, the results show that the effect of the consumption footprint on circularity persists even after two years, but this effect gradually decreases, where compared to the model without lag with a coefficient value of 4.860 (see Table 2) for the model with lag 2, i.e. with a two-year lag, the coefficient value is only 3.956. This finding may appear strange to some as it could be expected that higher circularity rates bring the consumption footprint down, it is however not the case. This may be due to the fact that countries with higher GNI per capita and their companies are more focused and concentrated on the circular economy than countries with lower GNI per capita, as confirmed by this analysis, where the association between GNI per capita and the level of the circular economy shows a statistically significant positive relationship. However, consumers in these countries are likely to spend more and somewhat without concern for sustainability. Whether this is a matter of mindset or a matter of price, where sustainable and more environmentally friendly goods may be more expensive, should be the subject of future research as it is a very interesting question. Not only higher GNI per capita is connected with higher rates of circularity. Testing the third hypothesis showed

a statistically significant negative relationship between the circularity rate and inequality. In other words, lower inequality was found associated with higher rates of circularity.

Figure 2 Diagram of connectivity between analysed variables



Source: Authors creation

If we link these results together, this creates at least a partial picture of how the relationships between these variables may work. In an attempt to connect all variables that were analysed in this paper in joint dependence and continuity, the connection may look something like Figure 2.

4Conclusions

As already mentioned, higher GNI per capita is associated with lower inequality. Both lower inequality and higher housing expenditure have been found to be positively related to a higher consumption footprint. Moreover, using a multivariate linear model, the significance of both relationships persists, and higher inequality was found to be associated with lower housing expenditure, thus reducing its effect on a higher consumption footprint. All these results can be interpreted as suggesting that lower inequality in higher-income countries is associated with more expensive goods and other services, with housing being no exception. Moreover, consumers with low sustainability concerns spend more and on unsustainable goods, thus generating a higher consumption footprint. On the other hand, a higher consumption footprint promotes a higher level of circularity, either because companies are more aware of the need for a circular economy or because these higher-income countries focus on sustainability. Either way, the result is increased circularity. This offers great scope for future research to determine whether, in the long term, the initially increased consumption footprint will start to decrease as the level of circularity reaches even higher values. The increase of circularity rate is however only a part of the solution, for this to happen, consumers must, among other things, become responsible and help societies achieve sustainable development. This suggests some similarities to the Kuznets curve, which speaks about an initial increase of pollution and eventual decline as the country's income countries to rise.

The results confirm that it is necessary to examine individual phenomena in their interconnectedness if the partial findings are to be the basis for design and measures to influence real phenomena and processes, not only economic but also social and environmental. The limit of the research is the available data and the related research horizon. Future research could be supplemented with additional variables, which could not only provide economic policymakers with more comprehensive information for their decision-making.

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Artificial Intelligence and Sustainable Development: Policy Approaches from Visegrad Group Countries

Gabriel Procházka¹

Abstract: The rapid rise of artificial intelligence (AI) presents both opportunities and risks for sustainable development. AI has the potential to transform industries, enhance resource efficiency, and tackle environmental challenges. However, it also poses significant risks, such as higher energy consumption and growing socio-economic inequality through job displacement. Without proper regulation, AI may further contribute to environmental degradation and social disparities. This paper employs a qualitative comparative policy analysis approach to examine AI strategies in Visegrad Group countries, focusing on environmental sustainability and labour market protections. The findings reveal that the Czech Republic leads with a comprehensive strategy, integrating measurable ecological targets and clearly defined responsibilities for implementing these objectives across relevant government bodies. Slovakia, by contrast, is the only country in the Visegrad Group without a dedicated AI strategy, relying instead on a broader digitalization framework that fails to address the specific challenges and opportunities associated with AI. Poland and Hungary demonstrate notable strengths, such as promoting energy-efficient AI technologies and implementing detailed reskilling programs; however, their goals remain overly general and vague, lacking clear specificity. It is unclear who holds responsibility for achieving these objectives or how their implementation will be monitored. By identifying key policy interventions, this study offers insights into aligning AI development with sustainability objectives to foster a more equitable and environmentally responsible future.

Keywords: AI regulation, Visegrad Group, Sustainable Development, Socio-economic Inequality.

JEL Classification: O38, L50, O14, Q56

1 Summary

This study explores the alignment of artificial intelligence (AI) strategies in Visegrad Group countries (Poland, the Czech Republic, Hungary, and Slovakia) with sustainability goals, focusing on two key areas: environmental sustainability and labor market protections. Using a qualitative comparative policy analysis, the paper examines the unique strengths and limitations of each country's AI policies, shedding light on regional approaches to balancing technological innovation with ecological and socio-economic priorities.

Key findings reveal a mixed landscape of progress. Czech Republic: Emerges as a regional leader, demonstrating a proactive approach to integrating AI with environmental and socio-economic objectives. Slovakia lags behind, hindered by the absence of a targeted AI policy. Poland: Promotes energy-efficient AI technologies and reskilling programs but lacks explicit carbon reduction targets or a clear accountability structure, leaving significant room for improvement in policy specificity. Hungary: Focuses on worker adaptation through extensive training programs and the development of energy-efficient AI technologies. However, its framework for environmental metrics remains underdeveloped. Slovakia: The only country without a dedicated AI strategy, relying instead on a broader digitalization framework. While it emphasizes education reform and workforce adaptation, the lack of specificity in addressing AI's unique challenges weakens its overall approach.

The comparative analysis underscores that while the Visegrad countries share a commitment to sustainability, there is significant variation in the depth and focus of their policies. The paper also highlights global AI governance trends, such as the emphasis on "green AI" and workforce adaptability, situating the Visegrad countries within the broader international context. Practical policy recommendations include adopting measurable sustainability targets, strengthening accountability frameworks, and fostering inter-country collaboration to enhance AI governance. This study contributes

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to the understanding of how regional AI strategies can support sustainable development, offering actionable insights for policymakers aiming to align technological advancement with environmental responsibility and equitable growth. It concludes with a call for more quantitative analysis and cross-regional collaboration to refine and expand the applicability of these findings.

2 Introduction

Artificial Intelligence (AI) continues to improve rapidly, advancing in decision-making, language processing, and pattern recognition, boosting productivity and opening new opportunities across industries (Sunita, 2024). AI-driven automation enhances production processes, making them faster and often more cost-effective, with potential to increase labour demand in non-automated sectors or in roles complementing automated systems (Goralski & Tan, 2020). Moreover, deepening automation—where AI systems become increasingly efficient—creates a productivity effect that benefits both industry output and non-automated tasks (Marr, 2020). However, these benefits come with notable risks. This study focuses on risks related to environmental impact and labour market disruptions.

One pressing environmental concern is the significant energy consumption required by advanced AI technologies and computational facilities. AI processes, such as machine learning and data storage, rely heavily on high-powered data centers, potentially accounting for up to 20% of global electricity demand by 2030 (Jones, 2018). For example, Google has partnered with Kairos Power to construct small nuclear reactors that will supply carbon-free energy specifically for its AI technologies (Morris, 2024). This challenge is exacerbated by applications like cryptocurrency mining, where power consumption rivals that of entire nations, threatening climate action and sustainable energy goals (Truby, 2018). Without efficient energy solutions—such as advanced cooling systems or renewable energy sourcing—AI's environmental footprint could undermine sustainability initiatives and the pursuit of a low-carbon economy (Xiang et al., 2021).

AI also profoundly impacts the labour market, where the efficiency and cost benefits of automation often lead to the displacement of traditional jobs. Acemoglu explains that AI-driven automation directly replaces human labour in certain industries, reducing labour's value share (Acemoglu et al., 2024). These changes reshape job availability and increase stress for workers in roles vulnerable to automation, contributing to psychological strain and social inequality. Unlike earlier technologies such as software and industrial robots, AI increasingly targets high-skilled tasks, shifting job demands and exacerbating wage inequality across skill levels (Webb, 2019). As high-skilled roles requiring advanced training replace entry-level or manual jobs, many workers face barriers to re-entering a technology-driven economy, widening disparities in wealth, knowledge, and power across regions and social groups (Nagano, 2019).

While AI enhances productivity and drives innovation across sectors, its environmental and labour-related risks underscore the need for balanced policies that support both innovation and sustainable development. Strategic action is crucial to ensure equitable access to AI-driven opportunities and promote green practices within AI technologies, aligning technological progress with sustainable development goals.

3 Methods

In this study, I adopt a qualitative comparative policy analysis approach, focusing on the AI strategies of the Visegrad Group countries, as I believe this approach is well-fitted for understanding the complexities and nuances of national AI strategies. My analysis is conducted through a review of each country's national AI policy, with particular emphasis on aspects related to environmental sustainability and socio-economic protections. Key policy documents, government publications, and relevant academic literature are examined to identify specific provisions for sustainable AI implementation.

Following the selection of countries and documents, the data for analysis is structured around three primary criteria:

- Environmental Sustainability and Resource Efficiency: The analysis evaluates how each national AI strategy addresses AI's energy demands and resource use. This includes examining guidelines or targets for reducing carbon emissions associated with AI technologies, promoting energy-efficient AI models, and providing incentives for adopting green computing practices.
- Labour Market Protections and Socio-Economic Adaptation: This criterion examines measures within each AI strategy aimed at managing AI's impact on the labour market. Key aspects include support for reskilling

programs, unemployment protections, and policies that facilitate workforce transitions into an AI-driven economy.

- Alignment with Global Regulatory Standards and Policy Trends: This criterion explores how each Visegrad Group country aligns its AI strategy with global regulatory trends and policy frameworks. By drawing insights from pioneering countries like Germany and France, as well as authoritative sources such as the Stanford AI Index Report (Stanford Report, 2024), the analysis identifies how these countries address emerging global standards that focus on the previous criteria and regulatory recommendations within their national policies.

By employing a qualitative comparative policy analysis approach, I compare and analyse the Visegrad Group countries based on the above criteria, with the aim of highlighting best practices, identifying gaps, and outlining recommendations to enhance the alignment of their AI strategies with sustainability goals. Additionally, I evaluate how these policies align with or diverge from recent global AI governance trends. In doing so, I assess how regional strategies reflect broader global shifts in AI policy from the perspective of sustainability.

4 Research results

4.1 Poland

Poland's AI Development Policy recognizes both the potential and challenges of AI, especially regarding energy demands and labour market impacts. While the strategy lacks specific targets for reducing carbon emissions, it promotes research initiatives focused on energy-efficient AI models, particularly in manufacturing and agriculture. This support is reflected in Poland's funding programs aimed at sustainable projects that optimize energy use across industries, aligning AI development with broader sustainability goals. On the labour front, Poland anticipates potential job disruptions due to automation, addressing these with reskilling programs targeting workers at risk of job displacement. These programs are part of a broader effort involving government collaboration with educational institutions to provide lifelong learning and digital skill development, equipping workers for the demands of a data-driven economy. Additionally, unemployment protections are in place to cushion the socio-economic impacts of job loss due to automation.

4.2 Czech Republic

The Czech Republic's national AI strategy integrates environmental sustainability with AI implementation by developing energy-efficient AI solutions and supporting eco-friendly computing practices. The strategy includes ambitious greenhouse gas emission reduction goals, positioning AI as a tool to achieve sustainability objectives, particularly in sectors like transportation and energy management. Labour market adaptation is a major focus, with proactive policies that include comprehensive reskilling and upskilling initiatives. These programs are designed for current workers and job seekers to develop competencies aligned with AI advancements, smoothing the workforce transition. Job security and adaptability are embedded in national policies, aiming to protect against unemployment risks linked to AI integration. Legal and societal protections are also in place to prevent discrimination and to uphold workers' rights and privacy in an increasingly automated workforce.

4.3 Hungary

Hungary views AI as a transformative force, especially on the labour market, where it is projected to affect up to 900,000 jobs by 2030. The strategy includes a robust framework for worker adaptation, with extensive reskilling and upskilling measures and collaboration between educational institutions and industry to develop relevant training programs. Additionally, social safety nets are emphasized to protect vulnerable workers during this transition. On the environmental front, Hungary's strategy promotes research into energy-efficient AI technologies, supporting projects aimed at optimizing resource use and minimizing carbon emissions. While specific metrics for tracking environmental progress are still under development, Hungary's strategy aligns with broader goals of sustainable innovation, particularly in agriculture and energy.

4.4 Slovakia

Slovakia's 2030 Digital Transformation Strategy aims to create an AI-driven economy that supports environmental and social sustainability. Though specific carbon reduction targets are not detailed, the strategy promotes an energy-efficient AI ecosystem, with initiatives focused on addressing environmental challenges through AI. Slovakia emphasizes education reform and lifelong learning to prepare the workforce for AI-related changes, with reskilling programs tailored for adapting to digital demands, especially for workers in professions vulnerable to automation. Collaboration among

ministries is highlighted as essential to identifying labour market needs and facilitating workforce transitions. Slovakia's approach reflects a commitment to both sustainable growth and the protection of labour in the digital age.

4.5 Global Trends

Global trends in AI development reveal a dual focus on environmental sustainability and workforce adaptability. Governments worldwide are increasingly emphasizing "green AI" practices, investing in energy-efficient and eco-friendly AI solutions to reduce environmental impact. Open ecological data initiatives enable broader access to critical environmental information, facilitating AI applications that optimize resource usage, integrate renewable energy, and forecast environmental risks. Examples include smart energy grids, optimized transportation systems, and projects in sectors like aviation that minimize fuel consumption and emissions, aligning technological advancement with ecological goals. In the labour market, AI-driven transformation is prompting a global focus on skill-building and lifelong learning to address shifts in job requirements. Countries are proactively implementing reskilling and upskilling programs, aiming to prepare workers for an AI-integrated workforce and mitigate the risks of job displacement. These initiatives often include digital literacy programs for vulnerable populations and advanced vocational training to close the skills gap in AI, data science, and robotics. By combining workforce adaptability with sustainable AI practices, nations are striving to ensure that AI growth is responsible, inclusive, and aligned with broader societal and ecological objectives.

5 Discussion and Conclusions

The analysis of AI strategies across Poland, the Czech Republic, Slovakia, and Hungary reveals a shared commitment to environmental sustainability and labour market adaptability, reflecting global trends in AI development. Among these countries, the Czech Republic stands out as having the most advanced and comprehensive AI strategy. Its ambitious greenhouse gas emission goals and direct linkage of AI advancements to environmental objectives set a strong example for others. This structured approach emphasizes the importance of quantifiable targets and accountability, positioning the Czech Republic as a leader in aligning its AI initiatives with global sustainability trends.

Conversely, Slovakia appears to lag behind in this regard, lacking its own dedicated AI strategy. Instead, it relies on a broader Digitalisation Strategy, which may dilute the focus on the specific challenges and opportunities presented by AI. This absence of a targeted AI framework hinders Slovakia's ability to effectively address environmental sustainability and labour market adaptation, making it the weakest among the Visegrad Group countries in this analysis.

In terms of environmental sustainability, Poland integrates energy-efficient AI technologies within its industrial framework but falls short with its lack of explicit carbon emission reduction targets. This highlights an area for potential improvement. Hungary, while supportive of energy-efficient AI technologies, is still in the early stages of formalizing its approach, suggesting a need to streamline efforts and establish clearer frameworks.

Regarding Labour Market Protections and Socio-Economic Adaptation, all four countries recognize the disruptive potential of AI on employment. Poland's strong emphasis on reskilling programs is commendable but lacks a comprehensive framework for unemployment protections, potentially leaving vulnerable workers exposed. In contrast, the Czech Republic excels with robust measures supporting workforce adaptability, demonstrating a proactive stance in identifying emerging labour market needs.

Slovakia's focus on educational reform, particularly its initiatives for lifelong learning and collaboration with industries, is notable. However, without a dedicated AI strategy, its efforts may lack the necessary specificity and coherence to be truly effective. In comparison, Hungary's detailed training programs emphasize specific competencies in AI and technology, providing an effective model for creating relevant training aligned with market needs.

To enhance their AI strategies, each country has opportunities to learn from one another. Poland could benefit from adopting the Czech Republic's ambitious carbon reduction targets, promoting accountability in AI's environmental impact. The Czech Republic should consider integrating Slovakia's initiatives to foster a vibrant AI ecosystem, including collaboration with civil organizations to maximize the societal benefits of AI technologies. Slovakia can benefit from Hungary's focus on tailored reskilling programs that address specific industry needs while also setting clear metrics for tracking progress in workforce adaptation. Lastly, Hungary should strive to formalize its approach to environmental sustainability, potentially mirroring Poland's industrial integration of AI solutions.

To enhance the significance of our results, we plan to incorporate quantitative data values in future iterations of this research, analysing metrics related to AI adoption, investment, and outcomes to provide a more robust assessment of each

country's performance. Despite the positive aspects of each country's approach, it is essential to acknowledge the limitations of this research. Comparing AI strategies across different countries is inherently complex due to the diverse socio-economic contexts, regulatory environments, and cultural factors that influence policy effectiveness. Furthermore, the analysis relies solely on strategic documents, which may not reflect the actual enforcement and practical implementation of these policies. Variances in political will, public support, and funding can significantly affect the success of these strategies, potentially leading to gaps between policy intentions and real-world outcomes. In order to generalize the results for other similar groups of countries, in my next research I plan to include other EU member countries and also non-EU countries.

While the AI strategies of Visegrad Group countries demonstrate a shared commitment to sustainability, their implementation and effectiveness are significantly influenced by socioeconomic factors. These differences include disparities in funding availability, public support, and institutional capacity, all of which shape how each country navigates the challenges and opportunities of integrating AI with sustainable development goals.

Funding for AI initiatives varies widely among the Visegrad countries, impacting the scope and depth of their strategies. For example, Czech Republic benefits from higher allocations for AI research and development, enabling more ambitious projects, such as measurable carbon reduction targets and comprehensive reskilling programs. Slovakia, in contrast, faces financial constraints that limit its ability to develop a dedicated AI strategy, relying instead on a broader digitalization framework that lacks specificity. These differences highlight the need for tailored policy support, such as EU-level funding mechanisms, to reduce disparities and foster more balanced regional development.

Public attitudes toward AI adoption influence the political will and effectiveness of policy implementation. Countries with higher public trust in technology, like the Czech Republic, are better positioned to implement bold AI-driven sustainability measures. In contrast, scepticism or lack of awareness in other countries, such as Slovakia, may hinder the adoption of transformative policies. To address this, targeted public outreach and education campaigns are essential to build consensus around the benefits of sustainable AI.

Institutional differences also play a critical role. The Czech Republic's well-established administrative frameworks enable efficient implementation and monitoring of AI policies. By comparison, Poland lacks clearly defined accountability structures, weakening its ability to enforce sustainability targets. Hungary is still developing the metrics needed to track environmental progress, limiting its capacity to evaluate and refine policies effectively. Strengthening institutional capacity across the region is crucial for improving policy coherence and effectiveness. Collaborative initiatives, such as regional knowledge-sharing platforms, could help bridge institutional gaps and enhance policy design.

Economic conditions also affect the feasibility of AI strategies. Wealthier regions in the Czech Republic and Poland can more readily invest in advanced AI technologies, while less developed areas in Slovakia and Hungary face barriers to entry, such as limited access to digital infrastructure. Addressing these disparities requires targeted investments in digital inclusion, such as expanding broadband access and providing subsidies for AI adoption in underprivileged regions.

To mitigate the effects of these disparities and improve policy effectiveness, the following measures are recommended:

- Establish a regional funding pool to support AI projects in economically disadvantaged areas.
- Promote public-private partnerships to mobilize resources and expertise for AI-driven sustainability projects.
- Implement capacity-building programs to enhance institutional readiness, focusing on accountability structures and monitoring mechanisms.
- Launch public engagement campaigns to raise awareness about AI's role in sustainable development, fostering public trust and collaboration.

By acknowledging and addressing these socioeconomic differences, the Visegrad countries can create more equitable and effective AI strategies, ensuring that technological advancements contribute to sustainable development across the region.

In conclusion, while each country is making strides in its AI strategy, the inter-country comparisons reveal that the Czech Republic has the most advanced framework, while Slovakia's reliance on a broader digitalisation strategy limits its effectiveness. By embracing best practices from one another and aligning more closely with global trends, Poland, the Czech Republic, Slovakia, and Hungary can collectively foster a more sustainable and equitable AI landscape. This

collaborative learning will significantly enhance their resilience to the challenges posed by AI advancements and ensure that they remain competitive in the rapidly evolving global economy.

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Sharing Economy in Social Farming Projects

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Abstract: The aim of the contribution is to provide an explanation of the mechanism of the functioning of the shared economy in social agriculture projects through an interdisciplinary approach of interested social sciences (economics, economic and social policy theory, sociology, etc.). Orientation to the issue of creating shared work to support employees with the stated needs in rural and suburban areas is considered the main priority. In essence, it is about supporting families in raising children, caring for close people with disabilities, etc. The importance of employing seniors and people in pre-retirement age as a result of the phenomenon of population aging is also not negligible.

Keywords: sharing economy, shared jobs, social farming, family support

JEL Classification: A14; B41; Q01

1 Introduction

The Human labor, as a factor of production, represents a certain type of commodity that is affected by the forces of supply and demand. On the one hand, the employee stands as the seller of his labor force, on the other hand, the employer represents the buyer, who, through the given contract, tries to increase his profit and achieve his business plan. The whole process is also determined and directed by the state institution and its employment policy (Mankiw, 1999). Based on these three categories, it is possible to determine the specifics on the part of the employee, the employer and institutional factors of employment regulation. The creation of shared jobs is currently one of the priority employment issues in the Czech economy, especially for supporting families with specific needs (raising a child, caring for a close person, etc.). These are intended to ensure greater flexibility in shorter working hours with the same second part. In Czech labor law, the term "shared job" was introduced at the beginning of 2021.

Social farming projects in rural areas can significantly contribute to the development of shared jobs, especially for supporting families with the aforementioned needs, but also for employing people with specific disabilities and seniors (Gaugler, 2023). In this sense, the aim is to create conditions within social farms for the integration of people with specific needs to carry out regular agricultural activities in order to ensure their development and support and improve their well-being (Hassink et al., 2007). In this context, these social farms can contribute to the fulfillment of the desired economic, social and environmental goals in the context of sustainable development.

2 Background, methodology and data for processing

Social farming has been in practice in the Czech Republic for many years, although it has only been formally defined in recent years. Historically, the concept of social farming has been implemented in previous centuries. In the absence or limited range of other options for including and providing for people with difficulties in the labour market, agriculture, as the most widespread anthropogenic activity with a very variable range of activities, created one of the largest spaces in which these people could find employment, whether directly within the family or within the community around the agricultural holding. Thus, people who, for example, age, health or mental disabilities, did not allow them to work normally found employment on the farm. However, along with the intensification of agriculture, most of the space for less effective activities disappeared, and part of the social function of agriculture, consisting in including people with difficulties in the labour market and offering activities to disadvantaged and marginalized people, was largely suppressed and transferred from agriculture to other sectors. Only with the development of alternative agricultural systems, aimed at the extensification of agricultural management and its sustainability towards the end of the twentieth century, did this component of the social function of agriculture begin to develop again. After partial practical activities and theoretical projects in the years 1990 to 2010, the current wave aimed at the definition and conceptual development of social agriculture was launched in 2013. The concept of social agriculture in its current form reached the Czech Republic on the basis of the Multifunctional Agriculture in Europe project, which ran in the years 2011 – 2014, and the Czech Republic

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participated in it as a partner. Relatively quickly, several farms and actors identified with the concept and initiated its further promotion. In 2014, an interdepartmental Working Committee on Social Agriculture was established under the Ministry of Agriculture, consisting of representatives of the Ministry of Agriculture, the Ministry of Labor and Social Affairs, representatives of the academic, profit-making and non-profit sectors, which deals with the concept at multiple levels.

According to the Organization for Economic Cooperation and Development, in 2022 only 6.2% of employees in the Czech Republic were employed part-time, the European Union average is 19%, with the Netherlands dominating with 47%. Switzerland also has a high share of such employees with 37.6% and Austria with 29.5% (Czech Statistical Office, 2023). In general, developed Western European countries have a share of part-time work in the range of 18-28%. The Czech Republic is thus significantly behind most of the "27" countries in this area, followed by only a few countries - Bulgaria, Hungary, Slovakia and Croatia (Czech Statistical Office, 2023).

Based on the above-mentioned contexts, the analytical comparative method prevails in the processing, which subsequently enables the determination of special or general laws by induction. At the same time, an interdisciplinary approach of social sciences dealing with the above-mentioned issues is applied, such as economics, economic and social policy theory, sociology, environmental studies, regional studies, etc..

3 Research results

3.1 Initial philosophy to the issue

The aim of social farming is to provide a wide range of people with health, social and educational activities based on agricultural activities. It is flexible, i.e. it actively responds to the current state of the community and its needs. In this way, it can also support employment in rural areas, because it can offer more people meaningful activities in its operations, and also offers services that are inaccessible to many people. This is especially the case for extensive farming farms, where heavy machinery is not used, the work is more diversified and the overall share of human labor in farm operations is higher (Donéeová et al., 2024). It creates new jobs in its operations and can thus become a social integration enterprise and a tool for social inclusion in general. In this sense, it fits the ideological trends of contemporary social entrepreneurship, where the emphasis is on entrepreneurs who are understood as creators of change in society and come up with new combinations in the following areas: "they provide new services, come up with new quality of services, come up with new methods of production, with new primary production factors, with new forms of organization, discover new markets". Social farmers focus on social innovations for the benefit of the community and society and their development. In this way, social agriculture limits the outflow of population from the rural environment (Hassink et al., 2014). It pays attention to regionality, gives preference to its own products over the globalized market and fully fits into the existing Rural Development Program in the Czech Republic. This type of agriculture is ultimately supported within the framework of the European Structural and Investment Funds for Rural Development. Social agriculture can also be an additional source of income for farmers.

The European model considers agriculture as a multifunctional discipline, the strategy of which is based on sustainable development and stabilization of rural areas. The term "social agriculture" was first mentioned in Europe at the end of the last century, and in the Czech Republic it appeared around 2010. The definition of social agriculture is not yet uniform in Europe and varies according to the method and extent of using agriculture for social purposes. In the Czech Republic, social agriculture is still in its infancy and, as a social enterprise, it depends primarily on willing actors from the civil society sphere and from among social innovators. European structural funds also significantly contribute to the development of social entrepreneurship. Most implementers of social agriculture in the Czech Republic learned about this concept from international projects and use foreign experience and examples. Previous experience in creating sheltered jobs in agriculture and using national employment policy is also used.

One of the forms of atypical forms of employment is the shared job, which was a novelty in the Czech economy until recently. Greater use of alternative forms of work can lead to a better redistribution of unemployment or even a reduction in long-term unemployment, which in this case mainly affects people unable to work full-time, such as carers, the disabled or people of pre-retirement age. Similarly, for companies, flexibilisation means gaining new groups of employees or maintaining a qualified workforce. Flexible working hours also enable a smooth transition from economic inactivity to the active phase and vice versa, i.e. retirement or return from parental leave. It also provides space for further education and development of employees.

3.2 Shared places within work-life balance in social farming projects

In the emerging era of Industry 4.0, the concentration of capital and technological development have become the "vanguard" of the accelerating dynamics of modern societies and have given it an appropriate qualitative direction. Economics, with its knowledge, has most significantly participated in this "construction of a new world" among the social sciences. The idea of decentralization in society towards the implementation of the principle of subsidiarity is a subject of interest for the social sciences, which, as interested disciplines with different paradigms of implicit anthropological and value ideas, are based on different contexts of social and worldview dimensions (Begg, 2008). When assessing the relevance of the principle of subsidiarity in its practical application, they will therefore not be completely identical. However, the principle of subsidiarity can help the social sciences, as a distinct social science discipline striving for at least partial independence from specific historically, contextually and politically conditioned social policies, to better formulate relationships with as little dependence as possible between the state and comprehensive care for the quality of life of all members of society. The formation of social interaction not on general philosophical and moral principles (freedom, equality, justice, solidarity, subsidiarity), but on specific doctrines of social justice or human rights formulated in political processes can lead to a loss of autonomy in favor of serving the person in the framework of caring for the quality of life and a growing dependence on specific historically, socially and ideologically formulated doctrines and policies. Many newly defined human rights, especially of a social and economic nature, contained in documents to which the social sciences refer, are essentially relative in nature, based on consensus in society and its economic possibilities, so they cannot be understood in the so-called strict sense of the word as temporally or regionally universal (Dumont, & Teller, 2007).

In the Czech Republic, the concept of work-life balance is becoming increasingly popular. The reason is that individual employers often entice applicants with a variety of benefits, often with the addition of "for a better work-life balance". In essence, it is a concept of corporate culture, the purpose of which is to ensure a balance between work and personal life. However, historical approaches primarily followed the interest in reconciling work and family life. It was only in the 1990s that the policy of reconciling work and family life began to develop terminologically towards the concept of work-life balance in the sense of reconciling work with personal life (Wepfer et al., 2015). The current concept of this concept does not focus only on the family, but also on other aspects of life, which can include studies, leisure activities, social life or mental health care. However, it is not just the effort to combine work and personal life that leads to a higher use of more flexible forms of employment. This trend is also facilitated by the overall digitalization and globalization of work. It is also necessary to take into account the fact that such forms of employment respond to the interests of individual employees and employers (Shukla & Srivastava, 2016).

Czech labor relations legislation regulates a wide range of institutes, the existence of which fulfills the concept of work-life balance. Employers themselves also contribute to a better balance between work and personal life by offering these institutes to employees or coming up with other forms of employee benefits. Tools fulfilling the concept of work-life balance include working from home, flexible working hours, vacation exceeding the legal minimum, sick days, reduced working hours through job sharing or enabling paid or unpaid leave. Shared jobs can be perceived as one of the most important institutes that aim to fulfill the meaning of work-life balance. As the key legislative instruments leading to the combination of work and family life, they must also meet the basic prerequisites (Šetek et al., 2022). These are the creation of suitable working conditions, appropriate financial security for the performance of gainful activity, and the existence of legislative regulation that will not hinder the performance of employment and will sufficiently guarantee the care of a family member. It can therefore be argued that the implementation of legislative regulation of individual institutes in the Czech legal order, which will contribute more to the combination of work and personal life, will lead to greater respect for these institutes and, above all, to their wider application in real practice.

3.3 Multifunctional agriculture and its reflection

Agriculture is an activity that is specific in that it is tied to agricultural land and is influenced by natural conditions. Land is the most important, basic and irreplaceable production factor for growing crops that serve as food for humans or for feeding livestock. Agricultural production is therefore divided in terms of focus into plant production, the production of cultivated crops, and animal production, the breeding of livestock. The production of agricultural commodities is the main function of agriculture. Especially in the case of small organizations, it can represent the possibility of a new influx of funds needed for their continuation, development and economic stability, both from production and from the services provided or educational activities.

Social agriculture is usually operated on smaller family-type farms, which often produce in an organic farming regime, but this is not a condition. Thanks to this, it is able to support the landscape-forming elements of the given location more and tries to think more broadly about the impacts of its work on the landscape and the environment. It has a positive effect on the biodiversity of rural areas and at the same time reduces the negative impacts of intensive agricultural production. The concept of social agriculture would ultimately be unthinkable if the one-sided view of agriculture as a producer of food and fiber and the maximization of yields and agricultural commodities had not been transformed, regardless of the broader impacts of such thinking on agricultural activity. This awareness gives rise to the concept of so-called multifunctional agriculture, which, in addition to ensuring a sufficient amount of food and agricultural commodities for the population (production function), also takes into account the protection and maintenance of natural resources (environmental function), maintaining the cultural character of the landscape (landscape-forming function), developing the recreational potential of the environment (recreational and tourist function), maintaining and developing local traditions (cultural function), maintaining the rural settlement structure (settlement-forming function). Furthermore, through the production of biomass, agriculture is becoming an important player in the field of renewable energy sources (energy function). Last but not least, agriculture helps to create new jobs, opportunities for social inclusion and new tools for care and social and educational activities, which represents the social function of agriculture.

3.4 The position of agriculture in economic, social, regional and rural policy

At first glance, the agricultural sector seems completely incompatible with the field of social economy and social work. Especially in recent decades, agriculture can evoke the image of parched or, conversely, waterlogged fields with heavy machinery, monolithic and damaged landscapes, spruce monocultures, forces disfiguring rural panoramas, etc. and the negative economic and sometimes political connotations associated with it. This is how a stereotypical view of agriculture has become entrenched in our imagination, which has grown into this form due to the need to "feed" as many people as possible cheaply and quickly after World War II, but also in connection with subsidy policies. However, it has gradually perverted with the help of large financial injections into the global business system, often without scruples. Social agriculture and other agricultural alternatives may appear in this prejudiced perspective as a flaw in the system. Yet these alternatives grow out of a certain ideological mycelium that has been emerging in the agricultural field since the 1980s, and academics have even begun to talk about a paradigmatic shift in the understanding of agriculture. It pits against each other the previously experienced and internalized intensive methods of production agriculture on the one hand, and multifunctional agriculture or post-productive agriculture with an emphasis on its environmental and local dimensions on the other (Wilson, 2008).

With the changes in the experienced ideas about agriculture, expectations from the countryside, which is logically linked to agriculture, also change. In this context, there is talk of the so-called commodified countryside, which builds its image on representations of the countryside as a tourist destination, an idyll based on nostalgia, a fiction of rural landscapes and life, or a place of adrenaline experiences. In the sense of commodification, it is the conversion of symbolic and aesthetically valuable images of the countryside into a market, exchangeable and tradable unit in which industrial agriculture does not find its application (Pospěch et al., 2014). In the line of dichotomous thinking about agriculture, there are also changed consumer preferences for agricultural production. In the conceptual distinction, the agro-industrial and integrated territorial paradigms are opposed, which are primarily related to the methods of "production" and distribution of food (Renting et al., 2008). The agro-industrial paradigm system is based on the original concept of the Common Agricultural Policy and was set up in the 1950s in the language of social geographers as a hypermodern geography of food (Spilková & Vágner, 2016). Agriculture was narrowed down to its food and production function, characterised by the following processes: 1. modernisation and industrialisation of food supply systems (production, processing, distribution, sales); 2. standardisation of production and practices and procedures in the processing of production; 3. globalised food markets (Renting et al., 2003). In this concept, agriculture is reduced to a possibly unified global system that pays little attention to regional needs and specificities of people and the environment. The integrated territorial paradigm, on the other hand, is directly linked to a specific location, in which it takes advantage of socio-economic relations of proximity. At the same time, it takes into account the impacts of its management on the landscape and nature and social relations. It supports the educational aspect, is aware of the landscape's face influenced by agricultural production and takes into account health and care. In these points it finds agreement with multifunctional, post-productive and social agriculture (Bock, & Oosting, 2010), but places increased emphasis on a shortened consumption and distribution chain, i.e. simplification of the producer-consumer relationship, and also on the proximity and cultural embeddedness of these players (Renting et al., 2003). As some authors add, these distribution mechanisms are placed outside the mainstream agricultural policy, which is ultimately the goal of their participants (Norberg-Hodge et al., 2002).

In these exchanges, they depend on hybrid organizational models, informal exchange, cooperation between the public, private and civil spheres (Spilková & Vágner, 2016). Alternative approaches to agriculture have gradually begun to be taken into account in conventional agriculture after the negative consequences of the central common agricultural policy on countries in the global south (Norberg-Hodge et al., 2002), or with regard to the health aspects or diseases of farm animals, such as foot-and-mouth disease, mad cow disease, or swine and bird flu (Spilková & Vágner, 2016). The setting of quality control standards for agricultural production and processing and the impacts of agriculture on the environment are developing (Wiskerke, 2010), the conversion of conventional to organic agriculture is receiving more significant support and awareness (e.g., in the Czech Republic, the Act on Ekological Agriculture came into force in 2000, which regulates the conditions of farming and is associated with a certificate of labeling of organic products and organic food), regional labeling and certification have received greater support (Pospěch, 2014; Spilková & Vágner, 2016,) and in general, more attention is paid to the quality of products, animal welfare, and also to helping farmers maintain the required quality standards set by the European Union (Krutilek, 2014). In the period 2014 - 2020, the Common Agricultural Policy of the European Union met the needs of farmers with an effort to have a positive impact on the environment and natural resources. In decision-making on agricultural policy, equal and balanced roles of the market, the state and civil society organizations are increasingly taken into account, and regional and local structures are involved. In terms of content, it is no longer the responsibility of agricultural experts, economists or rural development specialists alone, but is also shared with the sectors of public health, education, ecology, sustainable development, climate change and also urban representatives (Haubehofer et al., 2010).

The concept of multifunctional agriculture itself gained importance after the United Nations Earth Summit in Rio de Janeiro in 1992. The conclusions of the summit indicate that agriculture should produce more than just food and fiber, but should also fulfill other functions, such as caring for renewable resources, landscapes, and biodiversity, and should contribute to the socio-economic viability of rural areas (Renting, et al., 2008). This rhetoric of multifunctional agriculture has also been used by the Organization for Economic Cooperation and Development since 2001, primarily in connection with the economic aspects of agriculture and the legitimacy of agricultural support policies, the liberalization of commodity markets, and the adaptation of the neoclassical liberal economic approach. The neoliberal discourse is unable to include markets in its economy in which goods with positive or negative externalities are valued. It is difficult to quantify in monetary terms the outputs of agriculture, such as healthy landscapes and biodiversity, functional water management, food security, employment and socio-economic viability of rural areas (Renting et al., 2008). Multifunctional agriculture also appears to be a tool for enhancing the aesthetics of the landscape, which includes the natural heritage and visual value of the landscape, the historical context, the environmental quality of the site and the demand for recreation by residents (Renting, et al., 2008; Maruani, Amit-Cohen; 2007).

3.5 Benefits of social farming for farmers and the countryside

Working on a farm helps to increase or maintain overall physical fitness. People who work here can acquire or improve their skills, especially in the fields of agriculture, gardening, animal care and other similar skills. Working in a peaceful environment can calm the actors, it can contribute to a better lifestyle, whether in the area of sleep or eating. There are also benefits affecting mental health. Actors of social farming can experience feelings of well-being or peace, they can increase their self-esteem or begin to perceive their importance in the whole process. Last but not least, there is a social benefit, when actors come into contact with farmers, other employees, the general public. They can meet new people here, create new friendly relationships. The purpose is to fight social exclusion with the aim of integrating these people. Their independence, autonomy and personal responsibility are also developed here.

The benefits for employees can be pointed out primarily in six areas: physiology, cognition, emotions, pedagogical, social and self-knowledge. Physiological changes lead, for example, to training fine or gross motor skills, better coordination of movement or balance. Cognitive abilities are also developed here, i.e. the ability to process and understand received information, remember it, concentrate on the message, orientate in space and speech, the ability to express oneself, etc. (Šetek, 2019). It also has an impact on the emotional side, where it can evoke positive experiences in those involved. Those involved often experience joy in connection with nature. Furthermore, there is a connection to the pedagogical sphere, where individual actors acquire new skills, gain new knowledge, and learn by imitation. The social area works with integration, involvement of people in society, communication with the environment and with each other. The last level is the area of self-knowledge, where interested individuals can get to know themselves, work with their own value, and thus feel their importance, etc.

4 Conclusion

Social farming is the most comprehensive component of the green care concept. It is generally used for everything that concerns nature and its therapeutic effect on humans and has a predetermined plan and defined goals. Its purpose is to improve the health and psychological state of the individual and support their pedagogical development based on the interaction of humans and natural elements (Davison et al., 2022). As an important player, social farming also participates in the concept of community-led local development, where the social farm can be an active partner in solving problems and strengthening the individual and the community. Social farming supports social integration as an effort to mitigate or eliminate inequalities of marginalized groups of the rural population by integrating them into activities on the agricultural farm, whether in the form of employment, social and therapeutic services, or educational activities. It can also be seen as a tool of the social economy, which is profiled as a part of the national economy alongside the market and the public sector, and its aim is to actively respond to specific problems and needs of citizens in a given location (Leitmanová et al., 2023).

The implementation of shared jobs within social farming projects thus represents an opportunity to reconcile the family (personal) and working lives of employees, which is intended to facilitate the employment of people for shorter working hours, both on the part of the employer (farm) and on the part of the employees. They thus have the opportunity to take turns after a certain period of time, to share one job so that they can together fill the working hours scheduled at this location and at the same time reconcile the time spent working with personal matters. From the point of view of social policy theory, this is the implementation of the principle of subsidiarity and participation (Begg, 2008). The aforementioned implementation also means fulfilling all set goals in the context of sustainable development (economic, social and environmental) within the rural area and region. The principle of subsidiarity thus established essentially also means the right of the interested party to help the surrounding community and the right of a smaller community to help the larger community; this help should be focused on self-help (McKinlay, 1999). This principle also respects the fact that people do not live in isolation. Through the aforementioned principle, the importance and necessity of the activities of certain communities to ensure social security and interest can be emphasized. Fulfilling the principle of subsidiarity presupposes a certain education of the population to be responsible for themselves, including the real social situation, i.e. the space for their own social action.

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Capital Productivity and Cost Structure: Analysis of Firm Level Data

Tomáš Volek¹, Martina Novotná²

Abstract: Capital productivity is one of the factors that can influence the cost structure of firms. Firms are interested in using their capital as efficiently as possible to achieve higher productivity and reduce the cost per unit of output, thereby improving their competitiveness and profitability of the firm. The aim of this paper was to assess if the change in capital productivity has an impact on the cost structure in terms of personnel costs and material costs for manufacturing firms (textile industry) in EU 27 countries. An empirical study of 1407 textile firms showed that capital productivity is affected by the amount of tangible and intangible fixed assets acquired. It was found that over the period under study, as the size of fixed assets increased, firms were able to increase capital productivity and to use newly acquired assets more efficiently to increase firm revenues. The impact of the change in capital productivity of enterprises on the change in the share of personnel costs and share of material costs has not been found.

Keywords: Capital productivity, cost structure, textile industry.

JEL Classification: D24, E23, G01

1 Introduction

Making a profit is one of the basic goals of a business. Its size is significantly influenced by the size of costs and their structure. The cost structure of a company plays an essential role in the strategic management and decision making of the company. A properly set and analysed cost structure enables a company to allocate resources more efficiently, optimise processes and increase profitability. Investments in fixed assets such as machinery, technology, buildings or equipment can significantly affect the cost structure of a company. For these investments, it is necessary to assess in particular their efficiency (productivity). In the long term, the efficient use of fixed capital investments can improve the competitiveness of an undertaking and its financial stability. The aim of the paper will be to assess whether the change in capital productivity has an impact on the cost structure in terms of personnel costs and material costs with a focus on EU countries and the Czech Republic.

Productivity is a key factor for economic growth because it directly affects the ability of the economy and enterprises to produce more goods and services with fewer resources. An increase in productivity means that the efficiency of the use of capital, labour and technology increases. The neoclassical model production function is the basic starting point for considering the relationship between output and inputs (productivity). The basic production function used to measure productivity from a business perspective is the Cobb-Douglas production function. Without the influence of technology, this function can be described by saying that firm i produces output at time t through three inputs - capital, labour and materials (Demirer, 2020). Blažková et al. (2020) use a modified version of this function in measuring firm productivity, where total revenue (sales) is a function of tangible fixed assets, personnel cost and material consumption.

Generally, productivity defined as the ratio between the output of production and the input of production factors/means. The problem is to choose relevant measures of the output of production and the input of factors of production (Björkman, 1992). Productivity indicators are classified according to what resources are involved in production. Labour productivity measures the efficiency of the use of labour. Capital productivity measures how efficiently capital, i.e. equipment, machinery or investment, is used and total factor productivity (TFP), includes the total efficiency of all inputs including labour, capital and technology. TFP shows the extent to which factors such as innovation, technological progress or improvements in the organisation of production that are not explained by increases in labour or capital inputs alone contribute to output growth. According to Klaus et al. (2024), in addition to traditional factors of

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production (such as labour and physical capital), intangible factors (such as research and development (R&D), patents and software) are increasingly important for firms' economic growth

Productivity can be viewed from a macroeconomic perspective (Pavelka et al., 2014), a regional perspective (Dušek, 2018), a sectoral perspective (Buleca & Mura, 2014), a sectoral perspective (Novotnáš et al., 2021) or a firm perspective (Redlichová et al., 2023).

Productivity and costs of a firm are closely related factors that affect its overall efficiency and profitability. Higher productivity means that a firm can produce more products or provide more services in the same amount of time, leading to lower unit costs. By improving productivity, it is possible to achieve more production with less use of resources, which reduces variable and fixed costs. According to Grifell-Tatje and Lovell (2020), the productivity effect is in turn decomposed into a cost-efficiency effect and, in an intermediate context, a technical change effect. Productivity and business investment are closely related, as investment often serves as a tool to improve productivity. On the other hand, a lack of investment can lead to stagnation of productivity, which can mean a loss of competitiveness in the market. Investment in modern fixed assets can provide a firm with a competitive advantage and a greater ability to adapt to changing market conditions. A study by Gogokhia and Berulava (2021) points out that investment in innovation drives productivity. Conversely, low productivity can lead to cost increases. Long-term productivity improvements can translate into lower unit costs and thus higher competitiveness of firms. At the same time, some studies such as Brodny and Tutak (2022) point out that there are other factors that can affect the relationship between fixed asset investment and productivity.

2 Methods

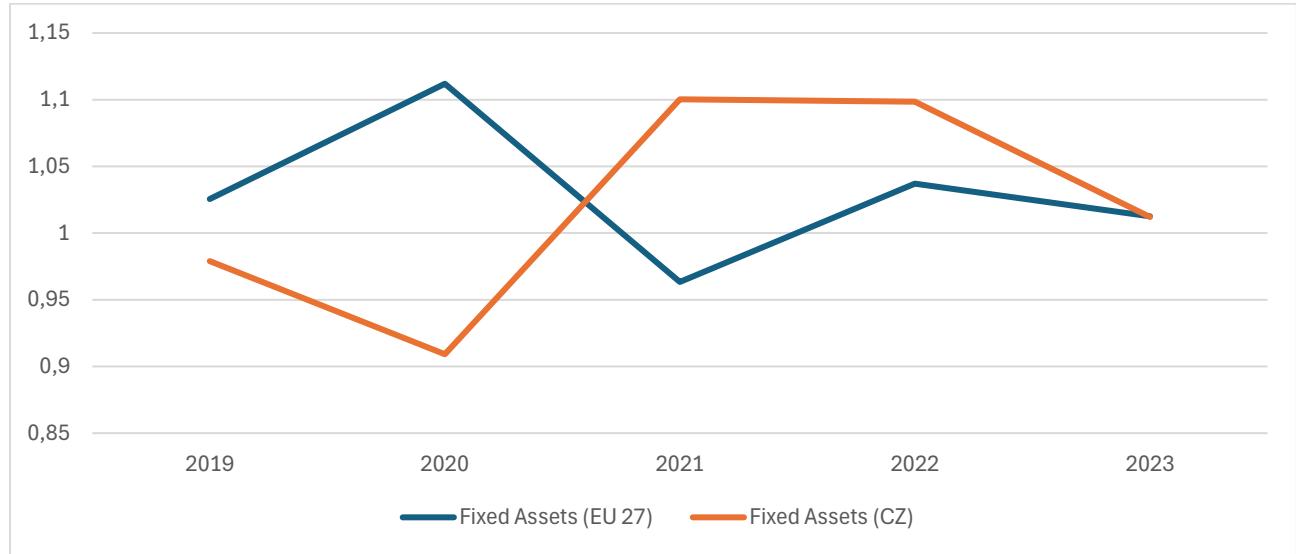
The paper focuses on the analysis of the relation of the development of enterprise capital productivity, i.e. the rate of asset turnover in textile enterprises with labour productivity and at the same time with the development of the cost of production, respectively with the development of the cost structure. The empirical analysis included 1407 textile enterprises (NACE 13) from the whole EU (27 countries), including 30 enterprises from the Czech Republic. The enterprises were represented in all size categories except micro enterprises. The same group of enterprises was surveyed in all years. The economic data of the surveyed enterprises were drawn from the ORBIS firms database. The period of observation was 6 years, between 2018 -2023.

The capital productivity was surveyed as the ratio of Operating revenues and Tangible plus Intangible fixed Assets. Labour productivity was calculated as Operating revenues and Costs of employees. Other indicators used in the analysis are Share of personnel costs (Share of Costs of employees and Total costs), Share of material costs (Share of Material costs and Total costs), Cost per unit of operating revenues (Share of Total costs and Operating revenues). The profitability of the companies was determined using the Return on Assets (ROA), which was determined as the ratio of EBITDA to Assets.

3 Research results

The capital productivity is influenced by the amount of tangible and intangible fixed assets (Fixed Assets) acquired by the enterprise. In a company, there can be a simple reproduction of fixed assets or an extended reproduction, in the case of the involvement of modern technologies, robotization or digitalization (elements of Industry 4.0). These investment activities can mean revenue growth or cost savings. The evolution of the change in fixed assets in textile enterprises in the EU (EU 27) and the Czech Republic is presented in Figure 1.

Figure 1 Development of fixed assets (index)



Source: own processing, Orbis database

Figure 1 indicates the different evolution of fixed asset investment in EU (EU 27) and Czech enterprises. While the level of fixed assets increased in the EU up to 2020, it decreased in the Czech Republic over the same period. In 2021, the evolution of fixed assets in the EU (EU 27) and the Czech Republic was completely opposite. In the Czech Republic, there was an increase of about 10% in 2021, which continued in 2022 (again an increase of 10%). In the EU, in 2021 is the only year in which investments in textile enterprises decrease by about 4%. In 2023, investment growth is the same in the EU countries and the Czech Republic (1.2%). The development of investment in fixed assets is strongly influenced by the capital productivity indicator. It is about whether revenues grow faster or stagnate than the growth of fixed assets. Table 1 provides an overview of selected indicators for the EU and Table 2 illustrates these indicators for enterprises in the Czech Republic.

Table 1 Level of selected indicators in textile enterprises in the EU (EU 27)

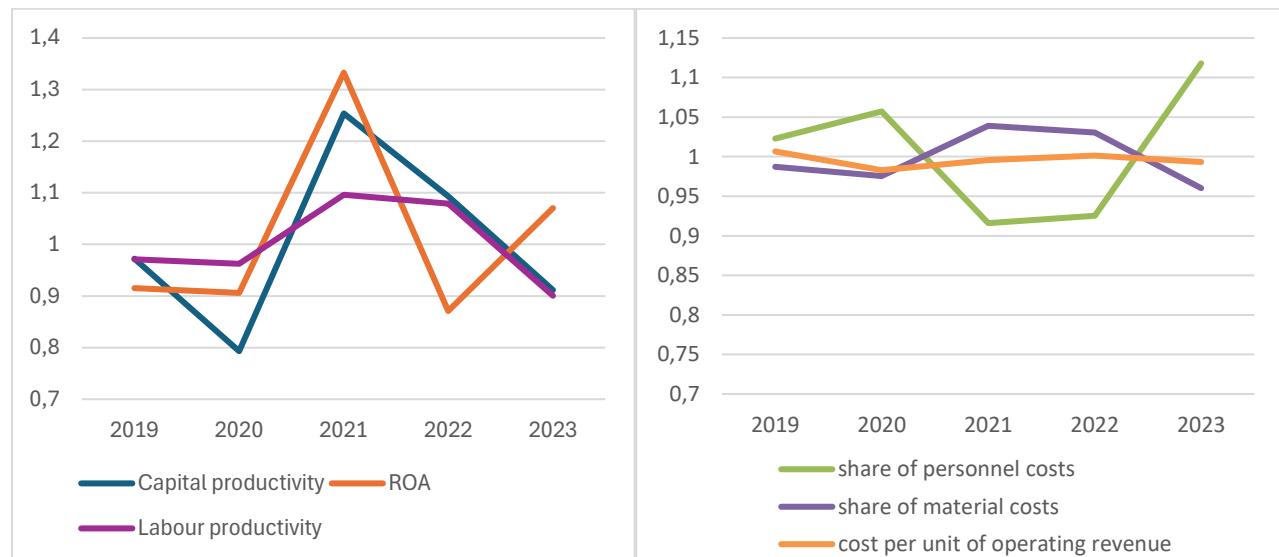
Indicators	2018	2019	2020	2021	2022	2023
Capital productivity (EUR)	3.71	3.60	2.86	3.58	3.92	3.57
ROA (%)	8.64	7.90	7.16	9.55	8.31	8.90
share of personnel costs (%)	22.19	22.70	24.00	21.98	20.34	22.74
share of material costs (%)	73.26	72.32	70.54	73.29	75.54	72.53
Labour productivity (EUR)	6.11	5.93	5.71	6.26	6.75	6.08
Cost per unit of operating revenue (EUR)	0.74	0.74	0.73	0.73	0.73	0.72

Source: own processing, Orbis database

A comparison of the level of selected indicators in textile companies (Table 1 and 2) shows that the level of capital productivity is significantly higher in the EU (EU 27), i.e. 1 Euro of fixed assets generates more operating income on average by more than a Euro (except in 2020 - the pandemic period). As regards labour productivity, it is roughly comparable, even higher in the Czech Republic than in the EU (EU 27) in some years. This is due to lower labour costs, which is also reflected in the share of labour costs in total costs. In the EU the share of wage costs in total costs is about 22 %, while in the Czech Republic it is about 18 %. The share of material costs in total costs does not differ significantly. The return on assets (ROA) is higher in textile companies in the Czech Republic until 2020, while from 2021 onwards textile companies in the EU on average have a better return on assets than companies in the Czech Republic. Figure 2 and Figure 3 illustrate the evolution of the indicators in the EU countries (EU 27). The left graph shows the indicators of

efficiency of production factors and return on assets, the right graph illustrates the evolution of the share of cost types in total costs and the cost of production.

Figure 2,3 Index of selected indicators in EU textile enterprises (EU 27)



Source: own processing, Orbis database

Figure 2 shows that capital productivity in the EU (EU 27) increased significantly in 2021, but at the same time fixed assets declined in that year (Figure 1), i.e. revenues grew in 2021 compared to 2020, while fixed assets declined. In the following year, the situation was reversed. As far as labour productivity is concerned only in this period (2020-2022) it increased, at the same time the share of personnel costs decreased. Costs per unit of operating revenue oscillated around 1 throughout the period under review.

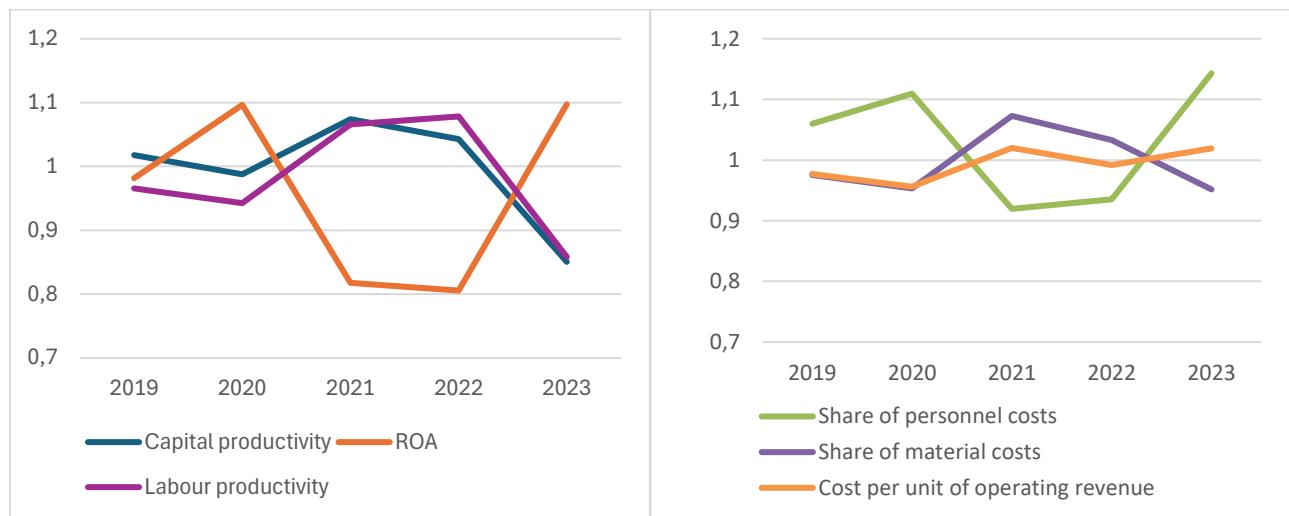
Table 2 Level of selected indicators in textile enterprises in the Czech Republic

Indicators	2018	2019	2020	2021	2022	2023
Capital productivity (EUR)	2.47	2.52	2.49	2.67	2.78	2.37
ROA (%)	9.55	9.38	10.28	8.41	6.77	7.43
share of personnel costs (%)	17.04	18.07	20.05	18.44	17.24	19.71
share of material costs (%)	76.99	75.08	71.56	76.77	79.31	75.47
Labour productivity (EUR)	7.68	7.41	6.99	7.45	8.03	6.89
Cost per unit of operating revenue (EUR)	0.76	0.75	0.71	0.73	0.72	0.74

Source: own processing, Orbis database

The development of chosen indicators in textile enterprises in the Czech Republic is different in some respects (Figure 4,5). In particular, the return on assets (ROA) in textile enterprises in the Czech Republic decreases in 2020-2022.

Figure 4,5 Index of chosen indicators in textile enterprises in the Czech Republic



Source: own processing, Orbis database

Capital productivity and labour productivity decrease in 2023 compared to 2022, identically in both EU (EU 27) and Czech enterprises, while the level of fixed assets in this year corresponds to simple reproduction (Figure 1). The evolution of the cost structure in EU (EU 27) and Czech firms is almost identical. The share of costs per unit of output increases slightly from 2020 onwards in enterprises in the Czech Republic.

4 Conclusions

Capital productivity is one of the factors that can influence the cost structure of firms. The firms want to make the most efficient use of their capital in order to achieve higher productivity and reduce the cost per unit of output, thus improving their competitiveness and profitability of the firm. In the long run, firms that increase their capital productivity become more sustainable and resilient to market fluctuations. The aim of the paper was to assess whether the change in capital productivity has an impact on the cost structure in terms of personnel costs and material costs for manufacturing firms (textile industry) in the EU (EU 27). The empirical study showed that capital productivity is affected by the amount of tangible and intangible fixed assets (Fixed Assets) acquired by the firm. Since 2021, there has been a significant increase in the size of fixed assets, where firms have been able to increase capital productivity, i.e. use newly acquired assets more efficiently to increase the operating income of firms. At the same time, the impact of a change in the productivity of capital in firms on the change in the share of personnel costs and share of material costs has not been demonstrated. The enterprise study by Caliegro et al. (2020) points out that the use of capital to increase productivity can be significantly influenced by the quality of the firm's management in terms of how efficiently it can use capital. The study found differences when comparing the development of the level of indicators for EU (EU 27) enterprises and enterprises for the Czech Republic. Enterprises in the Czech Republic have a lower share of personnel costs, a higher share of material costs and higher investment activity. In terms of productivity, enterprises in the Czech Republic have lower capital productivity but, on the other hand, higher labour productivity. On the other hand, in terms of the development of the individual variables monitored, the dynamics are very similar except for the profitability indicator (ROA). Despite these findings, capital productivity is an important indicator that needs to be further investigated. Kaus et al. (2024) point out that it is necessary to address the variance in capital productivity, which may signal distortions in market competition. In the future, they plan to focus on and the area of variance in capital productivity and the productivity of intangible fixed assets and their impact on productivity. The primary limitation of the paper is the focus on only one sector of manufacturing and the short time period when productivity was observed.

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Session:
**Finance, Accounting and Taxes: Current Issues and
Approaches to Their Solution**

The Financial Implications of the Imposition of E-Levy on Mobile Money in Ghana

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Abstract: The proliferation of mobile money services within the Sub-Saharan region has been of great benefit to most economies as it has helped in bringing financial inclusion, especially to the less privileged. However, most of these economies for instance Kenya, Tanzania, Uganda, etc. have implemented taxes on their mobile money services which have in some way affected the service. Just like these economies, the Ghanaian government decided to implement an electronic levy (E-Levy) on mobile money transactions as a way to increase revenue to aid in solving its pending financial issues. This created an uproar in the country as most people were against its implementation. The citizens were of the view that there were better alternatives than the imposition of a new tax.

This research was conducted to identify the financial implications that implementing this electronic levy would have on the economy of Ghana. In conducting the research, a questionnaire-based approach was used to find out from Ghanaians the kind of effects the implementation of the tax has had on their day-to-day activities. Most respondents confirmed that the implementation of the tax has been more of a bane than a benefit to them as individuals and the economy as a whole.

Even though the implementation of this tax is still in its early stages, this research concluded that even though the electronic levy can be a great avenue to increase revenue, its implementation was not properly planned and executed as it was implemented at the wrong time where the economy is already in shambles with inflation rates soaring over the roofs. The government should therefore revise their plan for implementation and re-strategize and inculcate the views of the citizens so that they can feel part of the process. This can bring harmony between the government and the citizens who are the taxpayers.

Keywords: E-Levy, Financial Transaction, Revenue, Mobile Money, Cash System, Africa

JEL Classification: H23, G28, O33, E62, O55

1 Introduction

Mobile money, which is a mobile payment system, was first launched in 2001 in the Philippines and Kenya in 2007 by Safaricom which was called M-PESA (Porteous, D., 2006; Jack, W., & Suri, T., 2011; Donovan, K., 2012). Allen et al, (2014) explained that mobile money operates on accounts owned by mobile service providers and used by the subscribers of these mobile networks. It is a sort of financial banking system in which transactions are mainly made via mobile phones. Aker and Mbiti (2010) described that the mobile money service is a different concept compared to the regular mobile banking system implemented by banks where their clients can access and perform bank-related transactions on their mobile phones. This system permits subscribers or customers to perform financial transactions through their mobile service providers without necessarily having a bank account. The process of converting monies received electronically through the mobile money interphase into cash is usually done through retail agents who are widely spread across making it easily accessible. The transactions also take place in real time using SMS as a verification medium. This makes it so easy and convenient as compared to the banking system. Currently, approximately 40 African countries use the mobile money system as a medium of financial transactions.

Ghana is one of the consumer countries of the mobile money service and has seen a great improvement in the finances of its economy since the adoption of this service in the year 2009. Before the introduction of the E-levy, taxes were not imposed on mobile money transactions. Hence, making it the cheapest way for transferring money and conducting business (Mensah, K., & Tetteh, E., 2023; Osei-Assibey, E., 2022; Owusu, A., 2023). On 29th March 2022, Ghana's

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legislative arm of government (parliament) passed an Electronic Levy (E-Levy) bill to tax mobile money transactions aside from the service fees charged by the service providers.

Amankwah (2022) writes that the introduction of the E-Levy in 2022 imposes a 1.5% tax on all financial transactions and has raised concerns regarding the possible burden on low-income users and the overall impact on mobile money adoption and usage. The niched discussion of E-levy's intention and possible benefits lacks any critical analysis that will determine the pecuniary effects on mobile money users and, at large, Ghana's economy.

Indeed, most literature reviews focus on the place of mobile money in enhancing financial inclusion. However, few scholars have conducted studies on how E-levy has influenced the attitudes of mobile money users in terms of frequency and value of transactions and alternative means of making those payments. This paper looks at the implication of the application of this levy on mobile money transactions and general financial stability in Ghana.

2 Methods

This framework shows the structure in which scientific research is carried out. It aids in controlling factors that could interfere with the validity of the findings. Research Design helps the researcher plan and implement the study in a way that would help the researcher obtain the intended results. This increases the chance of obtaining information that could be associated with the real situation. The two major patterns that are followed when conducting research are positivism, where the research is conducted based on objectivity and deductive logic, and interpretivism, where the 'human factor' is the main focus of the research (Collis and Hussey, 2014; Jennings G. R., 2005). Positivism is free from social assumptions where bias and sentiments are set aside but rather focuses on obtaining information through empirical facts. For this research, the interpretivism paradigm is used as its focus is on social actors (humans) and how they react to and interpret various circumstances (Saunders, Lewis, & Thornhill, 2009; Creswell, J. W., & Poth, C. N., 2021).

As the interpretivism paradigm is opted for, the suitable research approach is the qualitative method which involves using for instance questionnaires or unstructured interviews to conduct the research. This method best helps in investigating Ghanaians' views on the implementation of the E-Levy and the effect it might have on mobile money transactions.

Determining the population is essential for the research as it provides the frame within which the sample is drawn. This study focused on mobile money subscribers and users in Ghana. According to Bank of Ghana reports on research conducted in 2021, there were over 40 mil documented mobile money accounts and 17.5 million active accounts, and this represents our population for this research. As this research is a short-life exercise and the time in which to probe details is however limited, only a fraction of the population was dealt with. This is termed sampling.

Sample size refers to a proportion of the population selected for the investigation instead of dealing with all units of the population. For this research, purposive sampling was adopted to obtain the necessary information needed to conduct a meaningful analysis. With purposive sampling, the researcher uses his or her discretion in the selection of a sample (Greener and Martelli, 2015; Mohajan, H.K., 2018). As the size of the population for this research is so great, purposive sampling is most suitable as it allows very small samples whilst conducting qualitative research.

Respondents were selected based on the following criteria: (1) active mobile money users, (2) individuals with a history of frequent transactions via mobile money platforms, and (3) representation across different socio-economic backgrounds. This method made it possible for a sample that is reasonably heterogeneous and representative of the population that is directly impacted by the E-Levy.

As a result, instructions were detailed and a notice was restated asking respondents to provide the forwarding questionnaire only to those within the selection criteria to avoid interference and distortion on the sampling methods due to the questionnaire format. Furthermore, the responses were controlled to ensure that there were no considerably significant changes of a certain demographic representation which would undermine the effectiveness of the purposive sampling approach.

For this research, a sample size of 500 people was considered for this evaluation. This sample size was a result of time and resource constraints but vividly outlines the objective that this paper seeks to achieve.

Concerning this research, data was gathered from primary and secondary sources. Under primary data sources, a questionnaire was the main tool used to acquire the majority of the information. Secondary data collections on the financial implications of the implementation of E-Levy on mobile money in Ghana were extracted from selected reports and journals on the internet of how E-Levy impositions on mobile money in some countries in the Sub-Saharan Region

have impacted their economies. Further information was also sought from books to throw more light on the literature on the issue at hand.

The instrument used in acquiring data for the research was a questionnaire created on Google Form which was distributed via electronic means mainly through WhatsApp. This research instrument was the most suitable for data collection as a result of the number and varying location of the sample size. According to Saunders, Lewis, and Thornhill (2009), questionnaires are suitable instruments for qualitative research. The questionnaire comprised of closed-ended questions with a range of answers to select from and this was presented to mobile money users to obtain their sentiments and actions pre and post-E-Levy implementation. The components in the literature review served as a guideline in composing the questionnaire.

Recipients of the questionnaire were encouraged to share or forward it to other mobile money users. This was to ensure that the questionnaire reached different sects of people in different geographical areas in the country but the downside to it is that it doesn't guarantee an even distribution across the regions. It took twenty-one days to gather the responses to the questionnaire. In all, a total number of 576 responses were received on the twenty-first day of sending out the questionnaire which ended up exceeding the estimated sample size.

As stated above, the data was collected utilizing sending a ten close-ended question form via WhatsApp to participants and this was done with the aid of Google Forms. The responses derived from the Google Form were imported into an Excel sheet to vividly analyze the results. The data was arranged into categories and analyzed using mainly the narrative approach. Some quantitative tools such as percentages were however used in the analysis to provide clarity. Findings made were also illustrated by the use of tables and charts.

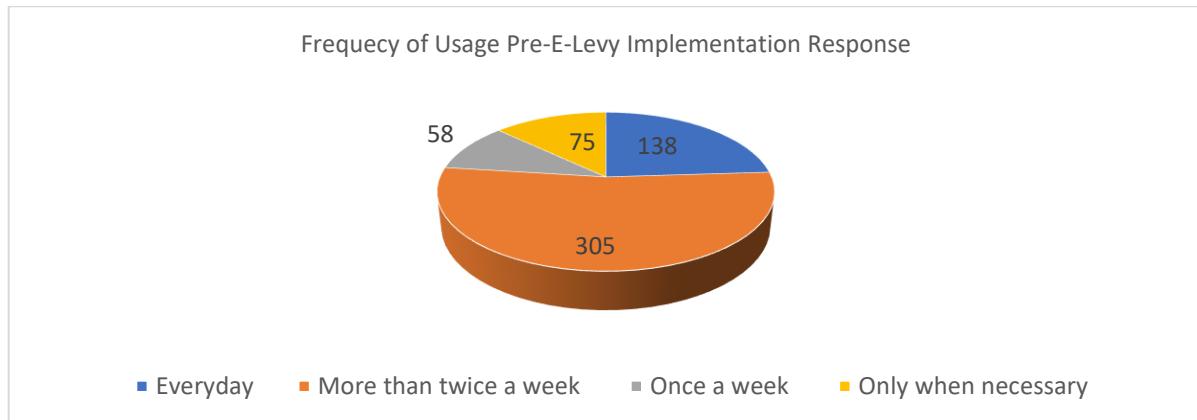
3 Research Results

This aspect of the research gives a rich explanation of the primary data collected. It examines the responses to the questionnaires submitted by mobile money users for their feedback or input and the results of the research. Thence, conclusions from the study have been well extrapolated.

3.1 Summary of Analysis

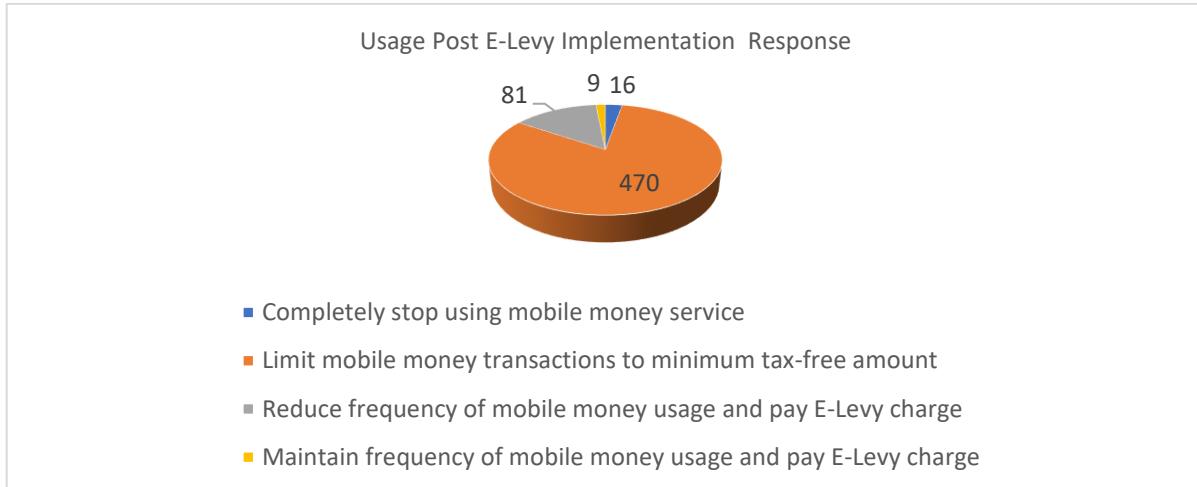
The chart below depicts the responses from the 576 respondents, thus Pre-E-levy implementation and Post-E-levy implementation responses.

Figure 1



Source: Own processing

Figure 2



Source: Own processing

3.1.1 Revenue Generation whilst Protecting the Vulnerable

This study has shed some light on how the imposition of this may help to get more revenue to alleviate certain burdens faced by the country today. As the 2022 budget presentation disclosed that the country is finding it difficult to access external funding due to its increasing debt, the objective of the government to increase revenue can in some way help project a reduction in deficit which can be a signal of lower fiscal risk (Klutse, 2022). Even though there are concerns about the levy hindering financial inclusion, the government has put in place measures to ensure that low-income earners are not highly affected by this levy. The government's method inculcated to protect the vulnerable was to place a waiver of tax on transactions below one hundred Ghana Cedis in a day. In so doing, the government seeks to kill two birds with one stone: broadening its tax base to mobilize more revenue without resorting especially hurting those least able to afford it.

3.1.2 Return to the cash mode

A key benefit of the mobile money service was in enabling financial inclusion through a mode that enabled even an illiterate poor and unbanked person to undertake basic transactions. The imposition of the E-Levy may in a way rob some of the citizens, especially the poor and those in rural areas the opportunity to enjoy this benefit. As the questionnaire was distributed through WhatsApp and therefore makes it difficult to trace the geographical jurisdiction of all the respondents, it is difficult to tell if some respondents may be living in rural areas. However, as some respondents stated they are unemployed, it can be assumed they receive remittances in other to survive. Those in rural areas and most unemployed who usually receive remittances through the mobile money service are mainly affected. They have to go back to receiving funds through other people or transport drivers which increases the risk of receiving their funds all in the name of trying to dodge paying the imposed levy. Some people have reverted to the cash system which has its downsides. This may increase the possibility of crimes as carrying cash around attracts thieves which puts people at risk. Reverting to the cash system leads the unbanked poor into financial exclusion which hinders savings and the ability to obtain credit. They will return to the system of saving their funds under their mattresses or investing them in jewelry, livestock, etc. which does not always appreciate in value. Also, reverting to the cash system leaves no trail or evidence of financial transactions which makes it nearly impossible to evaluate one's credit score or rating. In this sense, it is evident that the less privileged are one of those groups who are affected by this imposition which widens the gap between the rich and the poor in society.

3.1.3 Effect on Businesses and Cost of Living

All members contacted for the research confirmed that the implementation of the E-levy has had a negative effect on business transactions and this in the long run impedes the development of the financial system in Ghana. It was deduced from the research conducted that the majority of people performed financial transactions through the mobile money service regularly before the imposition of the tax. This drastically reduced after the imposition which implies that people who rely on the service for regular purchases, as well as payment for some services, have declined.

The implementation of the E-levy has also acted as a factor in the increasing cost of living that people are facing in the country. Although other factors such as COVID as well as the Ukraine-Russia war have spiked the cost of living to increase in most economies, the imposition of the E-levy is not making the situation any better for Ghanaians. This is because the wages of most Ghanaians remain the same while their expenses increase assignable to the price of goods and services.

3.1.4 Loss of Jobs for Mobile Money Agents

People who work as mobile money agents usually make their commissions through transactions made. Thus, the higher the value and volume of transactions that they carry out, the higher they earn. Per the evaluation of the research carried out, some people have reduced the frequency of transactions they carry out using the mobile money service to only when they feel there is no better alternative. The majority of people have also taken advantage of the tax-free window by reducing their transaction values to less than one hundred Ghana cedis to avoid payment of tax.

This reduction in transaction value and volumes has gravely affected the jobs of most of these agents. Research by the Bank of Ghana (May 2022) showed that about four thousand active mobile money agents were lost in April as well as a substantial drop in the value of transactions by 2.8 billion Ghana cedis when compared to the previous month. This was a result of lots of people emptying their mobile money accounts due to the panic and the uncertainties they had regarding the rollout of the electronic levy the month after. The loss of the source of livelihood for these over four thousand agents would have a rippling effect on their families in the short run and the economy as a whole in the long run.

3.1.5 Negative Effects on Fintech and E-commerce Industries

As stated earlier the imposition of the electronic levy negatively affects businesses, the most affected industries are FinTech and E-commerce industries. The Executive Director for the E-Commerce Association of Ghana, Paul Asinor explained that the tax has already negatively impacted these industries even though the implementation of the tax is still in its early stages. The E-levy has slowed down the output and continuous development of the E-Commerce sector as most payments are made through the mobile money service or the platforms provided by the FinTech companies. He stated that the major aim of the government to raise revenue would rather backfire as most people will revert to the cash system instead of using these online platforms which would easily enable the government to trace transactions to collect existing taxes.

Evidence on the Ghana Stock Exchange showed that the leading mobile money service provider in Ghana, MTN sustained a drop in its share price by 18.9 percent immediately after the implementation of the tax in May. This drop in share price began immediately after the announcement of the introduction of the electronic tax in November 2021. Following the trend from the announcement till May, they have lost a total of 29 percent in their stock value. The Ghana Stock Exchange Composite Index (GSE-CI) also showed that the entire industry's performance declined as of the third week of May by 8.16 percent.

4 Conclusion

To summarize all the conclusions deduced from conducting this research, it can be said that even though the E-Levy can in a way raise revenue for the government to finance its social spending, this tax was not implemented at the right time and in the right way. Considering the negative effect COVID-19 has had on the economy which many individuals and businesses are yet to recover from, the implementation of a new tax is going to be rebelled against. In May, Ghana recorded the highest level of inflation that the country has experienced in the last eighteen years.

Ghana Statistical Service stated that the 27.6 percent inflation rate has led to an approximate increase in food prices by 30 percent. As if this struggle to keep up their livelihoods is not enough, the government rolls out this tax in the same month when inflation is at its highest. This has caused most Ghanaians to be agitated and unwilling to accept this implementation.

Again, the mid-year budget review made by the government stated that they have reduced their target for the revenue intended to be generated from the E-levy for the year from 4.9 billion Ghana cedis to 611 million Ghana cedis. It has been just three months from the implementation of the tax from May 2022 and the government has already seen the evidence that it is performing woefully, hence the revision of their target. It can be deduced that most Ghanaians have found alternative methods of undertaking financial transactions which is evident in the volumes and values of transactions post the tax implementation.

Furthermore, the reactions of most Ghanaians after the announcement and the implementation of the levy show that, the government did a poor job concerning stakeholder engagement. The government did not make time to communicate properly to the relevant stakeholders in society such as heads of trade unions and other association heads to try and explain the myths and misunderstandings that have been conveyed to the public regarding the levy. It can be deduced that; the panic withdrawals were a result of individuals not being aware of the tax-free exemptions that they could enjoy if they transacted below one hundred Ghana cedis. Also, most Ghanaians feel the current government is inconsiderate of their plights and went ahead to implement the tax despite their pleas and demonstrations. Hence, they will do whatsoever to sabotage the plan to ensure it fails.

It can therefore be concluded that even though the sample is not big and widely spread enough to show a representation of the minds of all Ghanaians, based on the evidence from this research along with occurrences in the country, the tax has created and may further create more problems as juxtaposed to the benefits it turns to bring. Vulnerable groups and the minority in the society, whom the invention of mobile money was intended to help are those who are going to suffer most from the imposition of this tax. It is likely going to force them back into a period of financial exclusion, a situation which was fixed by the introduction of the mobile money service.

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Comparative Case Study on Portfolio Optimization: Modified Continuous Rank Length vs. Stochastic Dominance

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Abstract: This paper conducts a case study comparing the effectiveness of a modified Continuous Rank Length (CRL) metric with the Stochastic Dominance approach in portfolio optimization. The modified CRL method, designed to assess portfolio performance across the entire time interval, provides a holistic evaluation of rank stability, while Stochastic Dominance offers a robust framework for comparing return distributions. The analysis of simulated portfolios demonstrates that SD consistently identifies portfolios with the highest returns and lowest risks, particularly in early periods of the dataset. Conversely, CRL excels at selecting portfolios with enhanced long-term stability but is less efficient due to computational demands and broader stock inclusion. These findings provide actionable insights into the trade-offs between maximizing returns, ensuring stability, and managing computational resources in portfolio selection.

Keywords: Portfolio Performance, GET package, ERL, CRL, Extreme Rank Length, Continuous Rank Length, Financial Management, Financial Analysis, Stochastic Dominance

JEL Classification: G17

1 Introduction

In portfolio evaluation, researchers and practitioners must select the most suitable method for analyzing performance. With the increasing complexity of financial markets, traditional methods of comparison and evaluation often need to be revised to capture the nuances of portfolio behavior, mainly when long-term stability and risk are of interest. This study provides a comprehensive comparison of two portfolio optimization methods, offering practical insights for those interested in maximizing portfolio stability over time.

The two methods analyzed in this study are stochastic dominance (SD) and Continuous Rank Length (CRL). Stochastic dominance is a well-established approach in portfolio optimization, widely used for identifying portfolios with the best risk-return trade-offs. In contrast, the CRL metric, originally designed to detect outliers in functional data, is adapted here to evaluate portfolio stability over time. By comparing these methods, we aim to explore whether CRL's emphasis on consistent performance can serve as a valuable alternative to SD, particularly for investors who prioritize long-term stability over short-term gains.

2 Methods

We utilized a modified version from the GET package developed by Myllymäki & Mrkvíčka (2020) for the CRL metric. Due to our limited expertise in linear programming, we based our analysis on a previous case study by Kozmík (2019), which provided all the necessary SD data for comparison.

Before delving into the comparison, we will first define the metrics and methods used for it. Then, very briefly, let us also introduce stochastic dominance and our assumptions about this comparison.

2.1 Continuous Rank Length

CRL metric (Hahn, 2015; Mrkvíčka et al., 2022) is a method used to assess function behavior while accounting for the spacing between functions. The original formula can be found in Section 2.3.2 of Mrkvíčka et al. (2022). The standard version of this metric focuses on specific points within the interval rather than evaluating the entire interval. With a simple modification, we extended the CRL by summing these individual ranks, transforming it from an infimal metric to an integral one. The formula for this modification looks like this:

$$c_i = \frac{1}{s+1} \sum C_i(r) \quad \text{with} \quad C_i(r) = s+1 - c_i(r)$$

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where c_j is the continuous pointwise rank that is a refinement of R_i . For a better understanding, see Section 2.3.2 in Mrkvička et al., 2022.

Summing the ranks allows the metric to reflect the overall performance across the interval rather than concentrating only on the lowest rank. This provides a more well-rounded view of the function's behavior and makes the metric less sensitive to extreme outliers. A single poor rank, which would heavily influence a minimum-based metric, does not overshadow the overall performance in the sum-based approach. This is especially advantageous when evaluating portfolios, as it rewards those that consistently perform well, giving a more precise representation of long-term stability. This improvement addresses the limitations found in other metrics, such as the Extreme Rank Length, which was overly sensitive to extreme variations.

Return

Suppose we have stock i , where $i = 1, 2, \dots, n$ and we have adjusted closing stock prices in period t , where $t = 1, 2, \dots, m$, as initial values IV_{it} of stock i at the start of period t and final value FV_{it} of stock i at the end of period t . The simple return of one stock in one-period R_{it} is calculated using the following formula. To determine the return of a specific portfolio CR_t for period t , the individual simple returns of stocks within the portfolio must be weighed and summed. Assume we have n stocks and let w_i represent the weight of stock i in the portfolio. The weighted return of the portfolio in a period t can be calculated using the following formula. (Stewart et al., 2019)

$$R_{it} = \frac{FV_{it}}{IV_{it}} - 1 \quad CR_t = \sum_{i=1}^n w_i R_{it}$$

Risk

To assess risk, we calculated the standard deviation (SD) of adjusted returns for each quarter using complete daily data from the respective quarters. This allowed for a more precise and granular volatility measurement by capturing the daily variations in returns. This approach ensures a thorough evaluation of risk for each period. Since our software tools require functions to be either maximized or minimized, we used the inverse of the SD for each quarter. This adjustment was necessary to meet the software requirements and facilitate our analysis.

2.2 Stochastic Dominance

Stochastic dominance is a statistical approach used in finance to compare investments by evaluating their entire return distributions. Unlike methods that focus on single points or average returns, stochastic dominance considers cumulative probabilities, allowing investors to understand potential returns and associated risks. This comprehensive view enables tailored decision-making across varying risk tolerance levels, making it a powerful tool for selecting investments in complex financial landscapes.

First-order stochastic dominance (FSD) applies when one investment is preferred across all levels of wealth, regardless of risk tolerance. Investment A dominates investment B in the first order if, for every possible outcome, A offers an equal or greater return than B . This means that $F_A(x) \leq F_B(x)$ for all x , with strict inequality for at least one x , where F represents the cumulative distribution function (CDF) of returns. FSD is particularly relevant for investors who prioritize higher returns without consideration for risk, and it was formalized in early works by Hadar & Russell (1969) and Hanoch & Levy (1969), who developed foundational rules for ranking uncertain prospects.

Second-order stochastic dominance (SSD) refines the comparison by incorporating risk aversion, making it relevant for investors who value both returns and risk mitigation. Investment A is said to dominate investment B at the second order if: $\int_{-\infty}^x F_A(t)dt \leq \int_{-\infty}^x F_B(t)dt$ for all x , with strict inequality for at least one x . This criterion suggests that A provides the same or higher expected returns while reducing potential downside risk compared to B . SSD is foundational in finance and economic theory, with Rothschild & Stiglitz (1970) formalizing its relationship with risk preferences and Levy (1992) connecting it to expected utility theory, thus broadening its application in portfolio selection and risk management.

Third-order stochastic dominance (TSD) further refines the analysis by incorporating preferences for risk aversion and skewness, making it valuable for investors who prefer higher returns and lower risk and favor positive skewness (upside potential). Investment A dominates B at the third order if $\int_{-\infty}^x \int_{-\infty}^t F_A(u) du dt \leq \int_{-\infty}^x \int_{-\infty}^t F_B(u) du dt$ for all x , with strict inequality for at least one x . This criterion accounts for the asymmetry in returns, aligning with investors' preference for distributions with more significant potential for high returns. TSD was extended in Fishburn (1974) to

address skewness preferences. Whitmore & Findlay (1978) provided a detailed analysis, making TSD an essential tool for capturing the full spectrum of investment preferences under uncertainty.

Reflecting on stochastic dominance, our assumption is that strict inequalities must hold across all points, aligning with the equivalence that one portfolio dominates another if, and only if, for all utility functions (within the relevant set for each dominance type), the utility of one portfolio is greater than or equal to the utility of the other. However, our approach makes it possible to identify portfolios that excel across the broader performance spectrum while not meeting this strict requirement at a single point or under a specific function. This could be particularly impactful in cases with non-standard or unusual distributions. For distributions resembling normality, results may appear similar under both methods; however, portfolios with atypical distributions might yield different insights. This approach could provide results that are as strong, or potentially stronger, than FSD. Still, SSD and TSD may present more nuanced outcomes, possibly offering an empirical or graphical perspective on similar findings.

3 Case study

As previously mentioned, we used the same data set for consistency since we based our comparison on Kozmík's (2019) research. The data comprises stock prices from assets in the Dow Jones Industrial Average (DJIA) index, representing some of the largest and most actively traded companies. The data was collected using the quantmod package (Ryan & Ulrich, 2024), which retrieves financial information from Yahoo Finance. Our data set spans from April 2008 to July 2018, explicitly chosen to include Visa's market entry and avoid issues with missing data. This period also excludes the impact of the COVID-19 pandemic, ensuring that that event does not skew the data. While applying this approach in more volatile conditions, such as during the pandemic, is a future research goal and it is beyond the scope of this study.

Table 1 lists all the stock tickers, basic characteristics, and information. The characteristics were calculated quarterly from the quarterly returns. As noted by Kozmík, Apple stands out with the highest expected returns, but it also exhibits one of the highest standard deviations, indicating a higher level of risk.

Table 1 Basic characteristics calculated from quarterly data

Ticker	Name	Mean	Min	Max	SD	Median
APPL	Apple	6,36	-34,93	45,79	0,15	8,27
V	Visa	5,77	-24,48	31,98	0,11	4,64
HD	Home Depot	5,76	-19,92	34,12	0,10	6,63
UNH	United Health	5,58	-27,59	26,53	0,12	5,33
BA	Boeing	5,15	-24,07	30,13	0,14	4,79
NKE	Nike	4,85	-22,54	24,61	0,12	7,21
DD	DuPont	4,57	-51,39	84,95	0,24	4,25
MSFT	Microsoft	4,07	-26,09	25,21	0,12	5,76
CAT	Caterpillar	3,54	-39,75	56,60	0,18	5,98
DIS	The Walt Disney Company	3,53	-24,93	31,48	0,13	5,11
INTC	Intel	3,51	-20,15	19,91	0,11	1,95
TRV	The Travelers Companies	3,46	-16,86	27,38	0,09	4,63
AXP	American Express	3,35	-47,51	62,16	0,18	3,21
MMM	3M	3,31	-25,24	22,39	0,10	2,67
MCD	McDonald's	3,29	-13,60	20,54	0,07	3,23
JPM	JPMorgan Chase & Co	3,22	-35,98	37,27	0,16	4,64
JNJ	Johnson & Johnson	2,46	-12,55	16,01	0,07	2,26
PFE	Pfizer	2,35	-23,85	26,13	0,10	2,82
RTX	United Technologies Corp.	2,33	-21,42	19,28	0,10	4,31
MRK	Merck & Co	2,22	-16,82	20,85	0,09	1,98
CSCO	Cisco Systems	2,13	-25,74	25,21	0,11	2,75
VZ	Verizon Communications	2,11	-11,54	25,77	0,09	2,35
CVX	Chevron	2,08	-16,88	21,23	0,11	-0,26
WBA	Walgreens Boots Alliance	2,06	-29,00	29,72	0,14	0,98
WMT	Walmart	1,93	-12,87	26,54	0,08	2,05
KO	The Coca-Cola Company	1,74	-15,70	17,86	0,07	1,61
GS	Goldman Sachs Groups Inc	1,51	-37,07	49,12	0,17	1,26
IBM	IBM	1,18	-23,15	14,62	0,08	2,17
PG	Procter & Gamble	1,04	-24,49	14,34	0,08	1,51
XOM	Exxon Mobile	0,73	-16,16	19,84	0,09	0,28

Source: Own processing

Table 2 outlines the weight allocations for stocks under FSD, SSD, and TSD criteria, with corresponding returns and risks detailed in Table 5. The FSD portfolio assigns significant weight to high-return stocks, such as AAPL and HD, to maximize overall returns. In contrast, the more restrictive SSD portfolio concentrates on fewer assets, placing greater emphasis on the most profitable stocks, which leads to a slightly higher expected return. The TSD portfolio, while similar to SSD, does not increase the weights on top-performing stocks further. As a result, the expected return for TSD is slightly lower, indicating that relaxing the constraint with TSD did not yield better returns (see Table 5).

Table 2 Weights of portfolios selected by stochastic dominance

	AAPL	CAT	DIS	HD	JPM	MCD	TRV	UNH	V
■ FSD	0,441	0,001	0,015	0,321	0,029	0,037	0,030	0,002	0,124
■ SSD	0,528	0	0	0,472	0	0	0	0	0
■ TSD	0,510	0	0	0,49	0	0	0	0	0

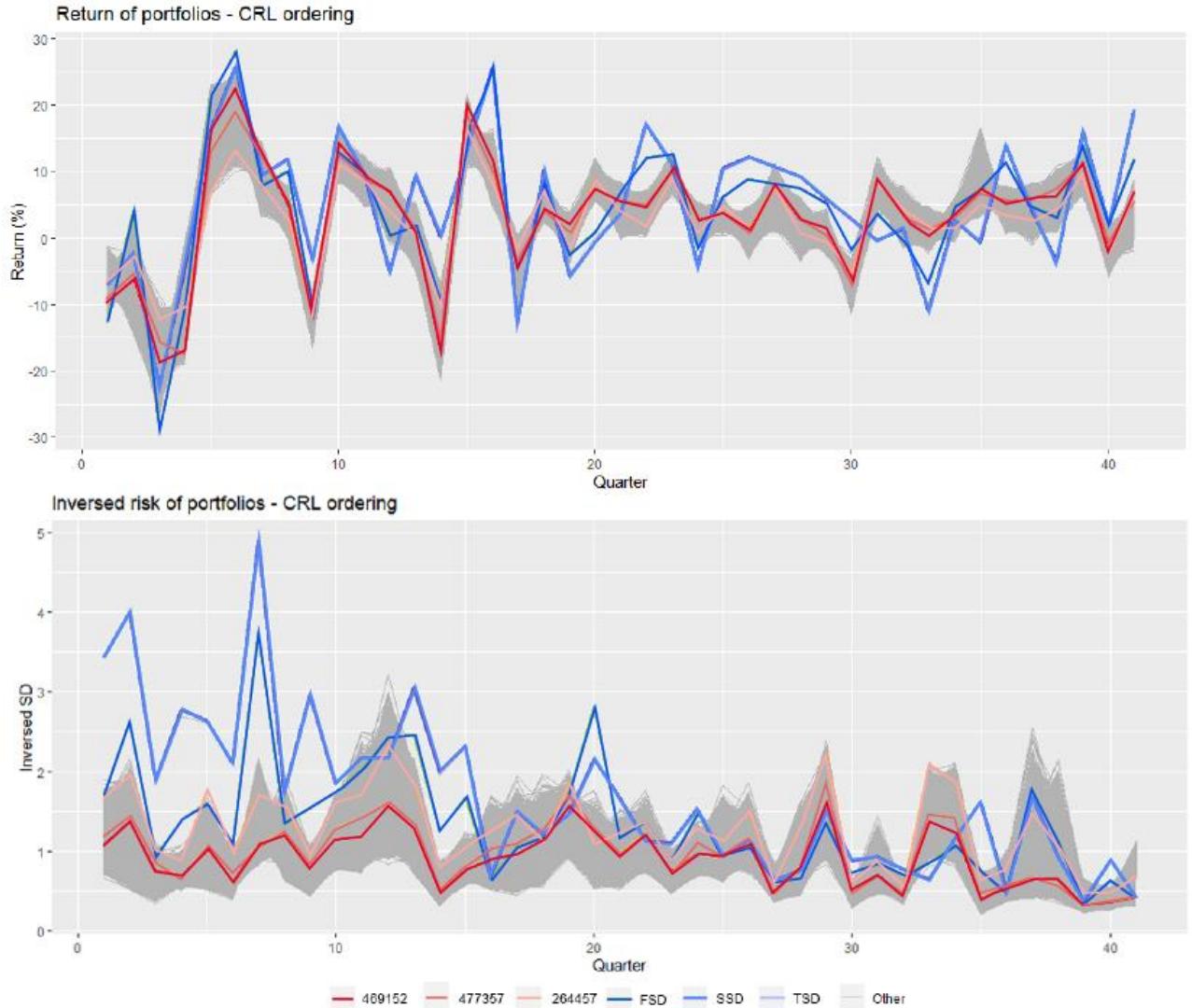
Source: Kozmík, 2019

One of the main advantages of the CRL metric is its ability to provide clear visualization. This allows us to plot all the functions selected by stochastic dominance and those identified as the best by our method within a single graph. This visual representation offers an intuitive comparison between the two approaches and highlights their respective selections.

Figure 1 presents our initial simulation of 500,000 portfolios, analyzed using the CRL metric. Although the number of simulated portfolios might seem relatively low given the 30 stocks involved, the results still offer valuable insights. In specific periods, such as quarters 32 to 35, our portfolios demonstrate notably higher returns and exhibit risk levels

comparable to those selected by stochastic dominance. However, in the earlier quarters, the portfolios chosen by SD outperform ours, particularly in terms of risk management.

Figure 1 First comparison of CRL and SD



Source: own processing

Table 3 displays the weight allocations for portfolios selected by the CRL method. Instead of including portfolio IDs, we used color labeling for clearer visualization. This table highlights a vital disadvantage of the CRL approach: the lack of constraints during simulation. As a result, every stock from the dataset is included, which may yield less efficient and optimal portfolios compared to the more selective nature of SD.

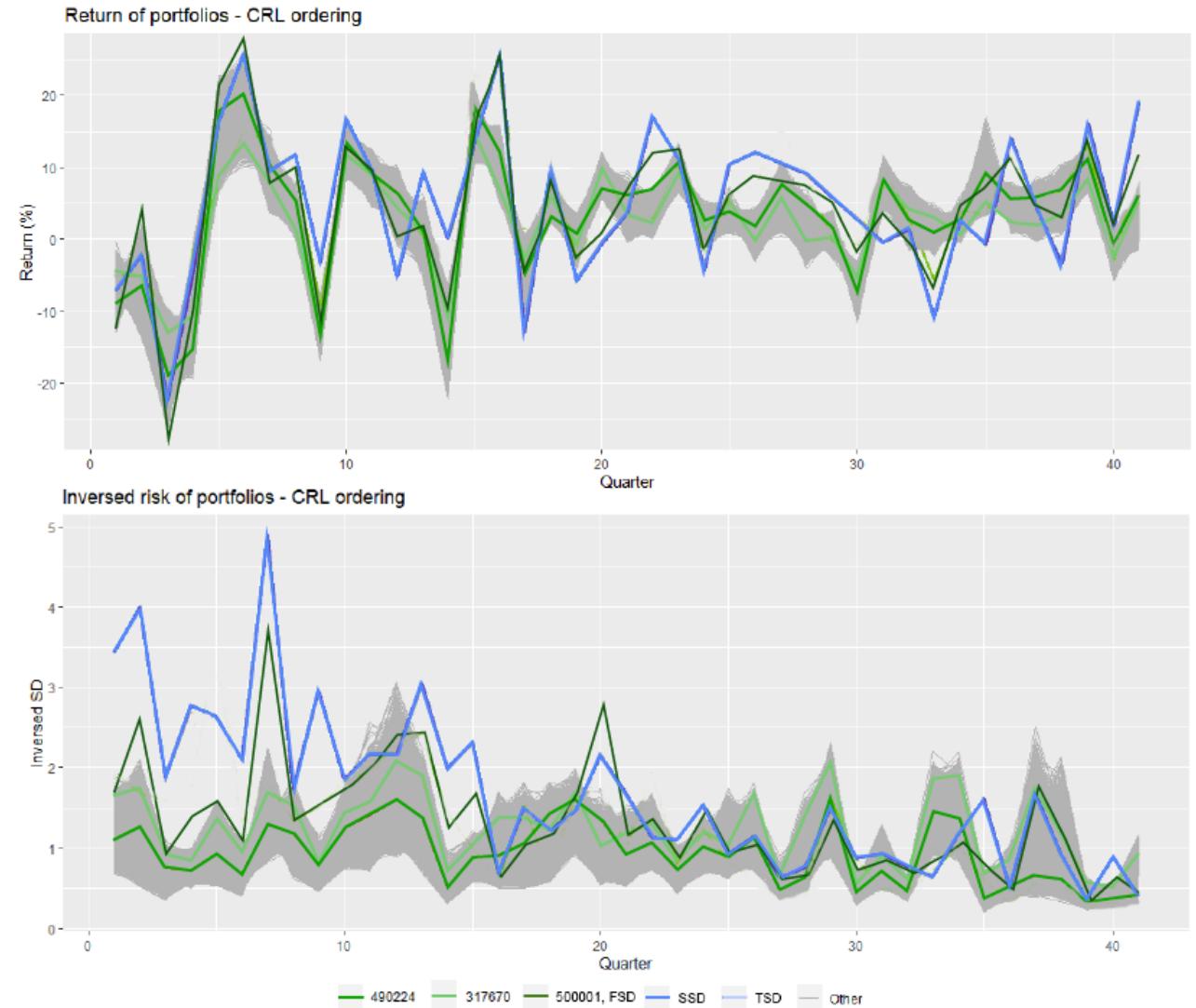
Table 3 Weights of three best portfolios by utilizing CRL metric (first simulation)

	AAPL	V	UNH	HD	NKE	BA	DD	MSFT	DIS	JPM	AXP	CAT	MCD	MMM	INTC
■	0,029	0,025	0,037	0,002	0,025	0,007	0,019	0,021	0,003	0,022	0,029	0,022	0,034	0,008	0,085
■	0,057	0,049	0,058	0,03	0,03	0,049	0,041	0,057	0,041	0,012	0,01	0,061	0,008	0,011	0,054
■	0,011	0,064	0,065	0,071	0,061	0,021	0,073	0,04	0,024	0,02	0,043	0,073	0,02	0,006	0,021
	TRV	PFE	WBA	JNJ	MRK	UTX	VZ	CVX	CSCO	GS	KO	WMT	IBM	PG	XOM
■	0,009	0,013	0,079	0,016	0,066	0,016	0,043	0,025	0,061	0,009	0,075	0,081	0,025	0,051	0,061
■	0,047	0,045	0,02	0,015	0,056	0,059	0,027	0,009	0,031	0,001	0,033	0,02	0,002	0,046	0,021
■	0,053	0,069	0,011	0,001	0,057	0,043	0,037	0,005	0,036	0,01	0,029	0,012	0,003	0,019	0,001

Source: own processing

Since a single simulation is insufficient for robust analysis, we conducted additional simulations to provide a more comprehensive comparison. Figure 2 presents another CRL-based simulation. Interestingly, CRL identified the FSD selected portfolio as the third best in this instance. Despite this overlap, the overall behavior of the portfolios selected by CRL compared to those chosen by stochastic dominance remains consistent: SD performs better in the early quarters of the dataset, while CRL-selected portfolios tend to dominate in the later quarters. This difference is largely due to AAPL's exceptional performance in the earlier quarters, which leads SD to prioritize it. In contrast, CRL is currently unable to focus on high-performing stocks like AAPL because our simulations are entirely random and lack a mechanism for targeted selection.

Figure 2 Second comparison of CRL and SD



Source: own processing

Table 4 presents the weight allocations for portfolios selected by the CRL method. The insights remain consistent with our previous observations: CRL's approach includes a wide range of stocks without constraints, which may lead to greater diversification but raises questions about the method's efficiency compared to stochastic dominance.

Table 4 Weights of three best portfolios by utilizing CRL metric (second simulation)

AAPL	V	UNH	HD	NKE	BA	DD	MSFT	DIS	JPM	AXP	CAT	MCD	MMM	INTC
■ 0,019	0,049	0,003	0,008	0,072	0,009	0,002	0,016	0,018	0,032	0,011	0,011	0,005	0,001	0,059
■ 0,086	0,034	0,082	0,021	0,063	0,049	0,086	0,045	0,034	0,026	0	0,033	0,018	0,023	0,079
■ 0,441	0,124	0,002	0,321	0	0	0	0	0,015	0,029	0	0,001	0,037	0	0
TRV	PFE	WBA	JNJ	MRK	UTX	VZ	CVX	CSCO	GS	KO	WMT	IBM	PG	XOM
■ 0,027	0,087	0,051	0,071	0,034	0,019	0,086	0,050	0,053	0,013	0,076	0,001	0,010	0,019	0,078
■ 0,024	0,044	0,025	0,013	0,028	0,057	0,020	0,004	0,003	0,015	0,022	0,035	0,005	0,007	0,019
■ 0,030	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Source: own processing

What is particularly compelling is the comparison of the basic characteristics of the selected portfolios. While stochastic dominance effectively identifies the portfolio with the highest potential value, the CRL method stands out for pinpointing portfolios that demonstrate greater stability over time. This attribute can be particularly valuable for investors prioritizing consistent performance and lower volatility, even if it means forgoing the highest possible returns associated with greater risk. However, it's worth noting that while FSD portfolios offer a similar level of stability, they come with less diversification. This raises the question of whether CRL's significantly higher computation time, which takes nearly a full day compared to less than a minute for SD, is justified for investors seeking a balance between strength and a well-diversified portfolio.

Table 5 Basic characteristics of all selected portfolios

ID	Mean (return)	Min (return)	Max (return)	Mean (risk inversed)
■ ■ FSD, 500001	5,17	-10	22,9	1,29
■ ■ SSD	5,01	-22,40	25,8	0,86
■ ■ TSD	5	-22,40	25,7	0,86
■ ■ 490224	3,4	-19,10	20,27	1,31
■ ■ 469152	3,38	-18,75	22,65	1,32
■ ■ 477357	3,29	-17,48	19,24	1,25
■ ■ 317670	2,34	-13	14,9	0,94
■ ■ 264457	2,34	-14,43	14,43	0,95

Source: own processing

4 Conclusions

This study provides a comparison of the Continuous Rank Length (CRL) method and stochastic dominance (SD) in portfolio selection, highlighting their strengths and limitations. This case study did not validate our initial assumption that CRL might outperform SD due to SD's strict inequality constraints. While CRL can generate a wide variety of portfolios with similar distribution characteristics, we found it challenging to simulate better-performing portfolios.

Despite its computational intensity, the CRL method excels at identifying portfolios that exhibit consistent performance and stability over time. This feature can be particularly valuable to investors prioritizing lower volatility and consistent returns over pursuing the highest possible gains, which often come with higher risk. However, CRL's lack of constraints leads to the inclusion of all stocks in the dataset, raising concerns about efficiency compared to the more selective and computationally efficient SD approach. Stochastic dominance, meanwhile, remains effective at pinpointing optimal portfolios in terms of expected returns, especially early in the dataset, and maintains a clear focus on overall return distribution and risk.

Despite CRL's potential, the substantial computational demands present a significant drawback. While SD calculations take less than a minute, CRL simulations for 500,000 portfolios require nearly a full day. This inefficiency suggests several promising avenues for future research. For instance, optimizing CRL's simulation methods should be a priority. One improvement could involve prioritizing stocks with higher mean returns to streamline the process. Additionally,

incorporating time-weighted adjustments to the metrics could provide a more dynamic reflection of current market conditions, making CRL more adaptable and efficient.

Another intriguing area for exploration is the selection and combination of preferred stocks within CRL-generated portfolios. By strategically combining these preferred stocks with others, we might construct high-performing portfolios that leverage CRL's strengths while addressing its limitations. Further research should also investigate how CRL and SD perform under varying market scenarios, such as economic downturns or periods of high volatility, to evaluate each method's robustness and adaptability.

Ultimately, this research underscores the trade-offs between stability, risk, diversification, and computational efficiency in portfolio selection methods. While SD remains unbeaten in identifying high-value, low-risk portfolios, CRL's focus on stability presents a compelling alternative for risk-averse investors—provided that future developments can mitigate their computational demands.

Acknowledgment

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ViDA as a Future Approach to VAT

Kateřina Hlavatá¹

Abstract: Digitalization currently affects several aspects of fiscal policy, and financial administration must figure out how to deal with modern and progressive strategies to ensure their effectiveness in collecting tax revenues. The paper deals with the progress of digitalization in the context of value added tax (VAT). For EU Member States, the revenues from VAT influence the prosperity of their economy since it represents a significant part of their tax mix. A few years ago, the European Commission started discussing the modernization of VAT's approach in the context of digitalization. This resulted in the proposal of a new directive called ViDA (VAT in the Digital Age). The approach focuses mainly on e-invoicing, making reporting transactions easier and quicker. Furthermore, the proposal of the ViDA Directive represents a single VAT registration and regulation of digital platforms. The aim of the article is to introduce the reader to the ViDA Directive and highlight that each EU Member State needs to start preparing for the new EU legislation.

Keywords: digitalization, ViDA, e-invoicing

JEL Classification: H20, H21

1 Introduction

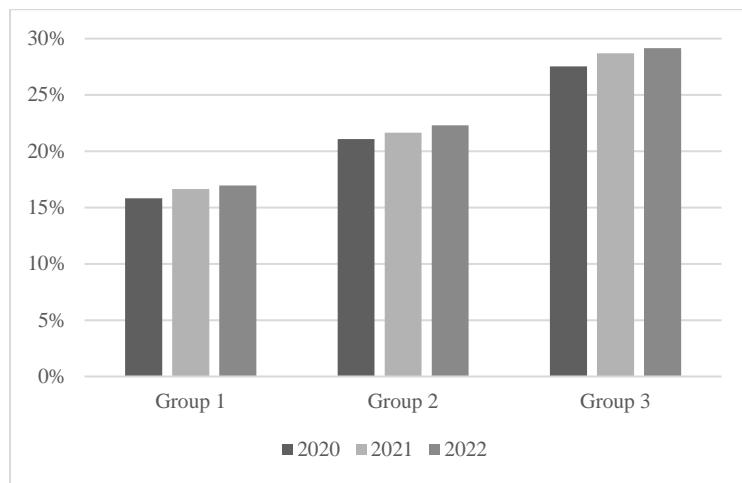
One of the key taxes, fundamental to the European Union's functioning, is value added tax (VAT). VAT sophistication, harmonization, and coordination within the EU are unmatched by any other taxes. For several states (such as the Czech Republic, Poland, and Hungary), VAT represents one of the most significant tax revenues for the national budget (OECD, 2020). The correct determination of VAT and following tax levy to state and VAT compliance is crucial for planning national calculation.

The following graph represents the proportion of VAT on tax mix in the EU Member States from 2020 to 2022. Since there are currently 27 EU Member States, the graph is divided into three groups² for better illustration. Each column represents the group's average of VAT on tax revenues. VAT increases its significance every year, which is in line with research saying that states should focus more on indirect taxes than direct taxes to support economic growth (Johansson et al., 2008; Arnold et al., 2011).

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² In the first group, the following countries are included: Austria, Belgium, France, Germany, Ireland, Italy, Luxembourg, and the Netherlands. The second group consists of: Czechia, Denmark, Finland, Greece, Malta, Poland, Portugal, Romania, Slovakia, Slovenia, and Sweden. The third group comprises: Bulgaria, Croatia, Cyprus, Estonia, Hungary, Latvia, and Lithuania.

Graph 1 The proportion of VAT on tax mix (the list of countries in each group is stated in the footer)



Source Eurostat (2023)

VAT is susceptible to tax evasion. One of the most prominent forms of VAT fraud is the so-called carousel fraud, a scheme in which goods are traded across multiple borders within the EU, allowing fraudsters to repeatedly claim VAT refunds on the same transaction without remitting the tax (Keen & Smith, 2007; Sergiour, 2012; Sato, 2015).

The determination and calculation of tax evasion is generally quite complex, with several methods available. Regarding VAT, the most commonly established way to express tax evasion is the so-called VAT Gap, which the European Commission regularly publishes. The VAT Gap represents the difference between the theoretical duty pay VAT and the actually collected VAT. According to the last VAT Gap Report, the EU Member States lost approximately EUR 61 billion in VAT revenue for 2021. Compared to 2020, the VAT Gap decreased by EUR 38 billion, mainly attributed to more effective measures in the fight against tax evasion, digitization of tax systems, and e-invoicing (European Commission, 2023).

To eliminate VAT evasion, the European Commission (2024) focuses on three initiatives:

- Improved administrative cooperation (using modern technology such as Eurofics, which helps share information between national tax authorities);
- Centralization of payment information on online sales (working on creating a centralized system for collection of payment data from online sales, which will lead to following cross-border transactions between EU and identify mismatches);
- EU Directive VAT in the Digital Age (ViDA), which is described in the text below.

2 Methods

Digitalization has its own place in the modern world and represents an indispensable part of the public and private sectors. The aim of the article is to present the vision and future of VAT that lies in the ViDA Directive, which is built on the principles of digitalization. The article introduces the reader to the overview of the topic of the ViDA Directive and formulates the ideas and goals.

To achieve the set goal, the descriptive method is applied based on the literature review of the question of digitalization, primary source data, and national and EU legislation. The auxiliary methods are methods of analysis, comparison, and generalization.

3 Digitalization

Generally, the digitalization trend is significantly growing in several aspects of people's lives. The public sector and financial administration are aware that they cannot fight with progress and must adapt their procedures and systems.

Digitalization positively contributes to the tax system, which is fairer, more sustainable, and has higher productivity and transparency (Baldwin, 2016; Barbone et al., 2012). Financial administration processes data more effectively, which leads to a better overview of the economic activities of tax subjects (Kitsios et al., 2020; Heinemann & Stiller, 2023).

Digitalization lowers administrative costs for tax subjects and aims to improve communication between tax subjects and authorities. It is also seen as a helpful instrument that helps to eliminate tax evasion (Slemrod & Gillitzer, 2013; Holá et al., 2022; Zídková et al., 2024).

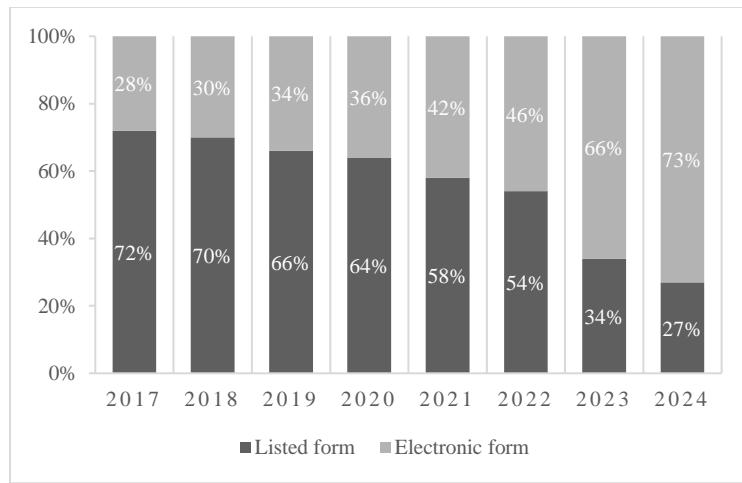
According to Keen & Smith (2007), the digitalization of tax administration represents not only a challenge from the technology aspect but also changes the whole approach to tax subjects. Digitalization brings up questions of how to stand up to data protection. They suggest that the tax administration invests in cyber security and adequately train its employees.

There are several indicators that determine the level of digitalization; the most common are the following:

- E-Government Development Index (EGDI) published by the United Nations, which focused on online services, telecommunication infrastructure, and human capital (UN, 2022);
- The Digital Economy and Society Index (DESI) published by the EU which focuses on using digital services and the integration of technology (European Commission, 2021);
- The Future Orientation Index (FOI) published by the World Economic Forum shows how states can respond to long-term challenges such as technological progress (WEF, 2020).

Alternatively, the proportion of electronic tax returns can be examined. The Czech Financial Administration published its statistics from 2017 up to 2024.³ Besides the digitalization and improvements of Czech tax portals, the decrease in paper tax returns is related to amendments in tax laws, such as extending the deadline when submitting tax returns of income taxes electronically. In 2024, more than 70% of tax returns are expected to be filed electronically.

Graph 2 The proportion of electronic tax returns in the Czech Republic



Source Czech Financial Administration (2024)

4 Directive ViDA

Besides reducing the VAT Gap, the ViDA Directive should respond to the development of digitalization and lead to a more efficient VAT system. The main areas are e-invoicing, single VAT registration, and platform economy.

From the legal perspective, the European Commission presented amendments in Directive 2006/112/EC, Regulation (EU) No. 904/2010, and Implementing Regulation (EU) No. 282/2011 regarding the information requirements applicable to specific VAT schemes.

The new approach promises:

³ For 2024, the proportion of electronic tax return is an estimate, as of April 2024, the share of electronic filings was 63%.

- Acceleration of the digital transformation;
- Reduction of tax compliance costs (EUR 4,3 million);
- Increased efficiency of tax control;
- Increased tax collection (EUR 135–177 billion);
- Improved cross-border trade;
- Reduction of tax evasions, etc. (Edicom Group, 2021)

E-invoicing

The EU would like to implement standardized digital reporting and e-invoicing for transactions between the EU Member States (intra-EU transactions). E-invoices will be obliged to be issued in line with the European Standard EN 16931 currently used for B2G transactions.

Whether the recipient agrees with e-invoicing or not will be irrelevant. This will also eliminate the possibility of issuing summary invoices. The e-invoicing process should lead to real-time digital reporting for cross-border B2B transactions. The EU Member States will have information from cross-border trades, which will help them fight VAT fraud in time. According to the European Commission (2023), this will help reduce VAT fraud by up to EUR 11 billion yearly.

In the end, e-invoicing is beneficial from the efficiency perspective (Bellon et al., 2022), reduce administrative errors (Poel et al., 2016), reduce costs (Fairchild, 2004) and lower CO₂ emissions (Koch, 2019; Hagsten & Falk, 2020).

Single VAT registration

Nowadays, taxpayers are obligated to register in multiple EU Member States in which they perform taxable supplies and are liable to pay VAT. It relates to monitoring national legislation, fulfilling national obligations as submitting regular VAT Reports, often hiring tax and law specialists and other administrative and non-administrative burdens associated with additional costs. Costs related to VAT registration were approximately EUR 1,200 per EU Member State, followed by EUR 8,000 annually for VAT compliance in each EU Member State from an average business perspective (EUR 2,400 for Small and Medium-sized Enterprises) (Madeleine et al., 2023).

Since 2015, simplification mechanism called One Stop Shop (OSS) has existed. Currently, OSS primarily applies to remote B2C sales and digital services. Via OSS, the taxpayers register only in one EU Member State. Following that, the taxpayers fill only one VAT Return (so-called single VAT Return) for each quartal, which declares all cross-border transactions to final customers in the EU. The ViDA initiative plans to use this approach more widely. Specifically, the OSS should apply also to:

- Transfers of own goods between the EU Members States;
- B2C sales of goods with installation or assembly; sales of goods on board ships, aircraft, or trains; and sales of gas, electricity, heating, and cooling by taxpayers not established in the EU Member State of consumption.
- Domestic B2C sales of goods by taxpayers not established in the EU Member State of consumption.
- Certain zero-rated transactions (e.g., sales of goods and services, among other things under diplomatic). (KPMG, 2024)

Platform economy

The platform economy is a quickly developed area of online platforms (such as Airbnb, eBay, and Uber) that mediate services and producers.

Since the European Commission is aware of the imbalance in the digital platform market due to the non-registration of online platforms, the ViDA Directive represents the "deemed supplier" concept. The intermediaries shall be considered from a VAT perspective as the supplier, even though they do not provide any goods or services but only mediate. This will lead to taxing the mediated services and the intermediary fee. The new concept will ensure equal conditions for traditional providers and online platforms (European Commission, 2023).

The ViDA Directive amends the definition of the short-term lease by considering it as a taxable supply of up to 45 days. Following that, online platforms will be required to upgrade their systems to track and store detailed information on suppliers, transaction flows, and customers. This data shall be archived for ten years. According to EU estimations, the new regulations on platform economy will increase the EU budget by EUR 6,6 billion within the decade (KPMG CR, 2023).

Current situation

In June 2024, the third proposal of the ViDA Directive was discussed. However, the EU Member States still have not reached a unified opinion on that, especially regarding the platform economy (Estonia vetoed the concept of putative provider since it is not in line with the principle of VAT neutrality). Therefore, the fourth version of the ViDA Directive is expected, and regarding the timing, the current expectations are talking about the year 2030⁴.

However, more and more EU Member States have started to or already implement e-invoicing in some way into their national legislation as shows Table 1.

Table 5 E-invoicing

State	E-invoicing
Germany	As of the beginning of 2025, e-invoicing will be mandatory for national B2B transactions, meaning that businesses must be prepared to receive e-invoices. However, certain companies (total turnover of up to EUR 800,000) will be allowed to issue invoices on paper with the recipient's consent until January 2027.
Italy	From 2019, business entities must use the national system (Sistema di Interscambio) for sending and receiving invoices.
Poland	Poland started a system for issuing and receiving electronic invoices in January 2022 (so called KSef). The mandatory obligation for businesses with sales exceeding PLN 200 million is currently postponed to February 2026 and for the rest to April 2026.
Romania	As of the beginning of 2025, Romania extends the mandatory e-invoicing obligations to resident entities for B2C supplies.
Slovenia	A proposal for a new Act on exchanging electronic invoices and other electronic documents is currently discussed. The proposal suggests that from 1 June 2026, business entities will be issuing only e-invoices to other entities. Regarding the final customers, the e-invoice might be issued if both parties agree. However, the final customer can request a paper invoice at any time. All e-invoices shall be transmitted to the tax authority within eight days of the issue or receipt of the e-invoice.
Spain	E-invoicing has been obligatory for business entities with an annual turnover exceeding EUR 8 million from July 2024. For the rest of the entities, the mandatory e-invoicing will be effective in 2025.

Source: Germany (2024), AGID (2024), Edicom Group (2024), Global VAT Compliance (2024), RTC Suite (2024), Quaderno (2024)

From the Czech Republic's perspective, businesses are currently not obliged to issue e-invoices. The only area where the e-invoices are used is for public procurement (from 2016, the Czech authorities must be capable of processing e-invoices). The Czech Republic should be inspired by other EU Member States. It should collaborate with technology providers and create a national system for sending and receiving e-invoices. Furthermore, the Czech Republic should slowly implement the obligation of issuing e-invoices, starting with businesses with high turnover. It cannot underestimate a lengthy legislative process; therefore, it should take some steps soon. Lastly, training for employees of the Czech authorities should be considered so the newly established processes are effective.

5 Conclusions

VAT is quite a vulnerable tax in terms of tax evasion. Due to digitalization, tax subjects have discovered new ways to avoid paying taxes. Generally, tax evasion schemes are becoming increasingly complex and, therefore, are challenging to detect. Hence, the EU Member States and their financial administrations need to respond adequately, which means adapting legislative measurements, investing, and updating their systems to handle the volume of data.

⁴ At the time this article is published, the fourth draft of the ViDA Directive has been approved by all EU Member States.

Digitalization of the VAT system is an inevitable step toward a more transparent and effective tax environment in the EU. The step represents the ViDA Directive proposal, which is currently being discussed at the EU level. Even though there are still a few reservations, it is obvious that its implementation will take only a matter of time.

The article summarises topics of the proposal of the ViDA Directive, which promises lower tax evasions via e-invoicing, reporting in real-time, a more straightforward registration process, and higher requirements on digital platforms.

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The ESG Reporting in the Czech Republic

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Abstract: The paper deals with the evaluation of approaches to the ESG reporting used by chosen companies. Apart from companies that report by law or completely voluntarily, some companies are forced to create sustainability reports by their business partners and end customers, who are increasingly interested in this area. The evaluated group of companies also includes representatives of the TOP 10 large companies in the Forbes ESG rating 2023. The objective of the paper is to critically evaluate the approach of a selected group of companies to the creation of sustainability reports.

Keywords: sustainability, ESG, reporting, statements, ESG ratings

JEL Classification: Q56, M41, G30

1 Introduction

The necessity of ensuring a sustainable future for generations to come has emerged as a dominant theme in recent years. Individuals and organisations are increasingly engaged in reflection on a range of interconnected issues, including climate change, water scarcity, waste accumulation in nature, anti-corruption, transparent reporting, and more. It is thus imperative that all countries, from individuals to corporations, engage in efforts to address this global issue.

The concept of corporate social responsibility (CSR) has historically been associated with charitable giving and marketing strategies. However, there has been a notable shift in the way businesses approach CSR, with an increasing number of companies integrating it into their everyday operations and business strategies. Those who utilise accounting information, such as investors, banking institutions, suppliers, customers, end customers, employees, the public, and so forth, require relevant data concerning the company's performance in the domain of sustainability. The data presented in financial statements is no longer adequate to produce an ESG report, as companies now report relevant non-financial (qualitative) information, the quantification of which is often difficult. Corporate governance including environmental and social aspects is an approach to evaluate the overall performance of a company, beyond the financial point of view. The ESG criteria consist of activities and standards in three areas: 1) environmental (E) – a company's approach to reducing the negative impact of its activities on nature and the environment; 2) social (S) – the company's responsible approach to society, the community and individual stakeholders; 3) governance (G) – a way of responsible and transparent management of the company. As posited by Březinová (2023), users of ESG information are not content with merely descriptive non-financial information; rather, they are increasingly inclined to prioritize related financial data.

The EU Corporate Sustainability Reporting Directive 2022/2464 of 14 December 2022 (CSRD) introduces a requirement to publish sustainability reports alongside the financial statements in the annual report to standardise the format of non-financial reporting and elevate non-financial reporting to the level of financial reporting (CSRD, 2022).

The sustainability report, originally conceived as a report on non-financial information, constitutes a discrete component of the annual report, as delineated in Act No. 563/1991 Coll., on Accounting. The objective of the sustainability report is to present the information necessary for an understanding of the impact of a given entity's activities with respect to sustainability, and to demonstrate the impact of sustainability upon the entity's development, activities and position. In the context of accounting, the term "sustainability" is defined in accordance with the following criteria: 1) environmental; 2) social; 3) human rights and compliance; 4) governance; 5) employment; and 6) anti-corruption and anti-bribery. The amendment to Act No. 563/1991 Coll., on Accounting, which was adopted as part of the so-called consolidation package, introduces a new obligation for certain entities to prepare and make available a sustainability report from 1 January 2024. Because of its phased implementation, this obligation is currently applicable only to designated accounting units (see Section 32f of Act No. 563/1991 Coll., on Accounting).

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As posited by Jirková Bočáková & Vyskočilová (2024), the greater the integration of sustainability reports into the decision-making processes of companies and investors, the more crucial the credibility of the information becomes. In contrast to financial statements, sustainability reports are characterised by a number of distinctive features, the most notable of which are as follows: 1) quantitative information disclosed cannot be derived from the companies' accounting systems; 2) sustainability reports often contain forward-looking information that is subject to a greater degree of uncertainty; 3) a significant quantity of quantitative data may not be disclosed in monetary units or even in the same unit of measurement; 4) sustainability reports are designed with a general public in mind, as well as a less uniform cohort of users with disparate expectations and information requirements; 5) the significance of qualitative and quantitative information in relation to one another.

ESG reporting offers a comprehensive overview of a company's activities and their impact on society and the environment. The CSRD introduces a requirement for a more profound understanding of a company's value chain (supply and demand chain). In accordance with the requirements of greater transparency, companies are now obliged to disclose information pertaining to their value chain to a significantly broader extent than was previously necessary. Prokešová (2024) posits, the primary impacts, risks, and opportunities of a reporting company are frequently situated within its value chain. If companies only focused on their own business area, this would result in a limited and incomplete representation of the contribution of their activities to the impact on society and the environment. Consequently, the incomplete picture would not permit a comprehensive identification of risks and opportunities. It is thus imperative that all relevant actors in the value chain be considered when assessing the impact, risks, and opportunities. Pizzetti et al. (2021) investigated the phenomenon of greenwashing within value chains. The study examined the impact of greenwashing on stakeholder perceptions from both an ethical and a business perspective. It investigated how different forms of greenwashing affect attributions of blame and intentions to invest. The authors investigated the point in the value chain where there is a discrepancy between the "responsible" and the "irresponsible". In this context, the authors provide a detailed analysis of the various forms of greenwashing and investigate the investors' motivations for investing and the company's tendency to deflect responsibility.

In their sustainability reports, companies set forth their adopted environmental stance. In a recent study, Barta et al. (2023) investigated the impact of implementing environmental, social, or economic Sustainable Development Goals (SDGs) on consumer perceptions of corporate reputation and trust. The authors verified that the implementation of the SDGs has a beneficial effect on the organisation, manifested in the form of enhanced user loyalty. The authors posit that compliance with the SDGs should be fully aligned with business objectives. In the absence of genuine commitment to the SDGs, such practices can be regarded as "greenwashing," whereby companies merely present the SDGs and utilize marketing communications to enhance their public image and mislead consumers. As Hayes (2022) notes, a significant challenge for organisations that have undergone a sustainable transformation is determining whether they are engaging in greenwashing. The practice of greenwashing is proving advantageous for companies considering the increasing consumer demand for eco-friendly and sustainable products.

ESG represents a paradigm shift in the way that businesses and investors approach their activities, with a focus on responsible and sustainable practices. As posited by Horková (2024), ESG is exerting an increasingly pivotal influence on the operations of capital markets and investor confidence in sustainable products. There is a growing tendency among investors to incorporate ESG reporting into their sustainable investment strategies. ESG factors have an impact on the financial performance of companies. The relationship between ESG factors and financial performance is elucidated by Kumar et al. (2016), who discovered a positive correlation between ESG company performance and return on equity, with ESG companies exhibiting a 6.12% higher return on equity. As Dorfleitner et al. (2018) observe, the results typically demonstrate positive correlations, although the precise magnitude is contingent on the period under consideration and the specific baseline assessment. The impact on the share prices of ESG companies is most discernible in the medium to long term.

Sustainability ratings are provided by ESG rating agencies. ESG rating is a way of assessing the long-term environmental, social and governance risks that companies face. These risks are often forgotten in financial analysis, which is one of the reasons why ESG ratings can be beneficial. However, the risk is different for each company, for example due to the industry in which it operates. The ESG rating aims to measure the extent to which companies monitor and communicate their environmental, social and governance impacts. The most prominent rating agencies include MSCI ESG Rating, ISS ESG Rating, CDP (Carbon Disclosure Project) Rating, Moody's Analytics ESG Overall Score and Sustainalytics ESG Risk Rating. Czech ESG ratings are still in their infancy. One of the most important rating agencies

in the Czech Republic is Forbes ESG Rating, in which the Association for Corporate Social Responsibility also participates.

The relationship between ESG practices and corporate financial performance, emphasizing the role of digital transformation. It finds that ESG positively influences financial performance, particularly in non-state-owned companies and polluting firms. The research highlights the need for effective policies to enhance ESG capabilities through digital technologies (Fu & Li, 2023). This article analyses how ESG reporting affects corporate sustainability performance, discussing its benefits and challenges. It provides a broad overview of current practices and their implications for businesses. Aziz & Alshdaifat, (2024) collectively contribute to a deeper understanding of how ESG reporting influences corporate behaviour and performance, as well as the challenges faced in implementing effective reporting frameworks.

A BARC study examines the hurdles organizations face in achieving reliable ESG reporting. It includes insights from a global survey of companies regarding their approaches and tools for ensuring trusted data flow (BARC 2023). According to a study undertaken by the BARC Institute, the main driver for ESG reporting is marketing. Employer branding and compliance with legal standards also play an essential role in Europe and the sustainable customer branding is essential for North American companies.

The Sustainable Development Goals (SDGs), also known as the Global Goals, were adopted by the United Nations in 2015 as a universal call to action to end poverty, protect the planet and ensure that all people enjoy peace and prosperity by 2030. The 17 SDGs are integrated, acknowledging that actions in one area will affect outcomes in other areas and that development must achieve a balance among social, economic and environmental sustainability. As a result, the goals exhibit some degree of overlap in areas E, S, and G (United Nations Development Program, 2024).

Figure 1 Sustainable development goals



Source: United Nations Development Program (2024) adopted by Chen (2024)

2 Methods

The main aim of the paper is to critically evaluate the approach of a selected group of companies to sustainability reporting.

Evaluation methodology – used measures (see Table 1):

The Ranking column includes almost 3 assessments of the ESG reports and activities of the companies evaluated. There is only one exception, the E-on Group, for which we do not know the value of the Forbes ESG Rating CZ 2023. The table below shows these three ratings: with the exception of the Forbes ESG Rating CZ 2023 mentioned above, the CDP and MSCI ratings are used.

First report - We consider the first publicly available ESG report that we were able to obtain from publicly available sources.

E, S, G are the abbreviations for Environment, Social and Government - the groups of Sustainable Development Goals. The individual goals are assigned to the groups only on the basis of the statements in the evaluated reports.

Report size - is the number of pages in the original report. The total volume of photos was estimated as the number of full pages. We do not consider tables or graphs as photos.

3 Research results

The quality of ESG reports varies widely. We can observe very sophisticated reports (e.g. the CEZ Group's report is 190 pages long) or companies that are just beginning to study the issue. Of course, this is related to whether it is already mandatory for a company to report ESG reports today or whether it will only become mandatory in the future. On the other hand, a significant number of companies that produce sustainability reports on a regular basis are not yet subject to mandatory reporting today but are forced to do so by their supply chains or customers.

Table 1 The overview of the basic measures

Organisation	The ranking	The first report	E	S	G	The report size / volume of photographs
ČEZ	Forbes ESG rating ČR 1 st CDP – B MSCI - AA	Sustainability report 2021	7, 6, 9, 11, 12, 13, 14, 15	1, 2, 3, 4, 8, 10 6, 9	5, 16, 17, 8, 13, 9	190 pages / photos less than 3 %
E-ON	X CDP – A, MSCI . AA	Sustainability report 2022	6, 7, 8,9., 11, 12, 13, 14, 15	3, 4, 5, 7, 8, 9, 10, 11, 12, 13	3, 4, 5, 7, 8, 9, 10, 11, 12, 13	78 pages/ 26 pages of pictures – 1/3
Moneta Money Bank	Forbes ESG rating ČR 2 nd CDP – A- MSCI - AA	Sustainability report 2017	2, 6, 9, 12, 13, 16	5, 8, 9, 10, 12, 13,16, 17	8, 7, 10, 12, 13, 16, 17	140 pages/12 pages (8,6%)
ČSOB	Forbes ESG rating ČR 5 th CDP – A MSCI – AAA (KBC group rating)	Corporate Social Responsibility Report 2006, Sustainable responsibility report 2011, Sustainability report 2021	The report does not divide GDOs into the groups, it understand them comprehensively 3,7,8,12,13			91 pages/12 pages (13,2%)
Komerční banka	Forbes ESG rating ČR 6 th MSCI – AA CDP – B	Social Sustainability report 2017, Sustainability reports from 2020	6, 7, 9, 11, 12, 13	6, 8, 9, 10, 12, 16	8, 9, 11, 12, 13, 16, 17	114 pages/ 21 photos (18,4%)

Source: Own processing

In our paper, we focused on evaluating the highest-quality enterprise reports that have been ranked by Forbes ESG Rating 2023 among the top 10 large companies. CEZ group took the first place, so we did not want to leave it out of our evaluation. Unfortunately, another company dealing with a similar area of interest did not make it into the ranking or did not even apply for the competition. Unfortunately, we do not have precise information about the process of the applications. To a better comparison, we have added E-ON group, as we believe that it is not able to find more comparable company. As far as the benchmarked banking institutions are concerned, there were 3 in the ranking and therefore there was no need to add more adepts. Since the Czech ranking may be misleading because only companies on the

Ratings

The Czech market is currently undergoing a ranking process, during which only those who have submitted an application have been included in the comparison. In order to provide a more comprehensive evaluation, the results of two additional ratings have been incorporated into the analysis. The MSCI and CDP indices. The MSCI ESG ratings

divide the rated companies into three basic groups: Lagarde (grades CCC and B, representing approximately 18% of companies in total), average (grades BB, B, and A, representing approximately 59% of companies in total), and leader (grades AA and AAA, representing approximately 20% of companies in total). The companies are assigned a rating and a corresponding score, which are used to determine an index grade. This grade ranges from CCC (the lowest rating, which is given to only 6% of the total volume of rated companies) to AAA (the highest rating, which is given to about 5% of the rated companies). The MSCI rating of companies in the sample is noteworthy for its balance, with five out of six companies rated AA and ČSOB rated AAA as a result of its affiliation with the KBC group (MSCI, 2024).

The CDP index of the CEZ group exhibited an increase in scores on an annual basis in both evaluated categories. The 2023 Climate Change Rating exhibited a notable improvement, advancing from a D grade in 2022 to a B grade (CDP, 2024). Furthermore, in the other rated category, namely water security, there has been an improvement from a grade of C to a grade of B-. The company is gratified by these developments and has invested considerable effort in effecting these enhancements. E.ON is among the top 8% of organisations assessed by CDP, and its rating from the year 2022 is an A grade.

The CDP index is utilised by investors, companies and governments for the purpose of comparison and comprehension of their respective environmental impacts. A CDP index reflects the extent of action, transparency and progress made by an organisation in reducing its greenhouse gas emissions. The index is scored from D- (the lowest score) to A (the highest score). In the Climate Change indicator, ČSOB, as part of the KBC group, has been rated A since 2022 and A- in the preceding five years. Moneta Money Bank has been assigned a rating of B on the Climate Change Indicator for the past two years, with grades ranging from B- to C in previous years. Komerční banka has maintained a B rating in the Climate Change Indicator since 2020.

First sustainability report

Additionally, we sought to ascertain the duration of the companies' engagement with ESG reporting. The addition of the First Report column to the table was therefore justified. The production of ESG reports facilitates the enhancement of both customer and employer branding, which is conducted in a sustainable manner. In an era characterised by a heightened awareness of sustainability, it is imperative that ESG reports not only address the concerns of legislators and capital providers, but also those of customers, potential customers and employees. It is therefore essential that ESG disclosure tools can provide ESG information that is not only in compliance with the requirements of regulators and investors, but also aligned with the objectives of marketing (BARCS, 2023). As indicated by the BARC 2023 study, over 33% of respondents from the banking and finance sector indicated that their inaugural ESG report was produced prior to 2021. A further 24% of respondents indicated that they had produced their first ESG report in either 2021 or 2022. A total of 55% of the companies surveyed have already published their inaugural ESG report prior to 2023. A further 24% of respondents indicated that they intend to publish their inaugural ESG report in 2023. This indicates that only 21% of companies intend to publish their inaugural ESG report after 2023. It is noteworthy that all companies surveyed view the production of ESG reports as a necessary undertaking.

A review of the publicly available websites of individual banking institutions reveals that the oldest report in this field is the ČSOB report, entitled "Corporate Social Responsibility Report 2006." Nevertheless, it seems reasonable to posit that other banking institutions are not too far behind in this regard. It is conceivable that reports from this period are no longer publicly searchable but may instead form part of internal information systems.

Selection of SDGs

Furthermore, we sought to ascertain which groups of Sustainable Development Goals (SDGs) the evaluated companies had prioritised. It was hypothesised that a comparable approach would be employed when selecting goals within the same sector. It is notable that SDGs 7, 8, 12 and 13 are referenced in all the aforementioned reports. While ČSOB does not categorise the SDGs into the relevant groups and demonstrates a comprehensive understanding of them, other companies divide the individual SDGs into groups that align precisely with the ESG categories. Furthermore, discrepancies were observed between the representatives of the electricity companies. Notwithstanding the fact that the e-on group report lists a greater number of GDOs, the CEZ group report dedicates a greater proportion of space to their description.

Report size

The process of ESG reporting is inherently data-intensive, with many companies failing to fully recognise the challenges associated with the collection of data, particularly in the case of environmental KPIs. The implications of ESG reporting for third parties represent a burgeoning area of investigation. The information reported with respect to ESG

non-financial reporting has an impact on several key stakeholders, including customers, investors, employees and suppliers. Evidence indicating that ESG reports are influencing or attempting to influence various interest groups can be observed in their visual presentation. The sample of companies under consideration is relatively limited in size, yet there is notable variation in the way photography is employed as a means of infusing emotion into claims that are otherwise relatively austere. The smallest proportion of photographs can be observed in the CEZ group ESG report, which corresponds to approximately 3% of the total length of the report. In contrast, the largest share of photo documentation is evident in the E-on group report, which accounts for almost 33% of the total length of the report. The sample of companies under comparison is relatively limited in size, yet there is notable diversity in the manner in which photography is employed as a means of infusing emotional content into claims that are otherwise characterised by a certain degree of sobriety.

4 Conclusions

The paper presented here deals with sustainability reports that were highly rated in the Czech Forbes ESG Rating 2023. Even for the sample of 5 selected companies, significant differences in the Forbes ESG rating, the CDP index and the MSCI index were found.

Non-financial reporting is currently mainly produced by companies with a focus on Western markets, where ESG values are demanded by customers and investors, and where even companies that are not yet subject to non-financial reporting are doing so on a voluntary basis. The graphic form of the reports compared suggests that they are also widely used as a marketing tool with an impact on stakeholders.

The quality of non-financial reporting varies considerably, not only between sectors but also between companies. Rating agencies are trying to respond to this by developing their own ratings. However, the current market for ESG ratings suffers from shortcomings, in particular a lack of transparency and consistency in the methodology, the source data used and the functioning of the ESG rating providers themselves, which may reduce confidence in ESG ratings. As a result, investors often prefer to rely on more than one ESG rating or to conduct the analysis themselves. The same issue is being addressed centrally by the European Commission, and until industry standards are agreed, it will be difficult to compare and even use individual ratings.

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The Evaluating the Financial Health of an Inter-Company Network - Evidence from the Automotive Industry

Jaroslava Pražáková,¹ Sandra Šindlerová²

Abstract: The aim of this paper is to assess the financial health of firms involved in an inter-firm network based on supplier-customer relationships. A real fragment of the automotive supply network was analysed. The financial health of each part of the network was assessed using a combination of the following bankruptcy and solvency models: IN01 model, Index Solvency, Taffler's model and Kralick's QT. The results of the bankruptcy models, K-means cluster analysis and functional analysis were complemented by core periphery analysis. By using these methods together, it was possible to identify the centre and periphery of the network and assess the differences in their financial health.

Keywords: networks, bankruptcy predictions, financial health, automotive industry

JEL Classification: G30, G33, M21

1 Introduction

Globalization, rapid development in the technical field and the development of production, information, management or communication technologies, caused an irreversible change of the environment. For this reason, economic entities are significantly interconnected, thereby improving their competitiveness and maintaining sustainable development (Tao, Cheng & Zhang, 2017). Networks are becoming the dominant organizational form of the economy and is referred as the network economy (Fiala 2008). Historically, the study of networks has been mainly the domain of a branch of discrete mathematics known as graph theory. In addition to the developments in mathematical graph theory, the study of networks has seen important achievements in some specialized contexts, as for instance in the social sciences. Social networks analysis focuses on relationships among social entities, or economic transactions between corporations (Boccaletti, Latora, Moreno, Chavez, & Hwang, 2006). Recently, the networks whose structure is irregular, complex and dynamically evolving in time are often the main subject of the research studies.

As reported by Rombach et al. (2014), networks are used to model systems where businesses interact with each other and are represented by nodes and their connections are represented by edges. For that reason, we can see the structure of the network represented by nodes and links (edges). Even though there is no hierarchical order in networks, we can identify nodes that are essential for network functionality. Zhang, Marin and Newman (2014) divide the network into a densely connected core and a sparsely connected periphery. Helo & Hao, (2019) add that the core–periphery structure is always detectable, no matter how weak it is. Understanding which nodes serve as hubs or authorities can provide insights into the resilience of networks. The centralities are measures that evaluate the importance of a node in a network based on the importance of its neighbours. This means that a node is considered significant if it is connected to other significant nodes.

The network resilience is also affected by financial health of the integrated nodes (companies). A financially healthy company is better positioned to withstand economic downturns and unexpected financial challenges. It maintains a balance between risk and return, ensuring stability in operations (Valášková, Nagy, 2023). Understanding financial health aids stakeholders in making informed decisions regarding investments, expansions, or operational changes. Metrics derived from financial health analyses can guide strategic planning (Kamal, 2024). Overall, financial health encompasses various dimensions that are critical for the sustainability and growth of organizations. By focusing on liquidity, solvency, profitability, and operating efficiency, companies can ensure they are well-equipped to navigate the complexities of the business environment while achieving long-term success. Bankruptcy prediction methods can be divided into three main groups: bankruptcy models (based on discriminatory, probit, or logit analysis), neural networks and generic algorithms (for example Pet and Jones, 2012) and decision trees. We found several studies that provided an overview of bankruptcy models, discussed their advantages and disadvantages, methods, and prediction accuracy (Alaka et al., 2018; Du Jardin,

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2018; Kovacova et al., 2019). Other research studies focused on the bankruptcy models refer to core authors in this field of study (Gu et al., 2017; Ouyang et al., 2018; Wang et al., 2017, Soukal et al., 2023). In our research we decide to use the four models from the first group.

2 Methods

The aim of the paper is to evaluate the financial health of enterprises involved in an inter-company network built based on supplier-customer relationships.

Used methods:

The network construction: the individual components of the network were identified using the Snowball method. this method is widely used in sociology and network theory in cases where it is difficult to identify the components of the network in another way. Studies discuss it in more detail for example: Naderifar, Goli & Ghaljaie (2017). We have identified a network fragment of 11 companies operating in the automotive industry.

Financial health: The data used for this analysis was drawn from financial reports from the year 2022. To estimate the financial health of individual elements of the network, four financial prediction models are used: Taffler index, IN01 index, Kralicek Quick test, Credibility index. The equations and interval for evaluation are below:

Taffler Model (Agarwal & Taffler, 2007)

$$T = 0.53 \cdot x_1 + 0.13 \cdot x_2 + 0.18 \cdot x_3 + 0.16 \cdot x_4 \quad (1)$$

where: x_1 = earnings before taxes (EBT) / short-term liabilities; x_2 = current assets / total liabilities; x_3 = short-term liabilities / total assets; x_4 = (financial assets – short term liabilities) / (operating costs - depreciation). The distress zone is below 0.2; the grey zone is between 0.2 and 0.3 and the safety zone is above the 0.3 level of T.

Kralicek Quicktest (1993)

$$Overall\ position = (q_1 + q_4)/2 + (q_2 + q_3)/2 \quad (2)$$

where: The evaluation scale uses the point evaluation ($q_1 - q_4$) from 1 up to 5 for each financial ratio ($x_1 - x_4$). The final grade (overall position) is the arithmetic average of evaluated ratios of financial stability and revenue position (i.e. q_1 , q_2 , q_3 and q_4). Financial ratios are: x_1 = equity / total assets; x_2 = operating cash flow / revenues; x_3 = EBIT / total assets; x_4 = (liabilities + loans – cash) / operating cash flow. Note that CF according Kralicek is calculated as Profit(loss) current year +(-) changes in reserve funds +(-). Kralicek considers a company with final grade better than 2 as creditworthy. And a business with a score higher than 3 can be considered as a bankrupt company.

Credibility Index (1993)

$$IB = 1.5 \cdot x_1 + 0.08 \cdot x_2 + 10 \cdot x_3 + 5 \cdot x_4 + 0.3 \cdot x_5 + 0.1 \cdot x_6 \quad (3)$$

where: x_1 = Cash Flow / Total liabilities and Equity; x_2 = Total Capital / Total liabilities and Equity; x_3 = EBIT / Total Capital; x_4 = EBT / Revenues; x_5 = Inventory / Total Assets; x_6 = Equity / Total Capital.

IN 01 index

$$IN01 = 0.13 \cdot x_1 + 0.04 \cdot x_2 + 3,92 \cdot x_3 + 0.21 \cdot x_4 + 0,09 * x_5 \quad (4)$$

where: x_1 = Total Assets / Total liabilities; x_2 = EBIT /interest expenses; x_3 = EBIT /Total Assets; x_4 = Revenues /Total Assets; x_5 = Current Assets / Total Assets.

The network structural characteristics: the density of the network, centralities, hub and authority algorithm and Core and Periphery analysis was performed in software UCINET.

Overall evaluation of the results: The results of network structural characteristics are compared with financial health evaluation. The results of the individual bankruptcy indices are used as input data for cluster analysis. The K-means analysis with 2 clusters was performed.

3 Research results

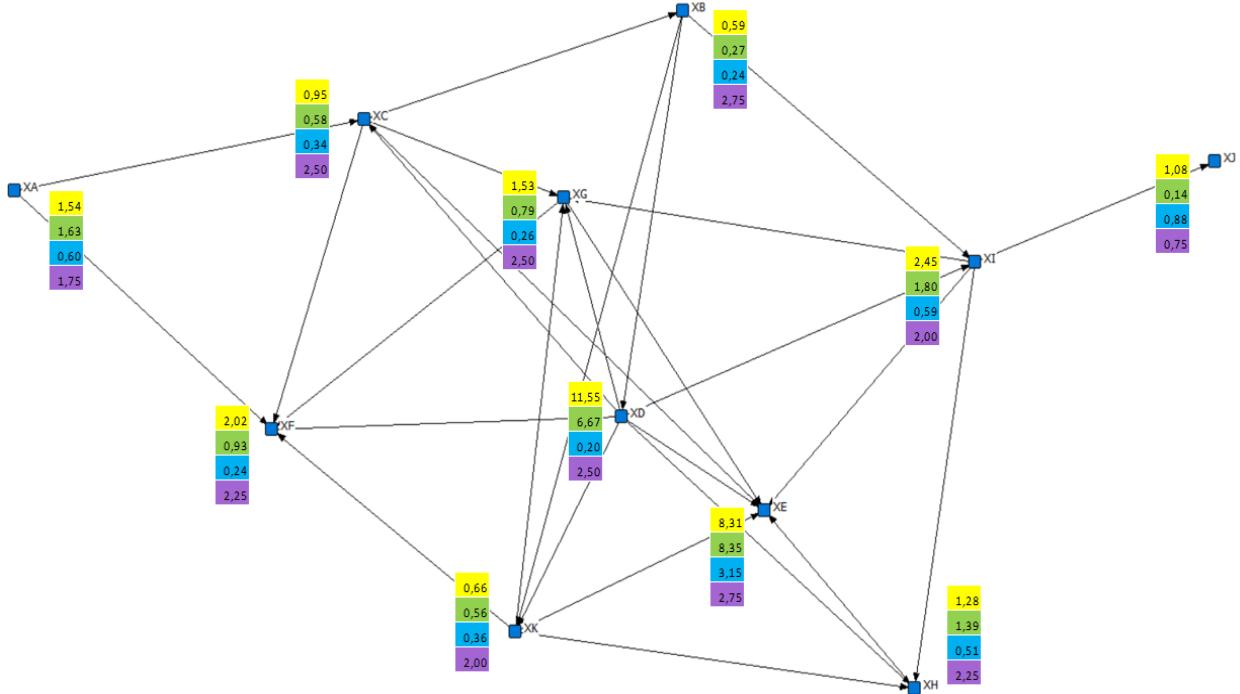
Individual parts of the network are identified based on real supplier-customer links between the companies. Due to the anonymity of the research, the companies are identified by abbreviations consisting of the letter X and the other letter assigned without reference to the original name of the company (from XA to XK). The mutual links between companies are marked by edges, and in the case of this network they represent the flow of materials in the network, with arrows

corresponding to the direction of the flow. Recently, the car companies and their business partners have been dealing with factors that threaten their business, from chip shortages to supply chain issues. In addition, the companies labelled XF and XG are not only parts of the supply chain, but they are also companies where cars are assembled.

Financial health analysis

The financial prediction models provide a comprehensive view of the financial situation of the companies analysed and their ability to remain stable in times of economic fluctuation. XE and XD are the best performing companies in the IN01 model. The model identifies these companies as the best performers, indicating their better financial health compared to other companies in the network. The Credibility Index (green marks in figure 1) confirms the results of the IN model and also ranks XE and XD as the top companies (yellow marks in the figure 1). In contrast, the Taffler's model (blue marks in Figure 1) identified only XE as a high performing company. Kralicek's quick (purple marks in Figure 1) test confirmed the results of the Credibility Index and the IN01 model with only a small change, with XE, XD and XG scoring best. This test reinforces the perception of these companies as financially stable. provide a comprehensive view of the financial situation of the analysed companies and their ability to maintain stability even in periods of economic fluctuations. The companies XE and XD achieve the best results in IN01 model. The model identifies these companies as the highest performers, indicating their better financial health compared to other businesses in the network. The Credibility Index confirms the results of the IN Model and ranked XE and XD as the top companies too. In contrast, the Taffler's model identified only XE as the company with high results. Kralicek' quick test confirmed the results of the Credibility Index and IN01 model only with a small change, when the XE, XD and XG companies achieve the best results. This test further reinforces the perception of these businesses as financially stable.

Figure 1 Network structure



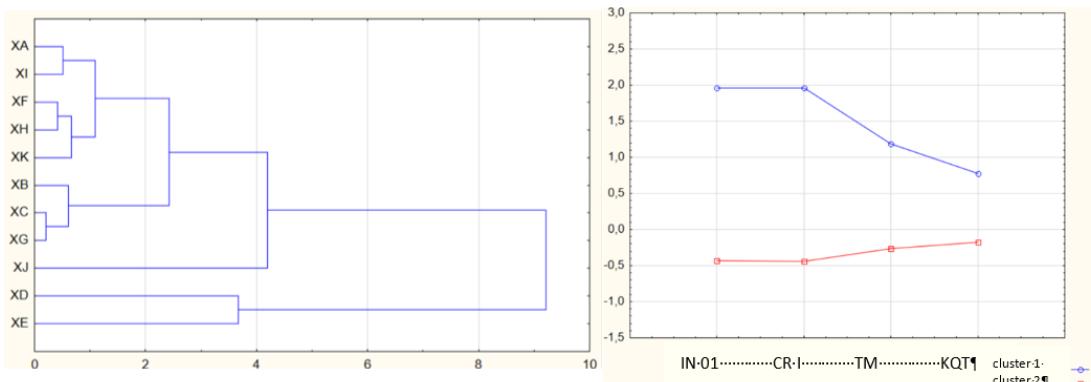
Source: Own processing in UCINET

36.4% of the enterprises create value and are classified as creditworthy by the IN 01 index. On the other hand, 18.2% of the enterprises are bankrupt. The assets of these enterprises are not sufficiently financed by equity capital, which means that they are financed by external sources. The remaining enterprises (45.5%) fall into the grey area. According to the Credibility Index, all enterprises are considered creditworthy and can be said to be financially stable. According to the Taffler model, 63.6% of the enterprises are creditworthy and 36.4% of the enterprises in this network are in the grey zone. This model suggests that most of the enterprises in this network are financially stable and are likely to remain so. No enterprises were classified as bankrupt using this model. The enterprises were divided into two groups according to the results and ratings of the Kralick's Quick test: the creditworthy group and the grey zone. The creditworthy group comprises

36.4% of the companies and was rated as stable by the model. The Grey Zone represents 63.6% of the sample, with no company rated as bankrupt. These calculations provide important insights into the financial health and stability of Network X.

In addition to financial indicators, the relative position of individual companies within the network is also a significant factor. The results reveal that the XE and XD companies not only demonstrate solid financial performance, as evidenced by the favourable outcomes of the predictive models, but they also illustrate a high degree of functional interconnectivity. This creates a financially stable hub of the X network with the potential to have a positive influence on other businesses in the network. Following the application of prediction models, a cluster analysis is conducted. This method is employed to group objects into clusters, with the objective of maximising the similarity of objects within a cluster while minimising the similarity between clusters. The criterion for this analysis is the degree of similarity between the entities. The values were initially standardised, and then Ward's method was combined with the use of Euclidean distances. This method is effective in grouping objects into homogeneous clusters. The results are confirmed by using the k-means method.

Figure 2 Ward method and Euclidian distance dendrogram and average values of the clusters



Source: Own processing in STATISTICA cz

The enterprises are divided into two clusters (Figure 2), with Cluster 1 consisting of Company XD and XE and representing the core of the network. The remaining nine enterprises, depicted as cluster 2, represent the periphery of the network. The resulting distances allow us to conclude that the most typical company in the periphery is enterprise XH. This is due to the fact that it has the lowest distance from the mean of cluster 2, which is 0.10. Conversely, the most distant enterprise from the cluster mean is enterprise XB, with a distance value of 0.48. The company XJ has the lowest distance, which is representative of cluster 2 (distance value 0.01).

A basic structural evaluation of the network

Using the Density overall method in the UCINET software, the density of the network was determined, which reached a value of 0.255. This suggests that the level of connectivity between nodes is relatively low in comparison to the maximum potential value. Moreover, the hubs and authorities of the Network X are identified according to the number of connections. The main nodes of the network are determined based on the connections. The most significant authority is the XF company, which is responsible for the dissemination of the majority of information, particularly within the domain of automotive manufacturing. The XD enterprise was identified as the primary hub, receiving and disseminating the bulk of the information and components within the network.

Subsequently, a core and periphery analysis was conducted using the UCINET software, which divided the network into a core and periphery. The network is structured around a core consisting of companies XE, XD, XF, XC, XI and XK, which are highly connected and are therefore likely to play a key role in the network. The periphery of the network includes enterprises XB, XH, XG, XA and XJ, which have lower connectivity and are probably less involved in the main flows of information and decision-making processes.

Results comparison

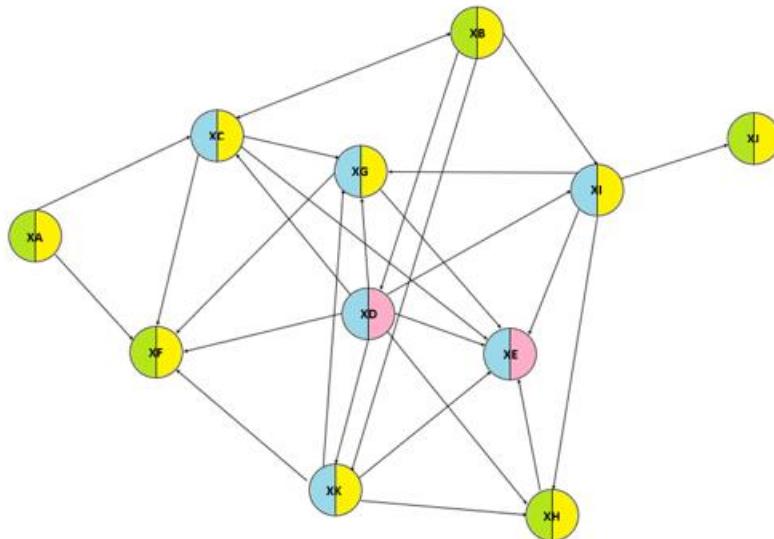
It is assumed that the core part of the network is responsible for managing the information flow through the network and for influencing the network structure. The Core Periphery analysis identifies the six companies as the core (blue marks in Figure 3), whereas the cluster analysis based on financial health prediction models identifies only two companies as the core (pink marks in Figure 3). From the perspective of network structure, it can be assumed that the six core

companies represent important nodes in the information flow, yet their financial health is not significantly different from the periphery of the network.

The exceptions to this are XE and XD, which are in excellent financial health and satisfy the condition of high interconnectivity in the network structure. Furthermore, they are indispensable to the network in terms of its functionality, given that they are a car manufacturer and therefore a crucial link in a demand-driven system. In defining the core, UCINET identifies those entities with a higher degree of interconnection, which are therefore regarded as having an impact on the stability of the network. Conversely, cluster analysis assesses financial stability based on the standardised values of prediction models.

The companies connected to the Network X show generally good financial health. XE and XD are the best performing companies according to the prediction models. On the other hand, the weakest enterprise is XB, which is labelled as bankrupt according to the IN01 model, probably due to low liquidity, indicating problems with repayment of liabilities. The Credibility index classifies XB as a creditworthy enterprise, but with a problematic economic situation, while the Taffler model and the Quick test place it in the grey zone. XB also relies more on external capital, which may be a way of financing its operations.

Figure 3 Result comparison



Source: own calculations

4 Conclusions

The companies in network X operate in the automotive sector. The observed differences in their financial results are affected not only by their individual performance but also by their position among the other members of the network. Despite the presence of relatively weaker players, the network is nevertheless well-established, largely thanks to its anchor companies. In certain circumstances, the company at the core of the network may intervene in favour of a weaker network node located on the periphery. This is typically the case when the network requires the node due to its distinctive characteristics and functionality. Otherwise, they may be replaced relatively easily, given that the periphery of the network is often sparsely connected. The decision to replace or support a compromised network link is entirely at the discretion of the network core, taking into account the specific circumstances. However, it is essential to monitor the evolution of the relationships and the financial situation of the individual companies.

The greatest similarity between the financial health of the core and the periphery shows the Kralicek's Quick test and Taffler's model. In contrast, the IN01 model and the Credibility Index results support the theory of a better financial situation of the network centre compared to its periphery. The balanced results for the Kralick Index and the Taffler Index may reflect the fact that the evaluated industry has better financial health in general than the market average, and these companies reach the significantly higher performance.

Moving a company from the periphery to the centre of the network, or vice versa affects the network robustness. Gleissner (2023) presents the key characteristics of the robustness companies: high financial sustainability, robustness strategy as a driver of future financial performance and company value and high level of competence in dealing with risk. It can be concluded that these key characteristics are also important for entire enterprise networks. When a company moves from the periphery to the core, it can strengthen its position and the network through better connectivity, access to resources and increased financial stability. Conversely, a move from the core to the periphery can mean higher financial risk and lower competitiveness. The core of the network usually has better opportunities for collaboration, which contributes to the success of both the enterprise and the network.

The paper aimed to highlight the fact that in the future, it will no longer be sufficient to evaluate individual network links; instead, methodologies for evaluating the entire network will need to be developed. These newly formulated methods must be based not only on the evaluation of financial health, but also on the respect of the network position. Nevertheless, the development of such methodologies requires a comprehensive understanding of the structure of inter-organizational networks and a commitment to empirical research over an extended period.

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Still Wine Can Bring Additional Billions to Public Budgets

Jarmila Rybová¹

Abstract: The aim of the article is to quantify the possible tax income from still wine for public budgets. The Ministry of Finance has evaluated the possibilities of introducing a higher than zero rate on still wines several times. Still wine is the only alcoholic beverage without excise duty. The Czech Republic applies a zero rate on still wines as well. The author assumes the same rate for still wines as the rate for sparkling wines and intermediate products. The tax will increase the price of a 0.7 l bottle of wine by CZK 18. The results of the article show a possible tax amount of around 4 billion CZK. The National Budget Council also presents a similar result. This revenue is much higher for public budgets than the tax on sparkling wine and intermediate products. However, tradition, popularity of the drink and pressure from producers are of great importance.

Keywords: still wine, excise duty, wine tax, tax revenues

JEL Classification: E620, H21

1 Introduction

The aim of this article is to add to the discussion to increase the rate of tax on still wine and passenger cars. Excise duty on wine is one of the taxes on consumption. European Union harmonizes these taxes with relevant directives:

- Council Directive 92/83/EEC of 19 October 1992 on the harmonization of the structure of excise duties on alcohol and alcoholic beverages still wine includes all products of CN codes 2204 and 2205, with the exception of sparkling wine.
- Council Directive (EU) 2020/1151 of 29 July 2020 amends Directive 92/83/EEC on the harmonization of the structure of excise duties on alcohol and alcoholic beverages.
- Council Directive 92/84/EEC of 19 October 1992 on the approximation of the rates of excise duty on alcohol and alcoholic beverages precisely defines the subject of the tax, the conditions of taxation and the minimum rates for wine.

The minimum rates in Council Directive 92/84/ EEC of 19 October 1992 for still and sparkling wines are zero. States may or may not tax these products. Excise duty rate on intermediate products is 45 EUR per 1 hectolitre of product. Tax rates on still wine are therefore very different in the member states of the European Union.

The Czech Republic taxes still wines at a rate of zero (according to the minimum rate of the EU directive), but taxes sparkling wines and intermediate products at a rate of CZK 2,340 per 1 hectolitre of drink, see Act No. 353/2003 Coll., on consumption taxes. Euro exchange rate in the year 2023 is 24.176 CZK per 1 EUR. Euro exchange rates change every year. The Czech tax rate in Euros is EUR 95.6664 per 1 hectolitre of sparkling wine and intermediate product. European Commission (2023) lists these tax rates in its documents.

The Ministry of Finance of the Czech Republic considered introducing a tax on still wine several times. Still wine has a zero tax rate even further. Wine growers, wine producers and importers are a strong interest group. In addition, the administrative costs associated with tax collection and the effectiveness of this tax may be the reason for the zero rate. Health experts argue that the alcohol in still wine is just as harmful to health as it is in other taxed alcoholic beverages. However, still wine is a single alcoholic drink without excise duty.

2 Literature Review

Council Directive 92/83/EEC of 19 October 1992 on the harmonization of the structure of excise duties on alcohol and alcoholic beverages. Still wine includes all products of CN codes 2204 and 2205. The directive divides still wines into two groups. The first group of products contains more than 1.2% alcohol by volume, but does not exceed 15% by volume. This applies if the alcohol contained in the finished product is of fully fermented origin. The second group of products

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are products with an alcohol content above 15% by volume, but not exceeding 18% by volume, if they have been produced without any enrichment and if the alcohol contained in the finished product is of fully fermented origin;

Another Directive 92/84/EEC precisely defines the subject of the tax, the conditions of taxation and the minimum rates for wine. It distinguishes between still and sparkling wines. The directive further divides still wines into two groups according to alcohol content. Member States may tax still wines with a higher alcohol content at a higher tax rate. It defines sparkling wines as wines with an alcohol content of 1.2-15%. The minimum tax rates for both groups of wines are zero. We call products with an alcohol content between 1.2-22%, which we cannot classify as beer, wine or other fermented products, intermediate products. The minimum rate is 45 Euro/hl. Here, too, it is possible to apply a reduced rate to intermediate products with an alcohol content of up to 15%.

I wrote about various approaches to the taxation of still wine in the Member States of the European Union in my article on the taxation of still wine in the European Union (Rybová, 2023). It is usually the case that countries that purchase still wine from other countries tax this product at higher rates. On the contrary, countries with higher domestic production and lower imports of still wine tax it at low rates or do not tax still wine at all. This is not the case in the Czech Republic. The Czech Republic purchases more still wine from other countries than it produces and still wine has a zero excise rate. On the other hand, sparkling wine imports less than it produces and the excise rate is higher than zero. Specifically, it is CZK 2,340/hl of sparkling wine. The taxation of still wine is politically impenetrable. Producers of still wine, mainly in Moravia, are a strong interest group against this taxation.

The International Organisation of Vine and Wine (2024) confirms that some European Union countries produce wine beverages in large quantities. Italy, France, Spain, Portugal, Greece, Germany and others trade their wine production on world markets. Incidentally, statistics from this organisation (International Organisation of Vine and Wine, 2022) show that China is also a significant wine producer. It is a significant producer and exporter of fresh grapes and tends to import wine. The author Shuanglin Lin (2022) analyses taxes burdening consumption in China. She states that specific taxes on alcoholic beverages are among the most significant taxes from total tax revenues in China and points out that these taxes are not favourable for income redistribution. The export of wine from the member states of the European Union may be associated with difficulties outside the European Union in the form of higher taxation in the country of consumption. For example, Dickinson (2023) reports that China imposed an import tax on wines imported from the European Union. According to the author, this move is a retaliatory measure for the imposition of tariffs on solar panels from China.

Authors Goodhue et al. (2012) examined wine tax, production, aging, and wine quality. The authors evaluate the effectiveness of different wine taxation practices. Their analysis found the following: an increase in the volumetric retail tax collected at sale increases quality, so that the basic Alchian-Allen effect holds. However, an increase in the volumetric storage tax collected each period decreases quality, as does an increase in the ad valorem storage tax. The effect of an increase in the ad valorem retail tax on quality is indeterminate. Increases in any tax reduce the quantity of wine produced. Any two-tax system that includes a volumetric sales tax spans the full range of feasible tax revenues with positive tax rates. Provided the tax system includes a volumetric sales tax it may be efficient, regardless of which of the other instruments, or how many of them, are used. We must evaluate the assertions about the inefficiency of taxation empirically on a case-by-case basis.

The authors Kuang et al. (2024) submitted an interesting article about Sassicaia 2015 scandal and its consequences. The findings from this study reveal a counterintuitive market response to the 2015 Sassicaia counterfeit scandal. Contrary to expectations, the publicity surrounding the event did not diminish buyer confidence. Instead, it appears to have increased demand for the authentic 2015 Sassicaia, perhaps because of an increase in the perceived rarity and heightened media attention. This suggests that in the high-end wine market, scandals can sometimes enhance the desirability of a product, particularly when its authenticity is verified. The analysis shows that the counterfeiting event led to a significant increase in the price of the 2015 Sassicaia compared to other Sassicaia vintages and comparable Super Tuscan wines. This outcome might seem paradoxical. However, several factors could explain this price increase: rarity perception and media attention.

3 Methods

The aim of the contribution is to estimate the amount of tax revenue from the consumption tax on still wine when the rate is increased. Two steps lead to the estimation of the still wine tax yield. The first step is to calculate the total volume of wine consumption in the Czech Republic. The second step is the calculation of the tax revenue from still wine. Individual subsections describe one of the steps.

3.1 Consumption of wine

The Czech Statistical Office (2024) publishes the consumption of wine per person in litres of the drink and in litres of pure alcohol. Beverage consumption in litres is part of the calculation in this article. Data for wine consumption summarizes the consumption of still wine, sparkling wine and intermediate products. This Office registers separately two types of wines, i.e. wine made from grapes and other wines. The amount of consumption of wine is the sum of both types shows table 1.

Table 1 Consumption of wine in the Czech Republic per year (per person)

Type of wine (unit of measurement)	2017	2018	2019	2020	2021	2022	Average of consumption
Grape wine (litre)	16.4	17.1	17.2	16.5	17.2	16.5	16.8
Other wine (litre)	3.0	3.3	3.1	3.3	3.6	3.4	3.3
Total (litre)	19.4	20.4	20.3	19.8	20.8	19.9	20.1

Source: Czech Statistical Office

Wine consumption is growing in the long term, according to data from the aforementioned office. For example, in 1971, 1 person consumed 11.3 litres of wine per year. In 1980, 1 person consumed 14.1 litres, and in 1990, 14.8 litres and in 2000, 16.1 litres.

The Czech Statistical Office (2024) recalculates food consumption to the average state of the population of a given year. The number of inhabitants is the average state of the population on July 1 in the relevant year. The following table 2 shows the average population figures in 2017–2022.

Table 2 Average population on 1 July in 2017–2022

Year	Average population	Year	Average population
2017	10 589 526	2020	10 700 155
2018	10 626 430	2021	10 500 850
2019	10 669 324	2022	10 759 525

Source: Czech Statistical Office

I need to calculate the total consumption in the Czech Republic in litres. Metadata of the Czech Statistical Office shows the use of the median number of inhabitants as of July 1 of a given year, see table 2. The calculation of total consumption in the Czech Republic is as follows:

$$\text{Total wine consumption} = \text{Consumption of wine per person per year} * \text{average population on 1 July} \quad (1)$$

These data cannot separate the consumption of still wine from sparkling wine and intermediate products. It will only be possible to separate the still wine in the second step.

3.2 Still Wine Taxation

As already mentioned, the tax rate in the Czech Republic and the minimum rate in the EU directive on still wines is zero. The Ministry may choose the rate for still wines at its discretion. We have many options to introduce this tax. We can set it arbitrarily in any amount. We can also raise it gradually to the level of excise duty on sparkling wine or it can be set to its level immediately. This is the easiest way to have the same rates for still and sparkling wines. The subject of the article is a simple model for calculating tax revenue from the tax for still wine. The rate for still wine is the same as the rate for sparkling wine. Equation 2 for calculating still wine tax revenue:

$$\text{Wine tax revenue} = \text{total consumption of wine} * \text{tax rate (CZK per litre of product)} \quad (2)$$

The consumption of still wine in litres of the product is correct for this calculation. The tax rate for still wine in this model is the same as the tax rate for sparkling wine, i.e. CZK 23.40 per 1 litre of product. But we do not know whether the consumption refers to still or sparkling wine. Therefore, we multiply the total consumption by the tax rate and then subtract the tax income from the sparkling wine and the intermediate product, see equation 3:

$$\text{Still wine tax revenue} = \text{Wine tax revenue} - \text{Sparkling wine and intermediate product tax revenue} \quad (3)$$

The difference between the tax on total wine consumption and the tax revenue from sparkling wine and intermediate products will show the amount of tax on still wine. This amount of excise duty on still wine is theoretical. Her ability to speak is limited. I did not consider the production of wine by natural persons up to 2000 litres. Wine production up to this limit is not taxed, see Svátková (2009). I am unable to verify this based on the available data. On the other hand, it is likely that home production and consumption of wine without its official sale is not in the statistical data.

We need to know the current revenue of the Customs Administration of the Czech Republic (n. d.) from the taxation of sparkling wine and intermediate products to determine the tax revenue generated by the taxation of still wine.

Table 3 Excise duty od sparkling wine and intermediate products

	2017	2018	2019	2020	2021	2022	Average of values 2017-2022
Excise Duty of sparkling wine and intermediate products in million CZK	380.7	408.0	403.6	444.7	483.2	552.73	445.49
Excise duty of domestic production	377.6	405.2	401.5	442.8	481.4	550.71	443.20
Import duty	3.1	2.7	2.1	1.9	1.8	2.03	2.27

Source: Customs Administration of the Czech Republic (n. d.)

Sparkling wines and intermediate products come mainly from domestic production and taxation works well here. In other states of the European Union with a predominance of consumption of domestic production, wine is tax-free, as stated for example by Rybová (2023).

4 Research results

The first results show the total consumption of wine in litres in the Czech Republic. The following table shows the excise duty for all wines (still and sparkling) and intermediate products in the event that the tax rate is the same for all types of products. I abstracted in the calculation from the tax exemption for low wine production.

Table 4 Theoretical wine tax revenues

	2017	2018	2019	2020	2021	2022	Average of values 2017-2022
Total consumption of wine in the Czech Republic per year (hectolitre)	2058,603.8	2164603.8	2166939.7	2115420.6	2181026.5	2143297.4	2138315.3
Tax rate per hectolitre of wine (same as rate for sparkling wine, CZK per hectolitre)	2340	2340	2340	2340	2340	2340	2340
Theoretically possible tax revenue in billion CZK	4.82	5.07	5.07	4.95	5.10	5.02	5.00
Excise Duty of sparkling wine and intermediate products in billion CZK	0.38	0.41	0.40	0.44	0.48	0.55	0.45
Theoretical tax revenue of still wine	4.44	4.66	4.67	4.51	4.62	4.47	4.56

Source: Own processing

The last row of the table shows the likely amount of tax on still wine. When we look at the amount of tax collected from sparkling wine and intermediate products, taxing still wine can be interesting for public budgets. Empirical studies show that an increase in the rate of excise taxes reduces the consumption of taxed products, but this is only temporary.

The National Budget Council of the Government (2023) writes in Daniel Bárta's commentary about the exception in the taxation of still wine. It is evident that this exception is not correct. The absence of taxation of still wine prepares public budgets by up to five billion per year. This result is consistent with the results of this study. This article states that in the European Union, 15 countries do not impose excise duty on wine, where consumption from domestic producers dominates. This is not the case in the Czech Republic. Here, domestic producers cover only a third of the consumption.

Another question presents itself to us. What will the price of a bottle of wine be if we raise the rate to the level of the rate for sparkling wine and intermediates? The following example shows a price increase.

Wine tax rate: Tax rate on 1 litre of wine CZK 23.4

Tax 0.75 litre of still wine CZK 17.55

The price of wine will increase by CZK **18**

Empirical studies show that increasing consumption taxes that are included in the price of goods results in a tax shift of more than 100%. This means that the seller increases the price not only by the tax but also by his margin. Fletcher, Deb and Sindelar (2009) describe this in their study on tax incidence.

5 Conclusions

It is evident that the tradition, the popularity of the drink and the pressure from the producers are of great importance. Still wine has a privileged position over other alcoholic beverages in the Czech Republic. This drink has a long tradition here. This applies not only to cultivation, but also to consumption. Czech society perceives it more as a food than as an alcoholic beverage. Czech governments have already considered the introduction of an excise duty on still wine several times, but have yielded to pressure from interest groups, mainly from producers. The experience of other European Union states shows that states that consume the majority of domestic production and import only a small amount do not tax wine. They protect their market. In the Czech Republic, we tax sparkling wines and intermediate products, where domestic production prevails. On the other hand, we do not tax still wines, where a large share is imported. At the same time, the results of this study, information from the National Budget Council show that taxation of still wine would bring more money to public budgets than taxation of sparkling wine and intermediate products. At the same time, the price of one bottle with a volume of 0.7 litres of wine would increase by only CZK 18. It is likely that consumption of still wine would decrease slightly for a short time. We can assume the impact of the consumption tax according to the results of various studies so far. A prerequisite for similar products is a low elasticity of demand. This means that consumers are less sensitive to a change in price. If the price of wine is higher, part of the tax may also fall on the producer. If the price of wine is higher, part of the tax may also fall on the producer in the form of a lower margin from the sale of wine. The tax can most often fall on customers by increasing the sales price by the wine tax.

In connection with the article by Goodhue et al (2009), I can add that the Czech Republic taxes sparkling wines with an ad valorem sales tax and a specific volume tax. The proposed taxation of still wine is the same as sparkling wine. The specific tax will increase the price when sold to final consumption. This may lead to a decrease in the quantity sold, especially for the cheapest wines. The Czech Republic most often imports these wines. A wine tax would affect domestic wines less than cheap imported wines. These may increase the competitiveness of domestic wines.

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Czech Accounting Legislation – Convergence with IFRS?

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Abstract: The long-term process of harmonization of Czech accounting legislation and elements of International Financial Reporting Standards should culminate in an amendment to the Accounting Act. Unfortunately, its final form and validity are constantly postponed, and so far, unofficial sources speak of a deadline of 2027. The paper will outline the main directions already incorporated into accounting legislation from 2024 and other breakthrough areas for the Czech accounting environment in which IFRS/IAS principles will be applied.

Keywords: accounting and reporting, IFRS, EU directives.

JEL Classification: M4, M48.

1 Introduction

The current Act No. 563/1991 Coll. on Accounting and the related implementing decrees originated in the 1990s. Although they are regularly amended, they still do not reflect the current accounting science and practice needs. External users mainly use accounting information for their economic decisions or investors in their investment decisions. Therefore, the emphasis is now on financial reporting. Accounting information should be relevant, understandable, reliable, and, above all, transparent. Over the past few years, there has been a shift in the principle of bookkeeping, thanks to digitization, digital support, and the creation and use of accounting software. Accounting should, therefore, be understood more as a tool for presenting the economic situation of the accounting entity through financial statements rather than mere bookkeeping.

2 Methods

The paper aims to summarize the main guidelines reflecting the long-term expected convergence of Czech accounting legislation and International Financial Reporting Standards elements. The initiative to formulate clear and uniform rules in the area of financial reporting was established in 1973 by the International Federation of Accountants (IFAC).

The adoption of accounting standards into the legal system of the European Union, together with the issuance of accounting directives, represents two primary ways through which the national accounting legislation of individual EU Member States is harmonized. (Nejmanová, 2024)

The starting point of the new Accounting Act is Directive 2013/34/EU, which replaced the original Fourth EU Directive. Some elements of IFRS/IAS have already been incorporated into Czech accounting legislation, in particular through Act No. 349/2023 Coll., amending certain acts in connection with the consolidation of public budgets with effect from 2024. However, the principal and fundamental changes are expected with the completely new Accounting Act. The available version for 2024 (note: this is already the second version, the first from 2023) is on the Ministry of Finance of the Czech Republic website. The essential legislative amendments and their proposals for the accounting area were used to create the paper. These sources have been supplemented by publications, the list of which is given in the sources of this paper.

3 Research results

At the end of 2023, the President of the Czech Republic signed the consolidation package, completing the process of finalizing one of the most controversial regulations of recent years. The consolidation package amends 65 acts, including the Accounting Act. The current significant changes in accounting legislation from January 1, 2024, for the amendment to Act No. 563/1991 Coll., on Accounting, have been amended by Act No. 349/2023 Coll., amending certain acts

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concerning the consolidation of public budgets. The key aspects include the introduction of a functional currency, sustainability reports, income tax reports, and the definition of turnover.

However, the newly prepared Accounting Act will majorly impact Czech accounting legislation. The proposed changes to the legislation will also be reflected in the formal change itself, as the current decrees should be amended. From the point of view of the business sector, it should be associated with the non-profit sector. At the same time, the Czech Accounting Standards should cease to exist, and the accounting process will be within accounting entities' competence, but only reporting will be binding. The concept of the Accounting Act will be based on the conceptual framework we know from IFRS/IAS. The main changes are shown in the table below.

Table 1 Draft to the Czech accounting system – contents.

The overall concept of the view of the accounting system – the focus of legislation on reporting.
Incorporation of elements of International Financial Reporting Standards (IFRS), conceptual framework.
Introduction of definitions of basic elements of accounting and terminology directly into legislation.
Modification of the categorization of accounting entities (first incorporated in 2016, change in 2025).
Introduction of functional currency (from 2024).
Introduction of ESG reporting (from 2024).
A significant implementation of valuation methods.
Reimagining Lease Reporting.
Introduction of so-called monetary accounting.
Adjustment of provision reporting.
New regulation of company transformations and consolidation.

Source: own processing

Functional currency

One of the most significant changes to the Accounting Act, with effect from January 1, 2024, is the introduction of the possibility to keep accounts in a foreign currency. According to Section 24a, the accounting currency can be the Czech or another currency if it is a functional unit currency. At the same time, it is the euro, the US dollar, or the British pound. (Act No. 563/1991 Coll.)

The subsequent regulation of the functional currency for accounting entities and entrepreneurs is supplemented by Implementing Decree No. 500/2002 Coll., where the terminology has been changed, for example, from the Czech currency to the accounting currency and from the CNB foreign exchange rate to the general exchange rate. Section 61d has been inserted into the implementing decree, defining the method of determining the functional currency. This paragraph refers to the criteria for selecting a functional currency under IFRS, i.e., IAS 21 Impacts of Exchange Rate Changes. IAS 21 also specifies the primary and secondary factors an entity must consider and assess when choosing a functional currency. The explanation of primary factors is based on the entity's business activity and takes care of what currency influences the sales and purchase transactions of the business.

A functional currency is the currency of the primary economic environment in which an entity carries out most of its economic activities in previous periods and subsequent periods. The share of transactions of the entity made in a given currency must be more significant than 50%. In the case of IFRS, a functional currency is mandatory for an entity, while under Czech law, using a currency other than the Czech currency is voluntary. An entity that chooses a non-Czech currency as a functional currency can only revert to the Czech currency if the other currency ceases to be functional. (Deloitte, 2024)

An accounting entity that trades mainly in euros, the customers of this accounting entity pay in euros, draw a bank loan in euros to finance its activities, and also hold most of its funds in euros; it is more than likely that the functional

currency of this accounting entity will be the euro and therefore has the option to keep accounts in euros. An entity uses the one that is most dominant as a functional currency. This eliminates the need for frequent exchange rate conversions and the related impact of exchange rate differences on accounting. (Daně, účetnictví, 2024)

The introduction of functional currency could benefit a wide range of entities operating in an international environment, including subsidiaries of large multinational companies and other entities. A functional currency brings attractive benefits, and compliance with the established rules can help companies in the following areas:

- Simplify financial reporting and budgeting
- Reduce currency risks, minimize the impact of exchange rate differences on accounting,
- and simplify the preparation of statutory financial statements. (EY, 2024).

Section 61e of the Implementing Decree describes in detail how to proceed when changing the accounting currency:

- Opening balances are converted using the latest closing rate of the central bank when the accounting currency changes, as well as comparative data for the previous accounting period,
- Only in the case of significant deviations will the average exchange rate be used for conversion for off-balance sheet statements,
- the difference arising from the recalculation of data in the income statement is reported in the balance sheet under item "A.IV.2. Other profit or loss from previous years",
- the difference resulting from the conversion of the cash flow statement and the statement of changes in own funds is reported on a separate line in these statements entitled "Difference from conversion to accounting currency."

Suppose most of the entity's business transactions are in euros, and the company keeps its accounts in Czech crowns. In that case, it must use exchange rate conversions when making transactions or during closing operations. As a result, realized and unrealized exchange rate gains and losses arise, which affect the profit and loss account. By switching to accounting in euros, the accounting entity will ultimately reduce exchange rate conversions and volatility in developing the exchange rate, which is the essence of determining and using a functional currency. (Daně pro lidi, 2023).

Sustainability Report (ESG)

ESG stands for Environmental, Social, and Government. These are three key factors that are used to assess a company's environmental, governance, society, and corporate governance. They also play an essential role in investments, loans, acquisitions, and subsidies. Companies that can successfully demonstrate their ESG performance gain a competitive advantage. Key ESG factors include:

- Environmental factors focus on the impact of a business on the environment, such as greenhouse gas emissions, wastewater discharges, and other activities affecting the ecosystem. Nowadays, this area is crucial as companies worldwide strive to reduce their carbon footprint and do their part to protect the environment.
- The social factor concerns how a business communicates and interacts with the communities in which it operates. It examines internal policies related to, for example, inclusion relationships with employees, customers, and other stakeholders. Workplace health and safety, product quality, and consumer protection are other important aspects that are taken into account.
- The governance factor focuses on the internal processes and policies that lead to effective decision-making and legal compliance. Governance includes the composition of the board of directors, remuneration of management, respect for shareholders' rights, and more. (ESG: Jak povinné měření udržitelnosti a společenského dopadu ovlivní firmy?, 2022)

The consolidation package implements the European Corporate Sustainability Reporting Directive (CSRD) into Czech law, which prescribes a new obligation to prepare a sustainability report under Section 32f et seq. of the Accounting Act. The directive represents a new framework for non-financial reporting (NFRD) and gives member states 18 months to implement it. The sustainability report replaces the non-financial report according to Section 32f et seq. of the Accounting Act in the version applicable until 31.12.2023. This obligation will be gradually applied in several waves. Sustainability reporting is intended to provide transparent information to understand an entity's sustainability impacts and the impact of

sustainability on its development, performance, and position. The CSRD aims to stimulate change in business practices and requires companies to provide a new level of disclosure. (Konsolidační balíček a nový zákon o účetnictví, 2023) & (Změny v Zákoně o účetnictví od 1. 1. 2024, 2024) & (Velký přehled ESG v roce 2024: Na co se připravit?, 2024) & (Mejzlík, 2024).

The CSRD imposes an obligation to verify sustainability reporting independently (external). This verification is required from the first implementation phase, but only at the level of limited assurance. Over time, specifically from 2028, the requirement for the verification level will increase to "reasonable assurance." By default, it is assumed that auditors will carry out the audits. (Mejzlík, 2024)

The first wave, from January 1, 2024, applies to business corporations, public interest entities with more than 500 employees, and large entities, even if they are not public interest entities. This obligation applies to banks, insurance companies, and securities trading companies in a regulated market with more than 500 employees. These entities in the Czech Republic include, for example, ČEZ, Škoda Auto, Komerční banka, Česká spořitelna. These companies must include a sustainability statement, often called an ESG report, in their 2025 annual report. (Konsolidační balíček a nový zákon o účetnictví, 2023) & (Změny v Zákoně o účetnictví od 1. 1. 2024, 2024) & (Velký přehled ESG v roce 2024: Na co se připravit?, 2024)

Figure 1 Stakeholders and timeframe of sustainability reporting obligations.

2025	2026	2028
Large companies and groups that have not been obliged to report under the NFDR so far	Small and medium-sized issuers of securities → Small and non-complex credit institutions and captive insurance companies	Companies based outside the EU that have a subsidiary or organizational unit in the EU and a turnover of more than EUR 150 million in 2 years.

Source: modified from Mejzlík, 2024.

During 2024 (for 2023), banks and investors are now required to report specific indicators regarding the share of loans provided and investments in green projects according to the criteria of the taxonomy of sustainable activities. This obligation focuses, in particular, on the green asset ratio, which expresses the proportion of exposures in line with the taxonomy compared to total assets. (Velký přehled ESG v roce 2024: Na co se připravit?, 2024)

The obligation to disclose ESG information will now affect many companies. In the Czech Republic, instead of the current 20 entities, it will be around 1500 entities. The sustainability report should be prepared and published for the first time for the financial year 2024. The sustainability report forms a separate part of the annual report. (Změna zákona o účetnictví transponuje CSRD do české legislativy, 2023)

With the growing demand for environmental and social change in the coming decades, investors and banks are increasingly channeling their capital into companies that can make these changes happen. ESG reporting also has an essential role in preventing malpractices such as greenwashing, which means providing misleading information about the environmental aspects of a company's products or services. In the long term, an ESG approach has been shown to drive turnover growth, attract talent, reduce costs, and build consumer trust. (ESG: Jak povinné měření udržitelnosti a společenského dopadu ovlivní firmy?, 2022)

Income Tax Report

The Income Tax Report provides critical information about the financial position of an entity. It contains the name of the accounting entity, the accounting period, a brief description of the activity, and the number of employees. The report shows total revenues, profit or loss, expenses of tax payable, and taxes paid. The data shall be organized according to a standard template and in an electronic format following a directly applicable European Union regulation. All data is compiled following European Union regulations and may include explanations for discrepancies in tax payments. (Act No. 563/1991 Coll., § 32m–32 r).

An accounting entity that is a business company that has a foreign branch or permanent foreign establishment for the given accounting period is obliged to prepare an income tax report for the first time for the second of two consecutive accounting periods in which the annual total net turnover reaches CZK 19 billion and for the last time for the first of two

consecutive accounting periods, in which the annual total net turnover does not reach CZK 19 billion. (Změny v Zákoně o účetnictví od 1. 1. 2024, 2024)

Draft of a new Accounting Act

The current Accounting Act of 1991 (Act No. 563/1991 Coll.) contains 10 parts with 40 sections. However, the draft of the new concept of the Accounting Act has a completely different structure and seeks to incorporate the structure and elements of IFRS. In its current form, the bill has 218 paragraphs.

Table 2: Draft amendment to the Accounting Act – contents.

PART	CHAPTER + PARAGRAPHS
OVERVIEW	I. Subject of regulation (§ 1) II. Objective and principles of financial reporting (Sections 2-26)
ACCOUNTING ENTITY AND ENTITY CONSOLIDATION	I. Basic Provisions on the Accounting Entity (Sections 27-29) II. Legal succession (Sections 30-31) III. Transfer of rights and obligations in the area of accounting (Sections 32-33) IV. Selected Accounting Procedures (Section 34) V. Types and categorization of accounting entities (Sections 35-41) VI. Consolidation Entities (Sections 42-57)
ACCOUNTING PERIOD	I. Definition of the accounting period (Section 58) II. Individual accounting period (Sections 59-66) III. Consolidation accounting period (Sections 67-68)
FINANCIAL REPORTING	I. Accounting and reporting currency (Sections 69-80) II. Valuation (Sections 81-101) III. Financial statements (Sections 102-120)
REPORTING OF INFORMATION OUTSIDE THE FINANCIAL STATEMENTS	I. General provisions on accounting reports (Section 121) II. Management Report (Sections 122-126) III. Sustainability report (Sections 127-138) IV. Report on payments to public budgets (Sections 139-143) V. Income Tax Report (Sections 144-149)
AUDITOR VERIFICATION OF REPORTED INFORMATION	(§ 150-153)
DISCLOSURE AND DISCLOSURE	I. Basic provisions on publication (Sections 154-158) II. Special cases of publication (Sections 159-161) III. Publication by a public sector accounting entity (Section 162)
BOOKKEEPING	I. General provisions on bookkeeping (Sections 163-171) II. Creation of accounting information (Sections 172-177) III. Inventory (Sections 178-181) IV. Special provisions on bookkeeping by a public sector accounting unit (Sections 181-182)
APPLICATION OF INTERNATIONAL ACCOUNTING STANDARDS	(§ 183-188)
MONETARY ACCOUNTING	(§ 189-199)
OFFENCES	(§ 200-209)
PERFORMANCE OF STATE ADMINISTRATION IN THE FIELD OF ACCOUNTING	(§ 210-212)
COMMON PROVISIONS	(§ 213-215)
TRANSITIONAL AND FINAL PROVISIONS	(§ 216-218)

Source: www.mfcr.cz, own modified.

A fundamentally different approach is already in the overall focus of the Act, which focuses mainly on financial reporting, conceived under IFRS. The historical development of Czech accounting legislation has so far been mainly focused on the accounting process as a form of recording operations in an accounting entity. As stated in Section 2 of the bill itself, to meet the objectives of financial reporting, this Act regulates:

- a) reporting of financial and non-financial information;
- b) verification of reported information and its publication;
- c) use of the reported information for state financial reporting and
- d) bookkeeping.

The terms assets, liabilities, debts, equity, contingent assets, and contingent debts, costs/expenses, and revenues **will be precisely defined in the law**. This will bring the law closer to international financial reporting standards. The definition will not differ from what we commonly include under these terms. Still, the current lack of a definition has sometimes caused problems in dealing with the innovations that the business world brings. Liabilities will have a new designation (newly, they will be debts), and provisions and accruals of liabilities will also be included (i.e., the current designation in the balance sheet as external resources will be abandoned). (Martíková, 2024)

The definition **of accounting entities** is more explicit: business entities, accounting units in the public sector, and accounting entities that are not established for business purposes, i.e., non-profit entities. The categorization of accounting entities applies to business and non-profit entities, with the adjusted values of limiting indicators expressed in the accounting currency concerning inflation for the previous accounting entity. (Březinová, 2024)

A new part of the so-called **monetary accounting** appears here. According to Březinová (2024), the replacement of „cash“ accounting with the term „monetary“ accounting can only be applauded. It is just another terminological term, „single-entry accounting“. From the point of view of the Income Tax Act, it is referred to as „tax records“. Both regulations are under the responsibility of one ministry, i.e., the Ministry of Finance, so it would be appropriate to unify this terminology. Perhaps we will be served by a one term for the same essence of evidence, as stated by Březinová (2024).

The area of **consolidation regulation** has now moved significantly directly under the statutory regulation (previously, it fell under implementing decrees and standards). However, it should be emphasized here that consolidation also includes the area of state consolidation.

However, one of the closest areas to IFRS is **valuation**. Valuation is one of the decisive accounting principles in accounting, and it is necessary to determine the appropriate valuation method and, subsequently, the valuation bases. Then, it is essential to decide on the moment at which assets and debts are valued.

The functional and reporting currencies have essentially already been covered by an amendment to the current law (see above). However, moments and methods of appreciation can be described as groundbreaking. We will now encounter:

1. Initial measurement (valuation) is the valuation at the time of recognition of an asset or debt. The book value is determined in this way as the primary book value.
2. A subsequent measurement (valuation) is at a different time than recognizing an asset or debt.

As a valuation base, it will be possible to use acquisition costs (referred to as expenses in the earlier version of the proposal), which is the sum of acquisition costs (i.e., performance purposefully incurred directly to acquire an asset) and ancillary acquisition costs (i.e., performance purposefully incurred directly to get the asset to a place that allows it to be used in an intended manner). From the point of view of the acquisition expense itself, the following can be valued:

- the nominal value of the cash flow, in the case of a monetary payment with a maturity of up to one year,
- the present value of the cash flow, in the case of a monetary performance with a maturity of more than one year (= the amount of the present monetary amount that corresponds to the future cash flow), or
- fair value (= the amount that would have been obtained from the sale of an asset or paid for the assumption of debt in an ordinary transaction between market participants at the time of valuation) in the case of a non-monetary benefit. This fair value is also used in subsequent valuation, depending on the type of asset.

Another valuation base is replacement acquisition costs. Compared to the current concept of the Accounting Act, there is a significant change, as it concerns not only costs that would have to be incurred for the acquisition of an asset but also actually incurred ancillary acquisition costs. A new feature is also the decommissioning cost, which, from the IFRS point of view, is applied to the valuation of fixed assets, e.g., in the case of provisions.

The subsequent valuation uses the equity value, which is considered to be the book value of the share in the business corporation, adjusted by the change in the amount of equity of the business corporation attributable to the share, i.e., it is the equivalent value of the equity attributable to the share. This concept has been possible so far when valuing securities as of the balance sheet date and fair value (see type of security).

From the point of view of adjustments to values in subsequent valuation, the new Accounting Act changes to a change in impairment in the form of impairment, which expresses the extent to which a return on the book value of an asset cannot be expected before this impairment is taken into account. Of course, the law continues to work with depreciation, which expresses an asset's decrease in economic benefits during its useful life. Depreciation is determined by the entity systematically, considering the residual value.

And how will the new law deal with the composition and content of **the financial statements**? The introduction to this part of the Act regulates the issues of the reporting currency. A specific currency is no longer defined as a functional currency (so far, it is the euro, the US dollar, or the British pound). According to the proposal, the financial statements will consist of the following very briefly: the financial statements and the annex to the financial statements, which contains accounting information explaining and supplementing the financial statements so that the financial statements meet the requirement of an accurate and fair view. In paragraph 2, it can be expected that the following are considered to be financial statements:

- balance sheet, which is a statement providing accounting information on the financial position;
- the profit or loss statement, which is a statement providing accounting information on financial performance;
- a cash flow statement, which is a statement providing accounting information on cash flows; and
- statements of changes in equity provide accounting information on changes in the financial situation in the form of increases and decreases in the equity components.

The Ministry of Finance shall issue a decree specifying the more detailed content of the financial statements, the arrangement and content of their items, and the content and arrangement of the notes to the financial statements.

Another significant change affecting many entities is the **new concept of leasing**, which is also addressed by the new IFRS 16 – Leases (issued in 2016 with validity from 2019), which will be binding for medium-sized and large entities. For small and micro accounting entities, reporting will be voluntary, or simplified reporting will be enabled, not requiring adjustments to values using the present value. The fundamental essence of its reporting is that the leases will be reported to the assets directly on the balance sheet as „right of use” and will be subject to time value and depreciation (these assets are now part of the off-balance sheet records) and at the same time as a debt. This concept of leases will, therefore, significantly impact the balance sheet total and financial analysis indicators.

However, the upcoming changes are also much more profound, as they will affect individual accounting categories and items, and their wording will then be modified in implementing decrees or in the standards themselves. According to the plans of the Ministry of Finance, the long-awaited new Accounting Act, which was supposed to come into effect on January 1, 2025, will not be effective until 2026 at the earliest. However, it can be assumed that it will probably not come into effect until 2027. This Act will bring about fundamental conceptual changes in Czech accounting legislation, including related tax and legal regulations, which will require investments in accounting education and systems (Deloitte, 2024).

4 Conclusions

The long-term increasing pressure to modernize Czech accounting legislation and its alignment with IFRS/IAS is now becoming more realistic. However, the date of validity of the new Accounting Act is still postponed. The proposed law should reflect a new understanding of financial reporting to achieve comparability in the European context. The current legislation of the Accounting Act is based on legislation created in 1991. It is, therefore, clear that it is often no longer sufficient for the current economic reality. A partial adjustment took place in the so-called consolidation package in 2023

and came into force for this year. Still, a substantial change is expected in the complete amendment of the entire legislation - i.e., from the Accounting Act through the implementing decrees to the standards themselves.

Overall, the new legislation brings essential changes that improve accounting information's transparency, relevance, and reliability according to European and international standards. These measures contribute to strengthening the confidence of investors and other entities in the Czech economy. The upcoming changes will bring improvements in the area of accounting and financial reporting in the Czech Republic, but at the same time, they will require a careful evaluation of specific information about the main activity of the units, which cannot be readily ascertained from the statements. Preparing sustainability reporting (ESG) aims to provide transparent information on an entity's sustainability impacts, development, performance, and position.

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Cultural and Creative Industry from the Perspective of the Municipalities and Cities

Miroslava Vlčková¹, Růžena Štemberková²

Abstract: Cultural and creative industries (CCI) represent an important sector that combines economic, social and cultural contribution to the development of regions. As part of this article, a questionnaire survey was conducted among municipalities with more than 2,500 inhabitants in the South Bohemian Region, the aim of which was to determine the state and potential of cultural activities and facilities in these municipalities. The questionnaires focused on the availability of cultural events, the availability of cultural facilities, the involvement of different target groups, cross-border cooperation and further education opportunities. The results showed that most municipalities are trying to support cultural life but are struggling with a lack of funds and qualified personnel. Further education of cultural workers is perceived by the municipalities as a key factor for increasing the quality of the services provided. The study emphasizes the need for greater support of cultural infrastructure from regional and state institutions. The results provide important data for planning the development of the cultural and creative sector in the region. The questionnaire survey is thus a valuable source of information for future strategic decisions in the field of culture and creativity.

Keywords: Cultural and creative industry, South Bohemia region, cultural activities, cultural and creative background.

JEL Classification: G32, G33, C35

1 Introduction

The term "cultural industry" was first introduced in 1944 by philosophers Theodor W. Adorno and Max Horkheimer in their book *Dialectic of Enlightenment* (Zuidervaart, 2015). They originally viewed industry and culture as two distinct concepts; however, today these terms have been merged into one (Němec, 2013; Hesmondhalgh, 2007). In the 1980s, the term "cultural industries" was also adopted by the United Nations Educational, Scientific and Cultural Organization (UNESCO), following the rise of cultural industries after the economic crisis of the 1970s (Power & Scott, 2004).

The cultural sector began to be seen as a potential driver for economic development. The first articles discussing the connection between culture and urban development were published in the U.S. in 1979, analyzing the role of art in Los Angeles (Markusen et al., 2008). Following this, the cultural industry gained more attention in Europe. By the late 1980s, European scholars and politicians started to advocate for the development of cultural spaces and activities as a means to revitalize neglected post-industrial cities (Markusen et al., 2008).

Cultural industries encompass a range of sectors, including film, television, music, literature, design, advertising, and other creative areas with economic significance. This sector is vibrant and involves the production, distribution, and commercialization of cultural and creative goods (DeBeukelaer, 2021; Pratt, 2004). On the other hand, the creative economy takes a broader perspective, focusing on jobs tied to creativity. In the UK, the Department for Culture, Media, and Sport defines the creative economy as including not only those employed within the creative industries but also creative professionals working in other sectors (Bakhshi et al., 2013). These industries drive job creation, open up new business prospects, generate value, and contribute significantly to overall economic progress (Hotho & Champion, 2011).

The term "cultural and creative industries" (CCI) is still relatively new in the context of the Czech Republic, even among professionals. However, we are now in a period where regions, cities, and municipalities are starting to recognize the significant role that CCI entities play. As a result, various studies and analyses are being conducted to map these entities. The CCI encompasses a wide range of activities, all of which are closely interconnected and rely on each other (Návrat & Dubová, 2014).

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In the Czech Republic, cultural and creative industries are characterized as "economic activities that build on creativity and talent. Unlike other cultural areas, CCI are not dependent on public funding, which means that they are more than 50% financially self-sufficient and form a significant part of the modern creative economy" (Vláda ČR, 2023). According to the definition, CCIs include "cultural and creative companies that have a predominantly commercial focus and are engaged in the creation, production, distribution or media dissemination of cultural and creative products and services" (Söndermann, Backes & Arndt, 2009).

Supporting cultural and creative industries in municipalities often requires cooperation between the public and private sectors. While large urban areas may have larger budgets for cultural events, in smaller municipalities funding for CCI can be more difficult. However, even here there are possibilities to support this area, for example through grants, subsidies from European funds or partnerships with non-profit organizations and private entities. The willingness of the local government to invest in the development of cultural infrastructure is also key (Bednář, a kol., 2013).

Řehák (2014) says that the cultural and creative industry represents an opportunity for economic and social development for municipalities in the Czech Republic. CCI brings new opportunities for creating jobs, supporting tourism and strengthening the local community. However, for its effective development, cooperation between local residents, the public sector and private investors is necessary, as well as a long-term strategy that takes into account the specific needs and potential of individual municipalities. If these challenges are overcome, CCI can become one of the pillars of sustainable development and the strengthening of local identity in municipalities throughout the Czech Republic.

The aim of this paper is to analyze the state and development possibilities of the cultural and creative industry in the municipalities of the South Bohemian Region with more than 2,500 inhabitants based on a questionnaire survey. The contribution focuses on the availability of cultural events and facilities, the involvement of target groups, the potential of cross-border cooperation and the possibilities of further education in the field of culture. The results of the survey will serve as a basis for strategic planning and support of the cultural sector in the region, with an emphasis on identifying challenges and opportunities for improving the cultural infrastructure and offer.

2 Methods

In the period from May to June 2024, a questionnaire survey was conducted aimed at ascertaining the state and development possibilities of the culturally creative sectors (CCI) in the municipalities of the South Bohemian Region with more than 2,500 inhabitants. Data collection was done electronically through Google Forms, which allowed for efficient distribution and collection of responses. A total of 41 municipalities and towns from the entire South Bohemian Region were approached, including all districts - České Budějovice, Český Krumlov, Jindřichův Hradec, Písek, Prachatice, Strakonice and Tábor. 22 respondents filled in the questionnaire, which represents more than half of the municipalities addressed (53,7 %).

Data collection

The questionnaire survey was designed to provide data on various aspects of CCI, such as the availability of cultural events and facilities, target groups, opportunities for cross-border cooperation and further education of cultural workers. The questionnaire contained both closed questions (dichotomous, multiple choice, Likert scale) and open questions allowing respondents to express their opinions and specific suggestions.

Structure of the questionnaire:

- Basic information about the municipality: size of the municipality, number of inhabitants, geographical location.
- Cultural facilities and events: questions focused on the number and types of cultural facilities (theatres, libraries, galleries, etc.) and the frequency of organized events.
- Target groups and their involvement: questions determining which population groups participate most in cultural life (youth, seniors, families, etc.).
- Cross-border cooperation: mapping the possibilities and current state of cross-border cultural cooperation, especially with Austrian regions.
- Educational opportunities: finding interest in further education and improving the qualifications of cultural workers.
- Funding and support: questions about the availability of finance for culture and forms of support from regional, state and European funds.

Data analysis

Data evaluation and analysis took place between July and August 2024. The data were first cleaned of incomplete and irrelevant responses and then analysed based on descriptive statistics. The first step of the analysis included calculations of mean values, medians and percentages of responses for individual questions. This step made it possible to identify basic trends, for example the frequency of cultural events in different municipalities, the types of most frequently used cultural facilities or the preferences of target groups.

3 Research results

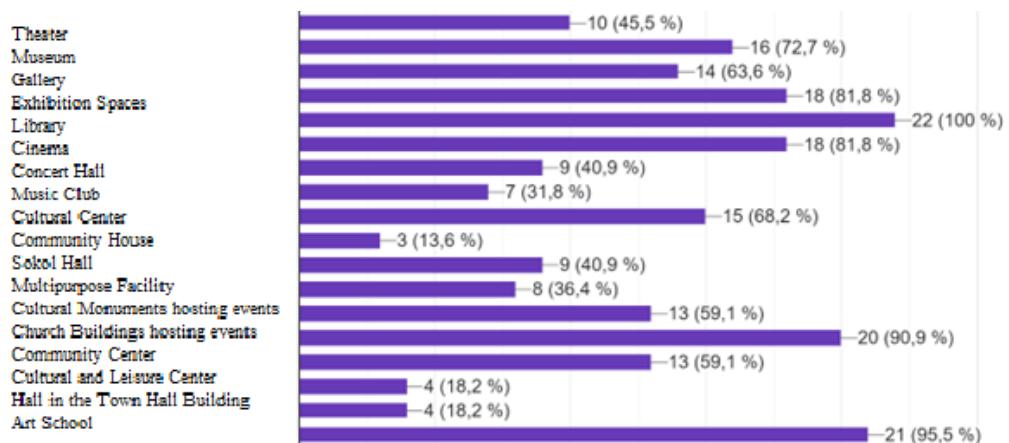
As part of the survey, the respondents were asked a total of 29 questions, while these questions were designed both as open and closed. In this post, the most important of them are selected and evaluated.

In the individual municipalities/cities, 1 to 3 people are most often involved in the cultural agenda at the municipal office, which is reported by 40.9% of respondents. Another significant group are offices, where 4 to 7 people participate in the cultural agenda, which is stated by 31.8% of respondents. At a smaller number of offices, namely 18.2% of respondents, more than 15 people participate in this agenda. Only 9.1% of respondents state that 8 to 15 people participate in the cultural agenda. No respondent stated that no one participated in the cultural agenda (0%). These results indicate that most municipalities and cities have a relatively small number of workers on the cultural agenda, with most authorities having between 1 and 7 people dedicated to this agenda.

First, it was found that the availability of cultural facilities in the municipality. Most municipalities (36.4%) rate accessibility as rather good, while 31.8% rate it as very good. Furthermore, 18.2% of respondents consider accessibility to be sufficient, neither bad nor good, and 9.1% rather bad. Only 4.5% of municipalities stated that accessibility is very bad. Overall, it can be said that most municipalities evaluate the availability of cultural facilities positively.

The question of what cultural, creative, culturally educational and similar facilities are located in the municipality was answered as follows:

Figure 1 Cultural, creative, culturally educational and similar facilities in the municipality



Source: Own processing

According to the graph, the most frequent answers show that the library (100%), elementary art school (95.5%), church buildings where cultural events take place (90.9%), and exhibition spaces (81.8%) are in the municipality with the largest number of respondents. On the other hand, only 3-4 municipalities have an association house, a cultural and leisure centre or a hall in the town hall building. Of the other (added) facilities, the respondents include the city park, the riverbank, the premises of the former rectory, the leisure centre.

As for the equipment and technical condition of cultural facilities, they are evaluated differently. The largest group of respondents (36.4%) consider the situation to be rather good. The same proportion (36.4%) assesses the situation as rather bad. Furthermore, 22.7% of respondents stated that the facilities and condition are sufficient, neither bad nor good. Only a small proportion of respondents (4.5%) rate the situation as very good. At the same time, it should be noted that most of the cultural facilities and infrastructure in municipalities are adapted for disabled people, and this infrastructure is used, as stated by 59.1% of respondents. Another 13.6% of respondents plan to build this infrastructure. On the contrary, 18.2% of respondents state that they do not have such infrastructure, and 9.1% of respondents have infrastructure, but it is not

used. These results indicate that most municipalities and cities strive to be accessible to people with disabilities, even if in some cases the infrastructure is not used or not yet built.

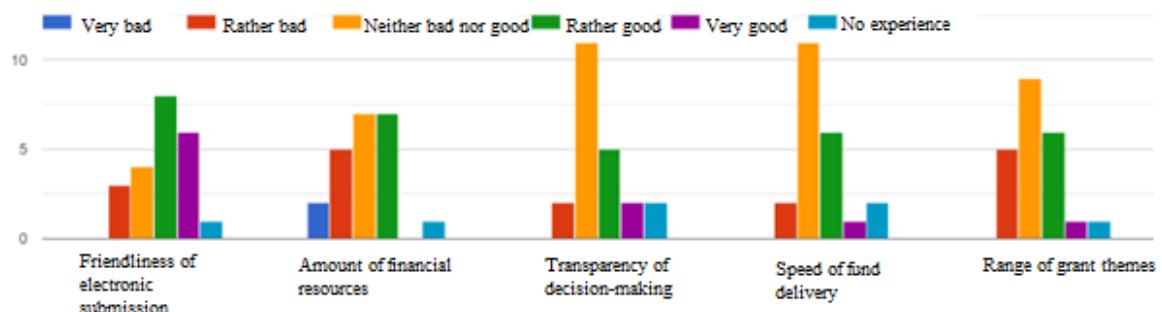
Regarding the number of organized events, the largest share of respondents (45.5%) stated that 16 or more cultural events are organized in their municipality per month. Another group of respondents (18.2%) states that 4 to 6 events are organized per month. The group of respondents with 7 to 10 events and 0 to 3 events per month make up 13.6%. The smallest share of respondents (9.1%) states that 11 to 15 cultural events are organized per month. These results indicate that most municipalities and cities have a rich cultural program with more than 16 events per month.

These events are intended for different target groups of the population. The largest share of respondents (45.5%) states that these activities are aimed at people of working age (31-65 years). Another important group are families with children, which represent 36.4% of the answers. A smaller share of activities is aimed at seniors (13.6%). Activities for young people aged 15-30 have the smallest representation (4.5%). Other groups, such as people at risk of cultural or social exclusion, are not represented in the graph. This result suggests that the greatest attention is paid to people of working age and families with children.

Similarly, attendance at cultural events is evaluated differently. The largest share of respondents (45.5%) states that attendance is medium, neither low nor high. The same proportion of respondents (22.7%) states that attendance is rather low, and likewise 22.7% of respondents rate attendance as rather high. Only 9.1% of respondents state that attendance is very high. No one rates attendance as very low. These results indicate that attendance at cultural events is mostly average, with some variability between individual municipalities and cities.

Regarding the experience of drawing support for culturally creative activities in subsidy programs, the respondents most often answered that they had "rather good" and "very good" experiences to the questions regarding the friendliness of electronic submission and the transparency of decision-making. This indicates that in these areas the respondents have positive experiences with receiving support for culturally creative activities in subsidy programs. On the contrary, the most frequent answers "very bad" and "rather bad" appear for the volume of funds and the thematic spectrum of subsidies. This result shows that respondents have negative experiences in these areas. Other results are evaluated in the following graphic representation.

Figure 2 Experience with drawing support for culturally creative activities in subsidy programs



Source: Own processing

This was followed by a question regarding opportunities for improvement in the area of drawing subsidy support. Out of ten options, the respondents answered as follows:

1. Greater connection of the cultural and creative sector to support programs (31.8%).
2. Simplification of the criteria for evaluating and approving applications (45.5%).
3. Providing training for effective project management (13.6%).
4. Improving the monitoring of results and impacts of financed projects (9.1%).
5. Providing better information about available opportunities (40.9%).
6. Creation of special programs tailored to the needs of specific industries (36.4%).
7. Increase in funds available for support (86.4%).
8. Greater transparency in decision-making processes (31.8%).

9. Providing more professional advice and support to applicants (9.1%).

10. Improvement of the process of applying for subsidies (59.1%).

These results indicate that the greatest need for improvement is in the area of increasing available funds and simplifying the processes of requesting and assessing subsidies, while less emphasis is placed on professional advice and support of applicants, as well as on monitoring the results and impacts of funded projects.

It follows from the above-mentioned questionnaire survey that in the municipalities of the South Bohemian region, the CCI plays an important role in improving the quality of life and developing the local economy. Cultural and creative activities can attract visitors, support local business and create new job opportunities. For example, holding cultural festivals, exhibitions and craft markets can attract tourists and encourage the consumption of local products and services. Municipalities that actively support cultural and creative activities can benefit from their contribution, among other things, in the field of tourism.

In the Czech Republic, there are several examples of municipalities that have successfully integrated cultural and creative industries into their development. For example, in municipalities with a rich historical tradition and heritage value, such as Český Krumlov, cultural heritage is linked with creative activities, which attracts tourists and supports the local economy. Another inspiring example is the restoration of former industrial sites into creative centres where studios, galleries and spaces for artist residencies are created.

4 Conclusions

The cultural and creative industry (CCI) represents a dynamic sector that has been gaining importance in the Czech Republic in recent years. It is an industry that relies on creativity, talent and innovation, covering a wide range of activities from art, design and architecture to digital media, advertising and cultural tourism. In the Czech context, the CCI concept is starting to be applied more not only in urban centres, but also in smaller municipalities, where it can have a major impact on the local economy, social cohesion and the quality of life of the inhabitants.

As it emerged from the questionnaire survey, despite the potential of the cultural and creative industry, municipalities in the Czech Republic face several challenges. Among the main ones are insufficient awareness of the importance of CCI, limited financial resources and the need for education in the field of cultural management. For the effective development of CCI, it is important to create strategic plans that take into account the specifics of individual regions and connect cultural activities with other areas such as tourism, education and local business. In the future, municipalities could focus on greater support for young artists and budding entrepreneurs in the creative industries, as well as the development of creative centres and hubs. Thanks to digitization and new technologies, the cultural and creative industries have a chance to expand into other areas as well.

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Harmonized Risk Indicators: A Matic Study of Potential Risks for the Pesticide Business in the EU-27

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Abstract: This study aimed to analyze the Harmonized Risk Indicator to study the potential risks for the pesticide business in the EU-27 (European Union-27). This study also focused on total pesticide sales to observe the progress of pesticide business in the EU-27 toward pesticide risk reduction. Data for pesticide sales for the EU-27 was obtained from the Eurostat database from 2011 to 2021. Data was analyzed for trends and regression using Microsoft Excel. The finding revealed that the pesticide market in EU-27 has grown significantly in previous years, and the trend has recently declined. Overall, pesticide sales increased in 2011 in EU-27 and decreased between 2012 and 2103. Sales increased significantly in 2014, 2016, and 2018. However, in 2019, sales saw a drastic decline; that could be a consequence of the COVID-19 pandemic. Again, a rise in sales from 2020 to 2021 was observed, but in 2022, a remarkable decline was observed in the pesticide business in EU-27. This study also discussed the risk reduction index based on the type of pesticide used, and analysis of the harmonized risk indicator showed that EU-27 has been very concerned with reducing the risk to human health and the environment from pesticides since 2011 and is using low-risk active substances and microorganisms to combat pests instead of active and toxic chemicals. It was concluded that the EU- 27 pesticide business fluctuated significantly by 2022, and rising food production demands and sustainable agricultural practices drove the risk reduction index.

Keywords: EU-27, Pesticide sale, Harmonized risk index, Pesticide business, Chemical pesticides, Risk Reduction

JEL Classification: G14, Q14, Q17

1 Introduction

Pesticides refer to a wide variety of substances, such as fungicides, herbicides, insecticides, rodenticides, nematicides, molluscicides, plant growth regulators, and others. Organochlorine (OC) pesticides, which had previously been used successfully to manage a variety of illnesses, including malaria and the disease typhus, were prohibited or limited in most technologically advanced nations in the 1960s. Other synthetic pesticides, such as organophosphate (OP) insecticide in the 1960s, carbamates in the 1970s, and pyrethroids in the 1980s, as well as herbicides and fungicides, introduced in the 1970s-1980s, made significant contributions to insect management and productivity in farming. Ideally, a pesticide should be fatal to the intended pests but harmless to other organisms, including humans. However, this is not the scenario, and the issue of pesticide usage and misuse has resurfaced. The common usage of these substances under the premise that "if something is beneficial, significantly more will be better" has wreaked havoc on humans and other living forms (Szpyra et al., 2016).

The key benefits are the consequences of the pesticides' actions or the immediate improvements anticipated from their usage. For example, eradicating caterpillars that feed on crops has the main advantage of increasing yields and improving vegetable quality. The three significant impacts result in 26 key advantages, which range from recreation grass preservation to human life savings. Secondary advantages follow the primary advantages but are less quick or visible. They can be invisible, more instantly visible, or long-term (Toan et al., 2021). As a result, secondary advantages are more challenging in demonstrating the relationship between cause and effect, but they can still be compelling arguments for

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pesticide usage. For example, increased cabbage output may generate more excellent cash for schooling for kids or health services, resulting in a healthier, more educated society. Secondary advantages have been reported, from improved physical fitness to biodiversity conservation (Rother, 2016).

Pesticide usage has resulted in enormous gains in forest products, public health, and the home realm - as well as the agricultural sector, which is critical to the Indian economy. Food grain output, at 50 million tons in 1948-49, had nearly quadrupled to 198 million tonnes by the last harvest of 1996-97 on approximately 169 million hectares of regularly planted land. This outcome was obtained by using productive seed types, modern irrigation techniques, and pesticides for agriculture. Similarly, outputs and productivity have grown considerably in most nations, such as the yields of wheat in the Kingdom of England and maize yields in the United States. Productivity increases have been attributed to a variety of variables, including the use of fertilizer, improved cultivars, and the use of technology (Sălceanu et al., 2023). Pesticides have become an essential component of the process, decreasing losses due to weeds, illnesses, and pest insects, which may significantly limit the quantity of harvestable products. Sánchez-Bayo (2021) also highlighted the dramatic gains in yields of crops in the US over the twentieth century. Szpyrka et al. (2016) said that "considerable economic losses" would occur if pesticides were not used, and they calculated the significant gains in production and economic margins that arise from pesticide usage. Furthermore, in the environment, the majority of pesticides undergo photochemical change, yielding metabolites that are largely non-toxic to both humans and the surrounding ecosystem.

The European pesticide business is dynamic to the region's agricultural sector. The primary goal of pesticide application is to protect crops from numerous hazards. These dangers include pests, illnesses, and weeds, which can injure or damage crops. As a result, this sector is critical in maintaining good health and producing the region's farming products. In 2021, Europe utilized 505.16 thousand metric tons of pesticides, representing 14.3% of total agricultural pesticide usage globally (Alix & Capri, 2018).

Although there is substantial debate over agriculture's environmental responsibility, the average usage of pesticides in Europe has not decreased in recent years. In reality, the detrimental impact is growing, as many recently released synthetic pesticides may be used in small amounts yet are more harmful. Between 2011 and 2020, pesticide revenues in the EU were relatively consistent, at roughly 350,000 tons per year. In 2022, a little reduction was observed, although this is not yet a pattern. The great majority is utilized in the agriculture industry. Since 2011, the European Union (EU) has provided EU pesticide sales figures and an overview from the European Environment Agency (Böcker & Finger, 2017). The publication on the usage of pesticides, which might begin providing data regarding pesticide use in various agriculture uses, is still in the works. Remarkably, the EU is unable to gather and publish these figures, given that EU Regulation No 1107/2009 on the licensing of crop protection goods states in subsection 67 that each farmer must register crops and use pesticides and retain these records. Regulation No 183/2005 on feed personal hygiene specifies in its Annex I, section II, (2) (a) that "feed providers must, in particular, maintain documentation on any utilization of plant protection goods and pesticides" (Brankov et al., 2021).

According to the European Commission's 2017 pesticide data, "Pesticides are a source of contamination and directly impact the preservation of biodiversity, aquatic ecosystems, and landscapes. To guarantee that these consequences are addressed correctly, authorities must be able to assess the danger and extent of pesticide contamination. This would also help to improve the application of current environmental policy instruments and identify any outstanding policy gaps for dealing with pesticide-induced environmental pressures (Falcó et al., 2012).

Because these are unintended effects that society and ecosystems face in addition to the direct producer or consumer of the pesticide, the use of pesticides has long-term negative effects on non-target animals and the environment. These consequences are referred to as external costs, external effects, or externalities. Because producers and consumers do not consider these external influences when making decisions, externalities lead to inefficient market outcomes. Therefore, in order to keep an eye on and control pesticide use and the associated risks, regulatory limitations are needed. To measure and track the risk associated with pesticides, the European Commission use two Harmonized Danger Indicators. Adjuvants and active compounds are frequently found in pesticides (Street, 2023). Adjuvants improve a product's performance or usage, while active compounds control the pest. The weighting of the annual sales volumes of all active substances on the market is based on the active substance's classification into one of four risk categories, and this computation yields the Harmonized Risk Indicator 1. By raising the total number of emergency authorizations granted for active compounds by the same precise weighting as previously and then combining these findings with the total number of active chemicals on the market, the Harmonized Risk Indicator 2 is produced. The Harmonized Risk Indicator 1 decreased by 38% between 2011 and 2013 and by 6% from 2020 to 2021. Nonetheless, metrics that track pesticide

sales, such as the Harmonized Risk Indicator 1, can encourage the use of more dangerous pesticides at lower conventional application rates. Studies show that more complex risk indicators do not correlate well with quantity-based metrics (Scown et al., 2022).

Conventional agricultural techniques rely heavily on chemical pesticides to ensure crop output consistency and quantity while maintaining food safety. Pesticides are also employed in non-agricultural environments, such as forest products, on highways and railroads, and in urban areas, including public parks, playgrounds, and gardens. Some of these sites, particularly green spaces in cities, are often visited by the general public, especially youngsters and older people, whose wellness is more susceptible to pesticides. Pesticides' hazards to both people and the environment are determined not only by the inherent features of their components (e.g., active chemicals, co-formulants, additives) but also by how they are utilized, which includes application rate, amount, and manner, as well as the soil and crop type (Gamage et al., 2022).

Pesticide usage data are currently unavailable at the EU level but will be required beginning in 2028 under the Data on Farming Inputs and Output regulations. Simultaneously, since 2011, the EU has collected harmonized yearly pesticide sales statistics. Pesticide sales in the EU-27 were generally steady between 2011 and 2020, totalling roughly 350,000 tons annually. Sales fell in 11-member nations, with Czechia, Portugal, and Denmark seeing the worst declines. While Latvia and Austria had the fastest gains in pesticide sales, Germany and France saw the greatest total boosts in volume sold. These two nations, alongside Italy and Spain, account for the majority of active substance sales across most groupings, and they are also the EU's top four agricultural producers (Garcia-Caro, 2023).

Pesticide usage and danger in Europe are affected by broader global trends. Climate change affects pest dispersal, which may lead to higher pesticide use. Simultaneously, pesticide pollution diminishes organic pest management and promotes organisms to develop pesticide resistance, creating a vicious circle of greater pesticide use. In terms of politics, the cost increases caused by the Ukraine conflict are unlikely to influence pesticide sales significantly. This shows that policy initiatives are more important than pricing in lowering pesticide use. Finally, in our linked global food chain, pesticides prohibited in the EU continue to be sold to non-EU nations. This raises the possibility that livestock and food imports may be polluted with pesticide residues that are forbidden within the union (Paul Hay, 2018).

2 Literature Review

Pesticides, often known as plant protection goods or biocidal compounds, are chemicals that reduce, eliminate, or prevent the action of hazardous organisms. Pesticide usage significantly contributes to crop productivity, both in terms of quantity and quality. However, certain members of society are critical of these items and refuse to utilize them. Reasons for this rejection include potential health concerns for the population, negative environmental consequences, and difficulties in risk assessment. Furthermore, customers may dispute the professionalism with which pesticides are applied and the compliance with the legal rules (Moysiadis et al., 2021). Pesticide approval and usage laws across the EU contribute to the reduction of possible dangers. Plant protection products are marketed in the European Union following Regulation (EC) No. 1107/2009. The EU Directive 2009/128/EC offers an integrated structure for the long-term utilization of pesticides; its implementation is dependent on member states' national action plans. Different federal states may have varied standards for adopting national action plans based on legislative restrictions in EU member states. In Austria, for example, federal legislation governs the approval of plant protection products, but state rules govern their application and storage (Böcker & Finger, 2017).

In the EU, evidence of competence is necessary for professional pesticide usage in agriculture (Directive 2009/128/EC). This is to guarantee that the individual using the product has the knowledge and skills required to apply pesticides with chemicals correctly and in accordance with all applicable legislation. The particular qualifications for this competency document are determined by national and state-specific rules (Delahay et al., 2023). However, only competent individuals may carry out plant protection measures, and pesticides with authorized, active components (Regulation (EC) No. 1107/2009) may be employed in specific EU member nations following an exhaustive examination procedure. Furthermore, many instructions stated in the authorization process must be observed while administering pesticides, including the administration rate, the application techniques, and any waiting times (Leach & Mumford, 2011).

Pesticide sales in the EU fell dramatically in 2022, mainly owing to price increases. Pesticide sales in 2022 were around 322,000 tons, a 10% decrease from the previous year. Pesticides are marketed in the EU in three categories: "fungicides and bactericides" (43% of the total sales in 2022), "herbicides, haulm destroyers and moss killers" (35%), and "insecticides and pesticides" (14%). In 2022, France (21%), Spain (18%), Germany (15%), and Italy (14%) sold the most

pesticides in the EU. These four countries are the EU's leading agricultural producers. During 2011 and 2022, several EU nations experienced considerable reductions in pesticide sales. Italy (-37%), Portugal (-36%), and Greece (-33%) had the most significant reductions (Garazha et al., 2023).

In 2013, pesticide sales were about 360,000 tons. Spain (19.5%), France (18.7%), Italy (13.8%), Germany (12.3%), and Poland (6.2%) were the countries in the European Union with the largest pesticide sales, accounting for 70.5% of the EU-28 total. Fungicides and bactericides remained the most popular pesticides, accounting for 42% of total sales, followed by herbicides, haulm destroyers, and moss killers (35%). Together with the group 'Other plant protection products' (13%), the three groups accounted for 91% of pesticides marketed in the EU-28 in 2013 (Alonso González et al., 2021). Insecticides and acaricides accounted for 5% of overall pesticide sales, followed by plant growth regulators at 3% and molluscicides 1%. They considered that specific member states of the EU, Spain, France, Italy, and Germany, are at the top of the list regarding pesticide sales by group and overall pesticide sales. Spain had the largest market for insecticides and acaricides (6.7 thousand tonnes) as well as other plant protection goods (17.3 thousand tonnes). Italy had the highest volume of sales of fungicides and bactericides at 32.9 thousand tonnes, while France placed first in herbicides, haulm destroyers, and moss killers with 27.8 thousand tonnes, as well as molluscicides with 1.1 thousand tonnes. Germany sold the most plant growth regulators in 2013, accounting for 2.9 thousand tons (Atwood & Paisley-Jones, 2017). The top four nations' trends did not always hold true. In Poland, for example, 12.5 thousand tonnes of herbicides, weed destroyers, and moss killers, 1.3 thousand tonnes of insecticides and acaricides, and 1.5 thousand tonnes of plant growth regulators were supplied. The United Kingdom was likewise in the top four for molluscicide and plant growth regulator sales (0.1 thousand tonnes), with the Netherlands coming in fourth with 3.0 thousand tonnes (Umetsu & Shirai, 2020).

The amount of pesticides sold each year can be linked to other data directly connected to the consumption of pesticides. Compares the amounts of pesticides sold for every country's utilization of agricultural land, and the nations that are members are ranked based on the number of pesticides (kilograms) per hectare UAA. Bulgarian had the smallest share of pesticide sales per hectare, at 0.24 kg/ha. Pesticides sold in Estonia, Ireland, Latvia, Sweden, Romania, Lithuania, and the United Kingdom totalled less than one kilogram. Only Italy ranks among the top four for pesticide sales per hectare, at 4.01 kg/ha. Malta had the most excellent pesticide use per hectare, with a figure of 13.59 kg. Sulfur is the most significant active chemical marketed and used in Malta, accounting for around 65% of the total sales and over 90% of all active compounds utilized. Netherlands, Belgium, Italy, Spain, Portugal, Greece, Germany, and France sold more pesticides per hectare than 2 kg/ha (Goffart et al., 2022).

Since the European Parliament passed the EU Directive (EC) No 128/2009 (SUD), a general framework for ensuring sustainable utilization of pesticides has been established, and European Union (EU) Member States have created National Action Plans in compliance with this Directive. Pesticides, goals, and quantitative objectives were explicitly developed for EU member states. As a result, the EU Commission created a risk assessment technique based on two harmonized risk indicators: HRI-1 and HRI-2 (Marchand & Robin, 2019). The present research focuses on HRI-1, which can be adopted nationally. Each EU Member State submits yearly harmonized risk indicators to the European Commission based on computations with their data and findings. However, only the EU Commission can determine this HRI-1 (concatenated) indication at the EU level. As a result, the current study seeks to shed light on the methodology utilized by the EU Commission to produce this HRI-1 and explain these figures. Data from 27 European Member States were examined. These figures have been correlated to data released on the EU Commission's website. Virtual advancements are planned, such as the shift in and development of active substance statuses (Bregaglio et al., 2022).

Pesticides are used in every aspect of the agricultural industry in European countries, from farms to marketing networks. Following 1945, the goal of boosting agricultural output resulted in an intensification of farming that heavily relied on machinery, fertilizers, and pesticides. The growth of agricultural methods based on sowing a less diversified variety of crops at higher densities was made possible by high-yielding cultivars, fertilizers, and pesticides. However, this sometimes increased pests (hereafter referred to as unwanted insects, fungi, weeds, and diseases). Pesticides provided reasonable crop pest control in the environment, which helped transform the agricultural system. Agricultural intensification, which has increased production per hectare and worker while expanding farm size at the price of biodiversity, has been made possible by pesticides, fertilizers, and technology (Tang et al., 2021). Farming systems have grown more specialized and streamlined, resulting in fewer natural restrictions and more pesticide use to manage pests. As a result, these systems have become increasingly dependent on chemical inputs. The widespread application of permanent and comprehensive pesticides is currently one of the primary causes of a decline in ecological functions and natural pest control, encouraging the use of further pesticides. In parallel, the appearance of pesticide resistance due to their widespread usage has resulted in a rise in their use. These two developments have led to the growth of a "pesticide

treadmill". Pesticides are presently the primary technique used to reduce the risk of crop losses as agricultural systems become more simplified. Furthermore, the growth in farm size and decline in the proportional share of family ownership regarding capital and land has persisted throughout the previous few decades, resulting in an increased reliance on foreign labour (Alvarez et al., 2023).

The low percentage of family members in the total labour force and the utilization of contract employment are frequently associated with increased pesticide use. The goal of maximizing output, which is not necessarily driven by economic logic, might contribute to excessive pesticide use. Furthermore, peer assessment, viewed as the norm, has an impact since farmers' reductions in pesticide use tend to be heavily impacted by whether other farms likewise drop. Upstream and downstream industries have been arranged to assist and benefit from agricultural intensification, resulting in a technical lock-in to pesticide usage (Helepciu & Todor, 2021).

Agricultural machinery manufacturers and plant breeding farms have concentrated their efforts on technology and species appropriate for intensive farming practices. The types chosen and marketed are those whose traits allow for the optimization of processing technology without regard for disease susceptibility. Pesticide corporations often promote pesticide usage in their promotional and marketing techniques, as they are the primary counsellors to farmers. Furthermore, extension services continue to be dominated by ways geared at finding only one answer to each problem, with little focus on systemic methods that address a group of problems or suggest improvements in many areas at once (Bub et al., 2023). Furthermore, the absence of value chains for novel crops that might aid crop diversification is frequently cited as a significant impediment to agroecological transformation and pesticide reductions. Aside from this issue, the inability to generate more value throughout all sectors is the most significant barrier to pesticide-free practice implementation. Farmers have little motivation to employ these procedures since the goods they produce do not command more excellent prices than traditional ones. Implementing pesticide-free techniques in specific industries (e.g., vegetables and fruits) may also be hampered by market needs for undamaged products. The market seldom considers pesticides' influence on individuals or the environment (Sarkar et al., 2021).

3 Materials and Methods

Total pesticide sales and potential risks for pesticide business in EU-27 were evaluated by observing harmonized risk indicators. This study utilized analytical methods based on the secondary data from Eurostat on pesticide sales in the European Union, and data was gathered from 2011 to 2022. For potential risks for pesticide business in EU-27, - a harmonized risk indicator was observed for each chemical used as a pesticide from 2011 to 2022; the parameters were included: 1) pesticides - harmonized risk indicator 1 (all active substances), 2) low-risk active substances 3) low-risk microorganisms, 4) low-risk chemical active substances, 5) active substances, 6) microorganisms, 7) chemical active substances, 8) active substances candidates for substitution, 9) active substances for substitution not classified as non-carcinogenic, 10) active substances candidates for substitution classified as carcinogenic, and 11) non-approved active substances. This indicator, presented as an indicator relative to a 2011-2013 baseline set to 100, helps measure progress toward pesticide risk reduction. The keywords used for the paper as a whole were pesticide sale, agri-businesses, agricultural growth, EU-27 pesticide business, total pesticide sales in the EU, chemical pesticides, Harmonized risk indicator, and pesticide active substances. Research engines used in this study were Google Scholar, Scopus, and other worldwide and regional information sources.

Formula of harmonized risk indicators for agricultural pesticide:

$$HRI = \frac{\text{Active Ingredient Usage} \times \text{Hazard Classification}}{\text{Baseline Year Risk Indicator}}$$

where

Active Ingredient Usage: The amount of pesticide used.

Hazard Classification: Based on categories like carcinogenicity or acute toxicity.

Baseline Year Risk Indicator: Standard value for historical comparison.

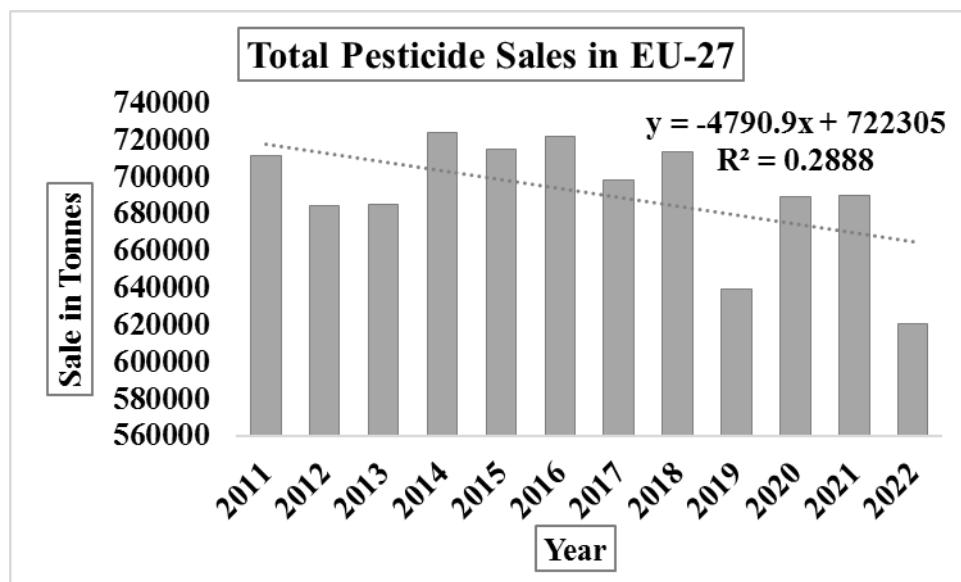
MS Excel analyzed data and outcomes and presented them in a classified manner using graphical representations and heat maps.

4 Results and Discussions

The pesticide market in EU-27 had grown significantly in previous years; recently, the trend has been observed toward declining. Figure 1 depicts the total pesticide sales in the EU-27 from 2011 to 2022. Overall pesticide sales were more

significant in 2014, 2016, and 2018, at around 723806.8, 721990.3, and 713734.8 Tonnes, respectively. Pesticide sales in EU-27 increased in 2011 and decreased between 2012 and 2013. However, from 2014 to 2018, an increase was observed in sales, while in 2019, sales saw a drastic decline (639269 Tonnes). It could be the consequences of the COVID-19 pandemic, and mobility was suspended due to the lockdown. From 2020 to 2021, sales rose, but in 2022, a remarkable decline (620400.3 Tonnes) was observed in the pesticide business in EU-27. Several interconnected elements, such as agricultural practices, regulatory frameworks, and economic situations, impact the rise of overall pesticide sales in the EU-27. Despite legislative attempts by the EU to lessen dependency on pesticides, the need for increased agricultural yields encourages the usage of pesticides. More pesticide use is required due to increased pest damage brought on by climate change and intensified agriculture. Pesticide use is correlated with higher GDP per capita because wealthier areas often invest more in agricultural inputs. Higher sales are also a result of favourable pesticide selling prices and increased real income. Though designed for safety, the EU's strict regulations may unintentionally prevent using biopesticides, increasing the need for conventional pesticides.

Figure 1 Total Pesticide Sales in EU-27

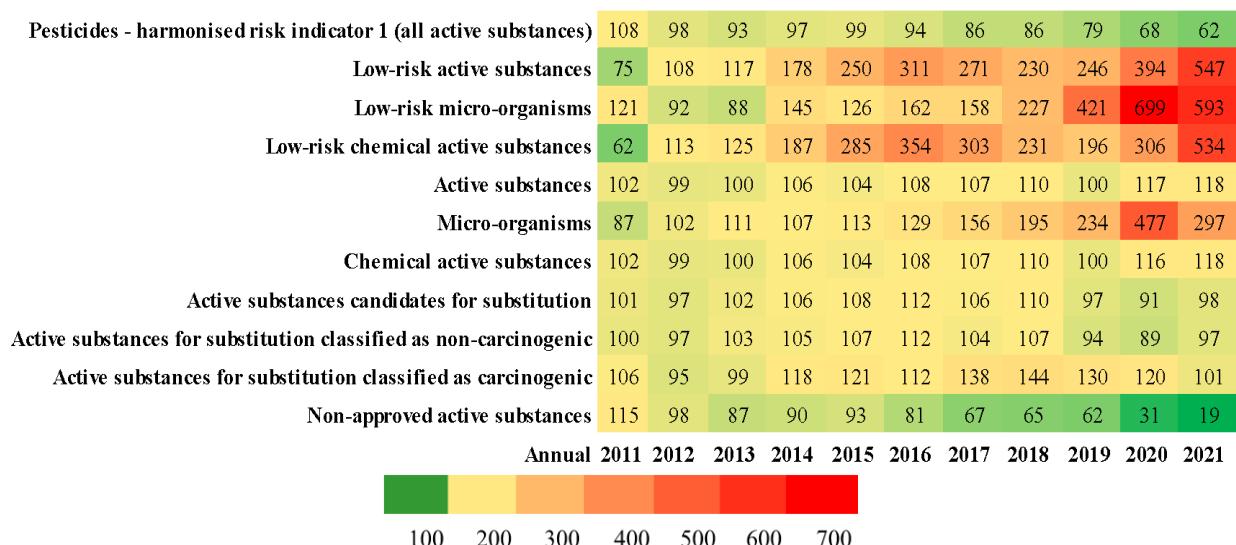


Source: Own processing

There are serious health and environmental issues raised by the EU-27's growing overall sales of pesticides. This tendency has a wide range of effects on human health, agricultural sustainability, and ecosystems. The Harmonized Risk Indicator for Pesticides is a comprehensive method for evaluating and estimating the potential risks associated with pesticide use in EU-27. This indicator provides essential information on the total risk level induced by pesticides in Europe, considering factors including toxicity, exposure, and environmental consequences. In this regard, data was collected from the Eurostat database and analyzed for Harmonised Risk Indicator for pesticide use in the EU-27 from 2011 to 2021, as represented in Figure 2. In 2011, Pesticides - harmonized risk indicator 1 (all active substances) was recorded at 108 indexes and in 2021, the reduction index was 62, which showed that the use of all active substances pesticides has declined in EU-27. In 2011, the use of low-risk active substances and low-risk microorganisms was recorded as 75 and 121 index, respectively and in 2021, the reduction index was high (547 and 593, respectively) because EU-27 countries started to use these substances in high amounts as pesticides as they are less toxic to the environment. The annual reduction index for low-risk chemical active substances was 62 in 2011, but it drastically increased (534 indexes) till 2021, which showed that EU-27 started to use low-risk chemical active substances pesticides for agricultural activity as a good indication to prevent future risk. The annual use of active substances was recorded at 102 indexes in 2011, but it increased (118 indexes) until 2021, which showed that EU-27 started using active pesticides for agricultural activity. The use of microorganisms as pesticides was 87 index in 2011, and it gradually increased to 297 index in 2021. The potential risk of chemically active substances was 102 index, and for active substances, candidates for substitution were 101 index in 2011 and 118 and 98 index, respectively, in 2021. The active substances for substitution were not classified as non-carcinogenic and had a 100 index in 2011 and 97 index in 2021, whereas active substances candidates for substitution classified as carcinogenic was 106 in 2011 and 101 index in 2021. The non-approved active substances index was 115 in 2011, whereas the 19 index was 202. The risk reduction index based on the type of pesticide used was also covered in this study. Analysis of the

harmonized risk indicator revealed that the EU-27 has been focusing on lowering the risk of pesticide-related health and environmental harm since 2011 and has switched from using toxic and active chemicals to combat pests with low-risk active substances and microorganisms.

Figure 2 Harmonised risk indicator 1 for pesticides use (Unit 100 index)



Source: Own processing

5 Conclusion

The study of harmonized risk indicators for the pesticide business in the EU-27 reveals significant insights into potential risks and regulatory challenges. The assessment of harmonized risk indicators for the pesticide business in the EU-27 reveals significant challenges and opportunities for improving environmental and health safety. In the EU-27, overall sale had noticeable up and down. The risk reduction index based on the type of pesticide used was also covered in this study. Analysis of the harmonized risk indicator revealed that the EU-27 has been focusing on lowering the risk of pesticide-related health and environmental harm since 2011 and has switched from using toxic and active chemicals to combat pests with low-risk active substances and microorganisms.

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Analysis of the Impact of Subsidies on Farm Performance Using a Mixed Effects Model

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Abstract: Agricultural subsidies are a key element of agriculture and have a major impact on international trade. In the European Union, the policy supporting agricultural incomes is called the Common Agricultural Policy, which is a complex system involving various instruments. The impact of this policy on the economic performance of farms is, therefore, an interesting topic, especially for policymakers. Czech agriculture has undergone major policy changes that have affected its position in the national economy and its importance at the regional level. Differences in natural conditions, as well as economic and social inequalities, continue to affect the level of gross agricultural production. Using a mixed-effects model, this study analyzed data from 10 South Bohemian farms (2012–2021). Results indicate that subsidies have a positive but statistically insignificant effect on economic performance, while assets positively and significantly contribute to profitability. Conversely, liabilities and investments in long-term assets negatively impact economic performance. These findings highlight the importance of asset management and cautious debt strategies for farm sustainability.

Keywords: agriculture, subsidy, mixed effects model

JEL Classification: Q11, Q18

1 Introduction

The aim of this paper is to analyse the impact of the received subsidies on the economic performance of farms. Subsidies play a major role in supporting the agricultural sector, especially in post-communist countries, but their real impact on farm economic performance can be varied. This research will focus on assessing how statistically significant the impact of subsidies is on the financial stability of farms in the Czech Republic. Agricultural subsidies play a key role in supporting farmers, stabilization food prices and ensuring food safety. These financial supports can have various forms, including direct payments, tax breaks and price supports. Their purpose depends on the current agricultural policy.

Subsidies help stabilise farmers' incomes, especially in times of market volatility. They act as a financial cushion, allowing farmers to manage the risks associated with unpredictable weather, fluctuating market prices, and changing consumer demands. Subsidies reduce income variability and make it easier for farmers to plan for the future and invest in their operations. This is particularly important for small and medium-sized farming enterprises that may lack the financial resilience to withstand economic shocks (Jovanović & Zubović, 2019). Subsidies are essential for supporting food safety by ensuring that food remains affordable to the general public. Supporting the production of staple crops keeps food prices low, which is vital for low-income populations (Anderson et al., 2023). Although concerns exist about the environmental impacts of certain subsidies, efforts are being made to structure them in a way that supports sustainable agricultural practices. For example, investment subsidies encourage farmers to accept environmentally friendly techniques. However, there is a contradiction between environmentally friendly techniques and technologies in relation to the volume of agricultural production (Špička et al., 2009).

In many regions, especially in rural areas, agricultural subsidies contribute to the overall economic development of communities. The financial support provided to farmers stimulates local economies, creates job opportunities and improves the quality of life in rural areas. This is particularly important in countries where agriculture is the primary source of employment and economic activity (Goodwin et al., 2011).

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Subsidies also play a role in addressing income inequality in the agricultural sector. The financial support provided to small-scale farmers and marginalised groups levels the individual conditions of each farmer to a national average. However, it is important to design subsidy programmes carefully to avoid disproportionately favouring larger farms at the expense of smaller farms (Kirwan & Roberts, 2016). The productivity of different crops and the efficiency of input use are fundamental components that affect the farm's bottom line. The attitudes and behaviors of farm managers significantly affect profitability. Studies have shown that specific personal characteristics such as business objectives, temperament and growth mindset are associated with higher profitability. For example, a study conducted in the UK found that these factors can predict up to 40% of differences in farm profitability (O'Leary et al., 2018). Access to finance, especially credit, plays a crucial role in increasing farm profits. Research conducted in Sudan showed that farmers with access to microcredit had higher profits compared to those without access, although the overall impact of loans on earnings was limited due to small loan volumes (Ibrahim et al., 2013). This suggests that while loans can improve financial conditions, it must be significant enough to have a significant impact on production outcomes.

Another critical factor affecting farm profitability is the introduction of new technologies. Participation in discussion groups has been shown to facilitate farmers' adoption of technologies, leading to increased profits. In Ireland, farms that participated in these groups showed higher levels of profit, while reconciling other aspects such as farm size and location (Hennessy & Heane, 2012). Similar practices of conservation agriculture have shown in Bangladesh that adoption of techniques such as crop rotation and residue retention can reduce operating costs and increase yields, thereby increasing profits (Miah et al., 2020). Economic viability is often related to structural characteristics of farms such as size and capital intensity. Larger farms tend to be more viable, especially in regions where EU support is available to support income levels. A study in Italy revealed that farms with higher capital intensity and larger size are more likely to be economically viable (Coppola et al., 2020).

2 Methods

A mixed effects model was used to analyse the impact of subsidies on farm performance. This model is suitable for this analysis for several reasons. Each farm has specific conditions, such as different sizes, technological levels, geographical location, climatic conditions or management skills, which can affect its economic performance. Mixed effects capture these variabilities through random effects. Specifically, in this model, a random effect (u_i) is included for each farm, which allows estimation of the differences between farms without having to model each farm separately. This ensures that the model better describes the different characteristics of each farm. The data are panel (longitudinal), meaning that the data contain multiple observations for each farm over time (2012-2021). Individual farm results in different years are not independent, as results from one year may be affected by results from previous years. The mixed model accounts for this time dependence, for example through the autoregressive correlation structure (AR(1)), which is used by the model in this analysis. In doing so, the model correctly takes into account that the economic performance of a farm in one year can be affected by its performance in previous years.

Farms can vary in their approach to how they respond to subsidies and other economic factors. A mixed model allows us to analyze fixed effects, (West et al., 2014) such as the effect of subsidies or assets on the bottom line, while accounting for the fact that each farm can have different basic performance or different specific conditions that are not quite explained by fixed effects. If a classical linear model was used, it would ignore the structure of the data (i.e., the dependencies between repeated measurements for the same farm (Hebák, 2013). This could lead to incorrect or biased estimates of fixed effects such as the effect of subsidies. The mixed model accounts for this data structure, leading to more accurate estimates of the effect of subsidies and other variables.

The data were retrieved by field survey during 2023 in the territory of the South Bohemia Region. All data were strictly anonymized and summarized in an Excel file. The paper contains information on the performance of 10 farms for the years 2012-2021 (10 years) and includes various factors that may influence the economic result (variable influencing farm performance). Different variables such as subsidies received (subsidy), assets (assets), land and buildings (lb), stand-alone movable assets (prop), current assets (ca), liabilities (li), sales (sales) and financial performance (fr) were analyzed using a linear mixed model, specifically their impact on farm performance and how these impacts may vary between farms or over time. These are panel data (longitudinal data) that contain information on several farms at different points in time. All variables are numeric except for the letter designation of individual farms to maintain anonymization.

For the sake of clarity, the mathematical notation of the linear mixed model is given here, which will be adapted later for the purposes of RStudio using the "lme" function.

$$pro_{it} = \beta_0 + \beta_1 \cdot subsidy_{it} + \beta_2 \cdot assets_{it} + \beta_3 \cdot lb_{it} + \beta_4 \cdot prop_{it} + \beta_5 \cdot ca_{it} + \beta_6 \cdot li_{it} + \beta_7 \cdot sales_{it} + \beta_8 \cdot or_{it} + \beta_9 \cdot fr_{it} + u_i + \epsilon_{it} \quad (1)$$

The following are descriptions of each variable with explanations. The model includes both fixed effects (coefficients β_1 to β_9) and random effects (u_i) and the correlation structure of the residuals.

- pro_{it} : The value of the dependent variable "economic result" (pro) on farm i in time t .
- β_0 : Intercept (constant term) of the model.
- $\beta_1, \beta_2, \dots, \beta_9$: Fixed effects coefficients for each variable (subsidy, assets, lb, ...).
- $subsidy_{it}, assets_{it}, lb_{it}, prop_{it}, ca_{it}, li_{it}, sales_{it}, fr_{it}$: Values of the explanatory variables for farm i at time t .
- u_i : Random effect for farm i , capturing inter-farm variability.
- ϵ_{it} : The residual (residual) component that represents the random noise or error for farm i in time t .

Fixed effects: subsidies received, year. Random effects: Individual farms (each farm may have its own specific conditions and factors affecting economic performance).

The Excel file with the data was imported into RStudio, where the following code was used:

```
res = lme((pro) ~ subsidy + assets + lb + prop + ca + li + sales + fr, random = ~1 | Farm, correlation = corAR1(form = ~ year | Farm), data = Semi)
```

```
summary(res)
```

This code defines and runs (let down) a linear mixed model using the `lme()` function and then displays a summary of the results using the `summary()` function. The focus of this research is to analyze the impact of the subsidies received on the economic performance of farms. Subsidies are often considered as a key instrument to support the agricultural sector to improve the economic stability and performance of farms. However, the question remains to what extent these funds actually contribute to better economic performance.

For the purpose of the research, two main hypotheses were formulated:

H0: Subsidies have a positive effect on the economic performance of farms.

H1: Subsidies have a negative effect on the economic performance of farms

3 Research results

Based on the outputs from the RStudio of the linear mixed-effects model, it is possible to interpret the influence of various factors on the economic performance of farms (pro) in the South Bohemian Region between 2012 and 2021.

The model takes into account random effects at the farm level, which captures the variability between farms. The standard deviation of the random effect (2257.858) indicates that there are differences in the underlying economic outcomes between farms that are not explained by fixed variables, and this variability is quite large. The variance of the residual component (4287.9) is also substantial, indicating that the model captures some but not all of the factors affecting economic performance. The AR(1) correlation structure used suggests that the economic results for each year are not completely independent. The correlation parameter, Phi (-0.05286333), is very close to zero, indicating that the dependence of results between years is weak.

The fixed effects analysis shows the effect of each variable on the economic performance of farms. Subsidies (subsidy) have a positive effect on economic performance ($\beta = 0.1719$), indicating that an increase in subsidies could lead to an improvement in farm economic performance. However, this effect is not statistically significant at 5% significance level ($p\text{-value} = 0.0861$), suggesting that the relationship between subsidies and performance is not unequivocal. Assets show a positive and statistically significant effect on farm economic performance ($\beta = 0.1371$, $p\text{-value} = 0.0003$). This confirms that farms with higher levels of assets tend to have better economic performance. Land and buildings (lb) have a negative and statistically significant effect ($\beta = -0.1183$, $p\text{-value} = 0.0009$). This result may indicate that heavy investments in long-term assets such as estates and buildings may burden farms in the short run and reduce their economic performance. Liabilities (li) also have a negative and highly significant effect ($\beta = -0.1636$, $p\text{-value} < 0.0001$), suggesting that higher farm indebtedness leads to lower economic performance. This is consistent with the expectation that higher liabilities

increase the financial burden on farms. Revenue (sales) and financial result (fr) are not significant factors affecting farm economic result, as evidenced from their statistically insignificant p-values (p-value > 0.05). This result may be surprising as one would expect higher sales and financial result to have a positive impact. It is possible that in this case these variables do not fully reflect the farm's complex economic situation.

The results of the analysis suggest that assets and subsidies have a positive effect on farm profitability, although the effect of subsidies is not statistically significant. Conversely, liabilities and investments in land and buildings have a negative impact on economic performance. Inter-farm variability plays an important role, which is captured by the random effects of the model. The model provides useful insights into the factors affecting farm economic performance, with assets and indebtedness, being the main determinants, while other variables are found to be less significant. Below is a summary of the model results.

```
Linear mixed-effects model fit by REML
  Data: semi
      AIC      BIC      logLik
  2009.341 2039.471 -992.6705

Random effects:
 Formula: ~1 | Farm
 (Intercept) Residual
 StdDev:    2257.858 4287.9

Correlation Structure: AR(1)
 Formula: ~year | Farm
 Parameter estimate(s):
   Phi
-0.05286333

Fixed effects: (pro) ~ subsidy + assets + lb + prop + ca + li + sales + fr
   Value Std.Error DF t-value p-value
(Intercept) -758.4811 1491.5843 82 -0.508507 0.6125
subsidy      0.1719 0.0990 82 1.737136 0.0861
assets       0.1371 0.0365 82 3.761338 0.0003
lb          -0.1183 0.0344 82 -3.442897 0.0009
prop        0.1075 0.0804 82 1.336532 0.1851
ca          0.0212 0.0559 82 0.379465 0.7053
li          -0.1636 0.0351 82 -4.657343 0.0000
sales       -0.0147 0.0173 82 -0.852093 0.3966
fr          -0.3712 0.5526 82 -0.671723 0.5036

Correlation:
 (Intr) subsidy assets lb      prop      ca      li      sales
 subsidy -0.535
 assets  0.015  0.019
 lb      -0.006 -0.176 -0.930
 prop    -0.173 -0.011 -0.467  0.349
 ca      -0.268 -0.152 -0.383  0.345  0.175
 li      0.189  0.045 -0.715  0.669 -0.061 -0.065
 sales   0.106  0.200 -0.081  0.082  0.320 -0.757  0.090
 fr      -0.014  0.094 -0.397  0.324  0.593 -0.043  0.282  0.308

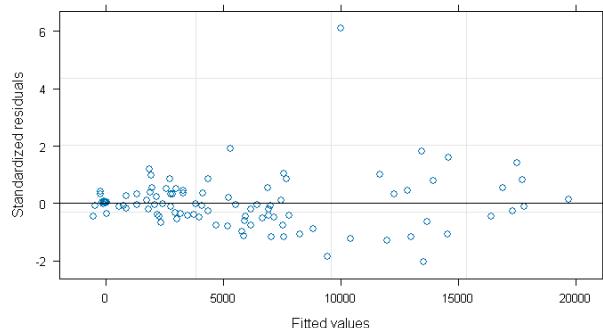
Standardized Within-Group Residuals:
   Min     Q1     Med     Q3    Max
-2.05229509 -0.44905118 -0.04031984  0.33793281  6.12138304

Number of Observations: 100
Number of Groups: 10
```

3.1 Robustness checks and post-estimation diagnostics

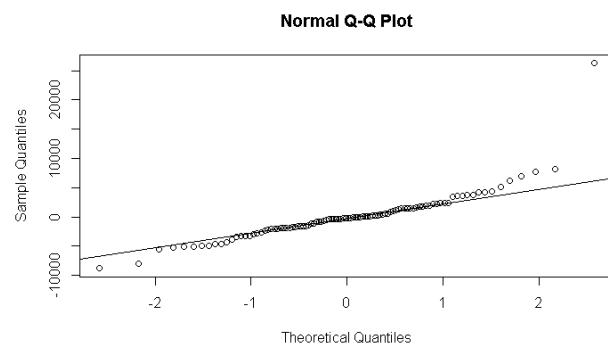
Graphs for residual tests, normality tests, autocorrelation tests and Durbin-Watson (DW) test are an essential part of the diagnostics for mixed effects models (and other statistical models). These tests and plots help to verify that the model correctly describes the relationships in the data and that it meets the basic assumptions for the reliability of the estimates, especially when analysing the impact of subsidies.

Graph 3 Residual Tests



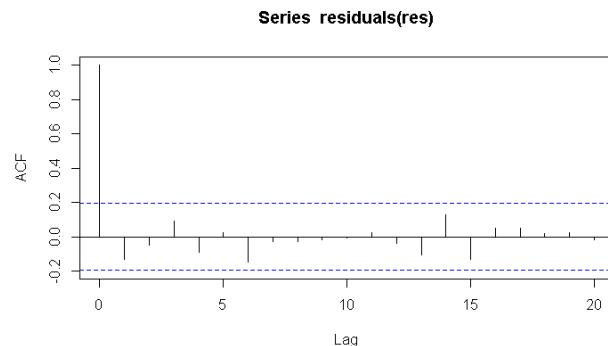
Source: Own processing from RStudio

Graph 4 Normality Tests



Source: Own processing from RStudio

Graph 5 Autocorrelation Tests (AFC)



Source: Own processing from RStudio

The ACF plot shows a mild negative autocorrelation at lower lags, which means that results from one year may be mildly affected by results from previous years. This weak dependence has been partially accounted for by using an AR(1) structure in the model, which suggests that the model is relatively well-specified, but there is still a slight time dependence.

DW

- **lag** Autocorrelation **D-W Statistic** **p-value**
- 1 -0.2217271 2.442986 0.01
- **Alternative hypothesis:** rho != 0

The residuals plot shows whether the residuals (prediction errors) of the model are randomly distributed. In tests of residuals from the analysis, it can be seen that the dispersion of the residuals is not completely uniform. There are some variations, which may indicate that the model is not predicting certain aspects of farm performance accurately.

Based on the displayed Q-Q plot, it can be concluded that the residuals partially deviate from the normal distribution, especially at the extremes. This suggests that the distribution of residuals may not be completely normal, which could affect the results of significance tests. Although small deviations may not be a problem, larger deviations could lead to biased results.

Autocorrelation plots (ACF) show whether residuals are correlated over time, which is especially important for panel data where results in different years may be dependent on each other. If the residuals show autocorrelation, it would mean that the model has not correctly accounted for the temporal structure of the data.

The Durbin-Watson test is a specific test for autocorrelation in the residuals. A D-W statistic value of 2.44 indicates that no significant autocorrelation is present (a value close to 2 is optimal). Based on this statistic, it can be assumed that the model successfully accounts for temporal dependencies between observations.

4 Conclusions

The conclusion of this paper confirms that the economic performance of farms in the South Bohemian Region during the period 2012-2021 is influenced by several factors, but the effect of subsidies on the economic result is not statistically significant.

The hypothesis that subsidies have a positive effect on the economic result of farms (H0) was not confirmed by the model results. Although the coefficient for subsidies was positive, suggesting that an increase in subsidies may lead to an improvement in farm profitability, this effect was not statistically significant (p-value = 0.0861). This suggests that within the analyzed period and data sample, it is not possible to say with certainty that subsidies significantly affect farm economic performance. This result may be due to the fact that subsidies are not the main factor influencing the long-term economic stability of farms, or that their effect is only manifested in combination with other variables.

The hypothesis that the other variables have an effect on the economic performance of farms (H1) was partially confirmed. In particular, assets (assets) emerged as a key factor with a positive and statistically significant effect on economic performance ($\beta = 0.1371$, p-value = 0.0003). This means that farms with more assets tend to have better economic outcomes, which is logical given that assets can provide farms with stability and the ability to respond better to market and weather conditions.

Other variables such as estates and buildings, (lb) and liabilities (li) show a negative effect on the economic performance of farms. This negative effect is statistically significant, which suggests that high investment in fixed assets such as real estate may reduce economic performance in the short run, probably due to the higher costs and debt burden associated with these investments.

An important aspect of the analysis was also the random effect between farms, which showed that there is significant inter-farm variability that is not explained by fixed variables. This means that, in addition to the analysed factors, there are other farm-specific conditions that affect their economic performance. These factors may include, for example, managerial skills, technological level, or geographical and climatic conditions, which have not been taken into account in this model.

Overall, this paper provides important insights into the factors affecting farm economic performance. While subsidies are not a major determinant of economic performance, assets and indebtedness appear to be key factors. These results suggest that support aimed at improving farms' access to assets and reducing their debt burden could have a greater impact on their long-term economic stability.

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A Comparative Analysis of Organic Crop Production in Different European Regions

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Abstract: This study aimed to analyze growth trends of different European regions for organic crop production in the agriculture sector up to 2023. This study also focused on a comparative analysis of organic crop production in different countries in European regions. Data for organic crop production for different European regions was obtained from the Eurostat database from 2011 to 2023 and analyzed for trends and regression using Microsoft Excel. Our findings revealed Poland from Eastern Europe, France from Western Europe, Finland from Northern Europe, and Italy and Spain from Southern Europe with the most significant overall organic crop production in 2023. Typically, better yields in organic farming in the southern region than in the other regions of Europe are due to good weather, which affects overall output. This study concluded that organic crop production is becoming increasingly significant in Southern Europe compared to other regions, greatly enhancing the region's agricultural sustainability and biodiversity preservation and busting the regional economy by promoting organic farming business. While organic crop production is generally on the rise, obstacles still exist to overcome before obtaining consistent growth and support throughout Europe.

Keywords: Agri-businesses, Organic farming, Eastern Europe, Western Europe, Northern Europe, Southern Europe

JEL Classification : G14, Q14, Q17

1 Introduction

Over the 10 years, the organic crops marketplace in various European economies has progressively grown, owing in part to regulations targeted at fostering the long-term sustainability of the farming industry within the framework of the idea of sustainable development, as well as financing from governments for the growth of the organic market. Such an increase, in particular, is aided by demand patterns and consumption of crops per person. From 2011 to 2013, there was a favourable trend of a rise in the total number of farmers (by 57.6%), particularly in the most industrialized countries of Europe. The EU accounts for 14% of all organic product farmers worldwide (Fernández et al., 2022). The European organic product market focuses on producing and consuming cereals, wheat, spelt oats, and a combination of the new season grains, green plants, and freshly harvested vegetables. The key obstacles to the market for organic foods until 2022 remained inadequate output to fulfil demand from customers, low agricultural performance, particularly in Europe's countries with the least developed economies, and the difficulties of introducing new methods of cultivation in organic agriculture (N. F. Zaruk et al., 2023). Agricultural difficulties will be significantly compounded, particularly due to the Eastern European food crisis created by the need to feed millions of migrants and seasonally displaced people.

According to Psuturi (2023), European countries accounted for over 2.6 million acres of land, or 21% of the total organic farming in Europe (12.1 million hectares). This indicates that European countries play a vital role in the organic market's evolution. The organic European countries' market is worth at least 524 million euros; however, most of the European agricultural marketplace is in a relatively undeveloped area. Most European countries' organic sectors have developed more slowly than others. Agricultural land area and farming growth did not correspond to equivalent expansion of markets or processing of goods network (N. Zaruk et al., 2023). The food recession, modifications to the consumer

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consumption framework, increasing food costs, and people migrating to other countries due to conflict or other reasons will all impact organic food marketplaces. As a result, it is essential to investigate the changes in agricultural sectors throughout Europe. The present work seeks to evaluate organic crop production in various European regions.

2 Literature Review

The academic literature constantly analyzed the establishment and growth of organic crop markets in various European regions; the primary research occurred from 2011 to 2023. During this time, the regulatory structure, organizations, and governmental regulations supporting organic agricultural farmers were being developed in conjunction with the European region's membership. The European organic food markets are characterized by a surplus of output over demand, a scarcity of materials needed for domestic agricultural processing facilities, and imports of processing products made from organic materials, all of which negatively influence regional development initiatives. According to research on the organic markets across several European regions, Kociszewski et al. (2023) discovered that Poland, Hungary, the Czech Republic, and Romania had the highest turnovers. Based on a different investigation, the organic business in various European domains was €260 million. The markets in each country have grown depending on the revenue relationships: in Bulgaria as well and Poland, the market developed multiple circumstances from 2006 to 2010; in the Czech Republic and Romania, the market developed multiple times from 2006 to 2020; in Estonia, the marketplace increased across the same period; and there was almost no market expansion in the country of Hungary and Slovakia. Solfanelli et al. (2022) organized the primary features of the Eastern European organic market: the Czech Republic market is the most established; Poland and the Baltic countries demonstrate the most rapid expansion, which includes farming; the Ukraine, Bulgaria, and Romania - the enormous market that started rapidly establishing regional organic markets and where improvement has been tracked to decreased stages; Hungary continues to expand at the slowest rate. Regional organic crops market growth activities in European countries are generally intensifying, particularly those aimed at exports. At the same time, the key issues in the Eastern European market are local farms' growth, access to international markets, and establishment of successful promotional networks. According to Peng (2019), in their research on the market for organic crop growth in Romania, local farms have significant challenges in developing official market networks; thus, they rely on producing items for their own consumption and unofficial sales. Consumers believe that a lack of market knowledge forces them to depend on food imports (Chiurciu et al., 2020). The researchers determine the factors that follow as significant obstacles to the growth of the organic sector in various European areas, such as encouraging and educating agricultural producers about technological advances in organic farming, guaranteeing the effectiveness of the supply chain, offering economies of magnitude from the processing of products and selling goods, advising customers and offering incentives to buy organic products, gathering encourage regulations, and demonstrating identifying and certification of products (Golijan-Pantović et al., 2022).

Investigating the organic market in many European countries in the past few years has shown promising possibilities. According to Pergola et al. (2018), adding additional countries to the EU following 2004 enabled increased organic output. On the contrary, organic production began flourishing across Europe due to the EU's official assistance. Solfanelli et al. (2019) discovered an increasing tendency in the organic market and a slowing rise in organic regions across the EU. Kotyza & Smutka (2021) found disparities in European countries' organic markets regarding client opinions on organic products, financial circumstances, manufacturing and transportation patterns, and export orientation. Francis (2020) investigated trends in organic farming using prior studies from several European locations. They discovered that organic farming increased in many countries after they joined the EU. However, in Europe, there are significant indications of the growing number of organic farms in their respective regions and the contemporaneous development of the organic crops market in each region.

3 Methods

This study conducted a comparative analysis of organic crop production across Eastern, Western, Northern, and Southern European regions. The selection of countries within these regions was based on the availability of comprehensive data on the key characteristics and trends of organic product markets from 2011 to 2023. This data provided the foundation for assessing organic crop production across Europe.

Statistical analysis was performed on organic crop production, focusing on total production volumes (measured in tonnes) over specified time periods. Data was sourced from the Eurostat database and analyzed using key evaluation indicators. The results were visually represented through graphs, including regression values for each country, to highlight regional trends and variations in organic crop production.

4 Result and Discussion

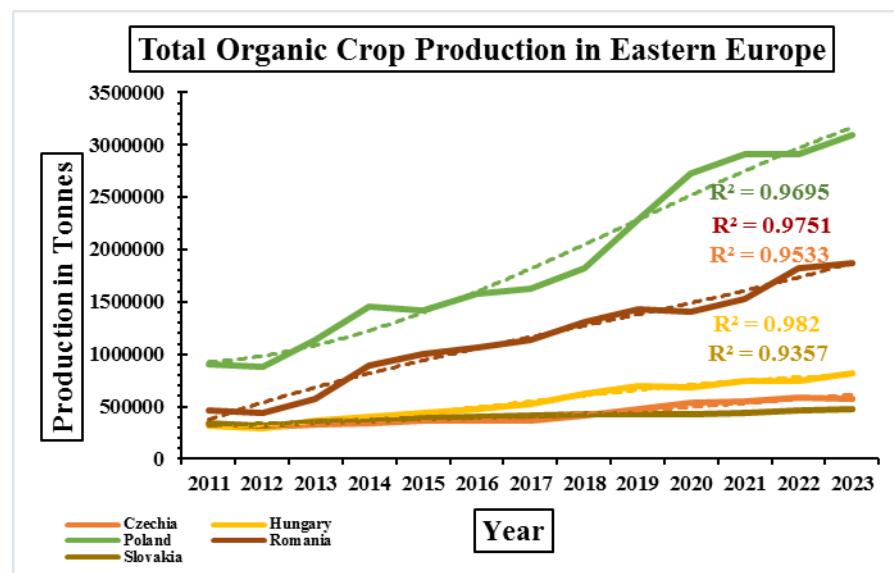
Europe has experienced a notable surge in the production of organic crops in Tonnes, and by 2030, the European Union (EU) hopes to raise the percentage of organic agriculture from 10 to 25%. Growing organic farming contributes to environmental benefits, including lower pollution and more biodiversity, which makes it essential to sustainable agricultural strategies. The effectiveness of organic farming, however, differs from country to country. While some, like France, Spain, and Italy, have led the way in developing organic farming, others have lagged behind because of a lack of understanding and support for programs like the Common Agricultural Policy (CAP). Our study focused on total organic crop production in different European regions.

4.1 Organic Crop Production in Eastern Europe

The total organic crop production in Eastern Europe is represented in Figure 1. The total organic crops produced in Czechia, Hungary, Poland, Romania and Slovakia were about 331 649, 320 312, 908 828, 463 703, and 337 836 Tonnes, respectively, in 2011. Total production was observed with continuous increase in Poland (309 411 Tonnes), Romania (186 672 6 Tonnes), and Hungary (824 294 Tonnes), and a slight increase in Czechia (579 579 Tonnes) in Slovakia (474 342 Tonnes) from the period of 2012 to 2023. Studies reveal that this trend in the production of total organic crops might remain increasing in Eastern European countries. In 2023, more than 405 5 thousand Tonnes of organic crops were produced throughout Eastern Europe. This region demonstrates a dedication to sustainable farming practices and biodiversity preservation by emphasizing the cultivation of grassland and fodder inside organic crop zones.

In addition, Eastern Europe produced many organic fruit crops such as citrus, olives, grapes, nuts, berries, and subtropical and temperate fruits. Despite economic downturns, Europe's domestic market values and the amount of land managed organically have grown steadily, suggesting a solid basis for producing organic crops there. Furthermore, the growth of organic plant production highlights the continuous initiatives to advance organic farming methods and advocate for safe goods for human health. With significant organic agricultural sectors found within the EU-13 group of Member States, including Poland, the Czech Republic, and Romania, it is clear that organic farming is expanding throughout Europe (N. Zaruk et al., 2023).

Figure 1 Total Organic Crop Production in Eastern Europe



Source: Own processing

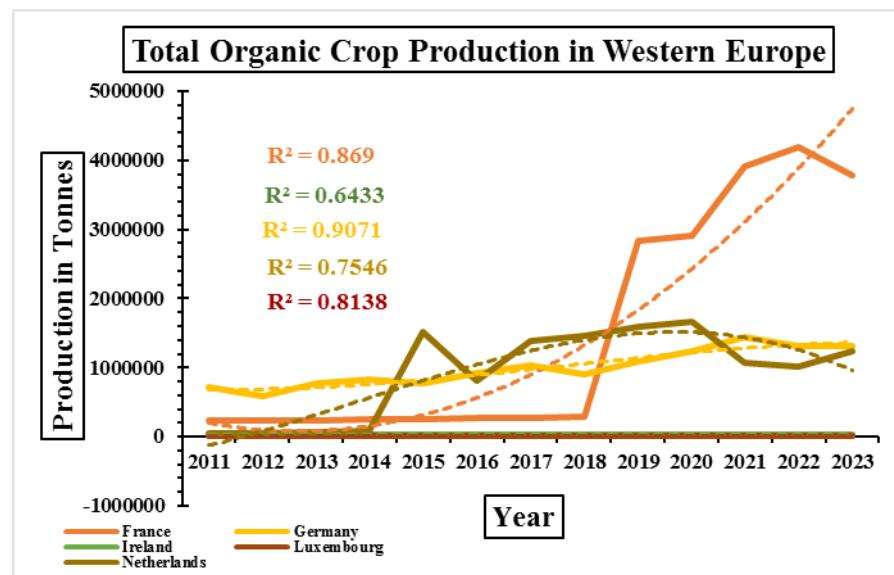
4.2 Organic Crop Production in Western Europe

The total organic crop production in Western Europe is represented in Figure 2. In 2011, France, Germany, Ireland, Luxemburg and the Netherlands produced about 237 748, 711 545, 297 36, 684 9, and 501 90 Tonnes of organic crop, respectively. From 2011 to 2018, the organic crop production in France was very slow (283 014 Tonnes); in 2019, robust growth was observed at 284 124 1 Tonnes, which continuously increased till 2022 (418 218 7 Tonnes). Germany (131

747 9 Tonnes) and the Netherlands (124 200 6 Tonnes) had steadily increased trends in organic crop production, whereas Ireland (34 922 Tonnes) and Luxemburg (12 155 Tonnes) remained constant in the organic crop production race throughout the years from 2011 till 2023.

Western Europe's increasing organic crop production will significantly impact the global food market. With significant areas devoted to different fruits such as olives, grapes, nuts, and temperate fruits, Western Europe is a significant producer of organic fruit crops. The organic agricultural sector in the region has demonstrated its durability and potential during economic downturns, as seen by the robust growth in domestic market values and organically managed land. Furthermore, as a result of growing consumer demand and environmental concerns, organic farming has increased, leading to the mainstream adoption of organic products and the creation of local and international economic opportunities. The growth of the organic food market in Western Europe is in line with the global trend of consumers seeking safe, high-quality, and environmentally friendly food products, even in the face of obstacles such as supply-demand imbalances and certification issues (Ulukan et al., 2022).

Figure 2 Total Organic Crop Production in Western Europe



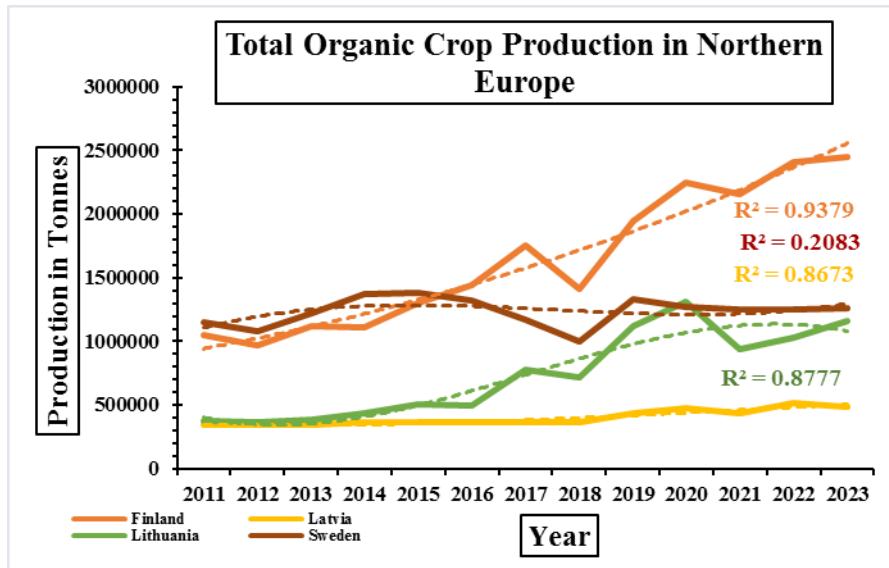
Source: Own processing

4.3 Organic Crop Production in Northern Europe

The total organic crop production in the Northern European region is represented in Figure 3. In 2011, Finland, Latvia, Lithuania, and Sweden produced about 104 506 2, 343 366, 377 098, and 115 232 4 Tonnes of total organic crops, respectively. Till 2023, production of organic crops was observed to continuously increase for understudied countries such as 244 974 4 for Finland, 484 158 for Latvia, 115 757 0 for Lithuania, and 125 886 1 for Sweden in Tonnes.

Growing organic crops is a significant component of sustainable agriculture in Northern Europe. With countries like Sweden leading the way in the total organic crop area ratio to total agricultural area, the region is home to a sizable portion of organic agricultural land. Northern Europe is a leading producer of organic fruit crops, encompassing subtropical, temperate, berry, citrus, olive, and grape varieties. To meet the EU's target of 25% organic farmland by 2030, the total production of organic crops in Northern Europe is anticipated to rise by 10.7% per year (Nesmyslenov, 2020).

Figure 3 Total Organic Crop Production in Northern Europe



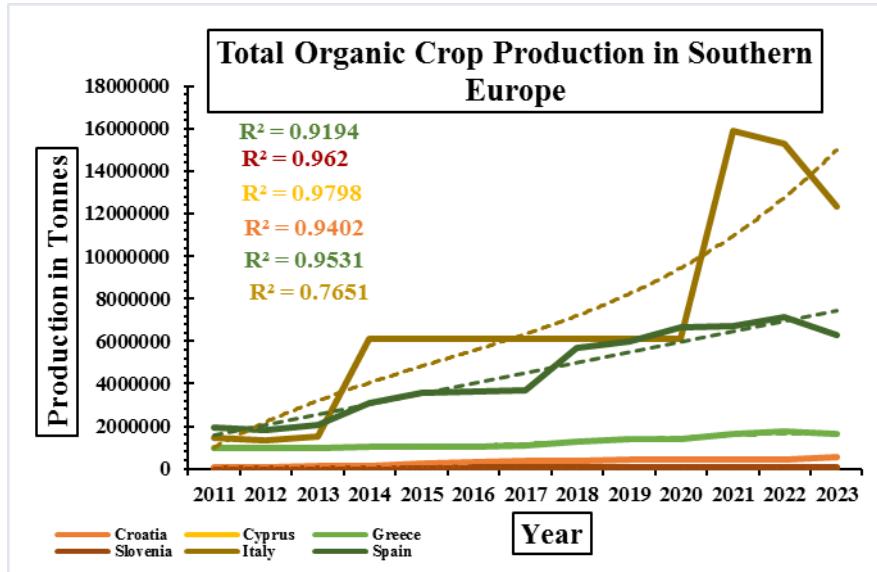
Source: Own processing

4.4 Organic Crop Production in Southern Europe

The total organic crop production in the Southern European region is represented in Figure 4. The total organic crop production recorded in Croatia, Cyprus, Greece, Slovenia, Italy, and Spain in 2011 were about 101 144, 150 37, 996 846, 252 87, 144 786 9, and 195 589 2 in Tonnes, respectively. Except in Slovenia, the production of organic crops was observed to be increasing continuously in every selected country from 2012 to 2023. In 2023, the total production of organic crops was recorded as 528 777, 419 07, 162 140 3, 737 36, 123 472 93, and 631 226 2 Tonnes in Croatia, Cyprus, Greece, Slovenia, Italy, and Spain, respectively.

Organic farming, especially in Southern Europe, is crucial to producing sustainably produced food. A significant percentage of the arable land in countries like Spain and Italy is farmed organically. They grow organic fruit crops, including olives, grapes, nuts, berries, citrus, subtropical fruit, and temperate fruit. The emphasis is on enhancing biodiversity and self-regulating systems. Furthermore, in 2018, there were 15.6 million hectares of organic agricultural land in Europe; the highest organic land areas were found in Italy and Spain, significantly increasing the output of organic crops on the continent. This demonstrates how organic crop production is becoming increasingly significant in Southern Europe, greatly enhancing the region's agricultural sustainability and biodiversity preservation (Kundius, 2023).

Figure 4 Total Organic Crop Production in Southern Europe



Source: Own processing

5 Conclusion and Recommendations

Our study summarised that Poland, France, Finland, Italy, and Spain were the countries with the most significant overall organic crop production till 2023. European organic crop production trends highlighted the requirement for ideal crop production across territories, which shows a connection with traditional agricultural production areas. The following countries had a percentage of organic forming shares exceeding 10%: Czechia, Finland, France, Greece, Italy, Poland, Romania, Slovakia, Slovenia, and Spain. A comparative study of the production of organic crops in various European locations indicates notable differences impacted by regulatory, economic, and meteorological factors. Due to good weather, southern regions typically have better yields. However, Eastern, Western, and Northern Europe confront problems, including shorter growing seasons and lower temperatures, which impact overall output and the significance of local soil health and biodiversity, significantly affecting the success of organic crops. Generally, organic crop production in Europe is promising, but regional differences call for customized approaches to increase organic agriculture's productivity and sustainability. Comparative studies of organic farming systems in various geographic regions emphasize the significance of switching to organic farming practices for sustainable land use and environmental safety.

Acknowledgement

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EU Food Safety Assurance in Active Use: Empirical Evidence on Alert Notifications Regarding the Financial Background of the Affected Producers

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Abstract: The presence of various market failures in placing foodstuff on market is a phenomenon that can also be identified across European countries. From an economic point of view, it is possible to discuss food safety in the context of the development and financial stability of the agro-food industry value chains. The given sector in some EU member states has faced and is still facing pressure to reduce food producers' prices often below the level of production costs, which can negatively affect food safety standards. This relationship consequently touches the issue of wasting natural resources and related processed foods, which do not meet the minimum legal requirements for their safety. EU member countries use for these purposes a type of "safety net" via an information exchange instrument named Rapid Alert System for Food and Feed (RASSF). This instrument is sharing information both with public authorities and also consumers. This article aims at identification of RASSF notifications provided by the Czech Republic during years 2023 and 2024 from the point of view of financial situation of respective food producers involved in this notification alerts. Based on the partial results of this article, it was concluded that the indicators of financial stability and revenue areas can be indirectly considered as proxy variables affecting the complex quality of food production. The comprehensive provision of information on the quality management of food production by individual producers can therefore be considered a fundamental aspect influencing consumer behaviour, which is related to the possibility of continuous improvement of the concepts of sustainable food quality assurance.

Keywords: food safety, Rapid Alert System for Food and Feed, financial position

JEL Classification: M29, Q18

1 Introduction

Food quality is a complex problem area of multidisciplinary type. It could be per se interrelated with both nutrition of population, a general awareness of the composition of food, a developing standards and amending legislation. Furthermore it could be considered also food nutritional composition, behaviour and preferences of customers and other related aspects. In the context of a business performance and competitiveness it is also necessary to perceive the performance issues of businesses operating in the food manufacturing industry, which are adopting managerial approaches of cost controlling, while facing global competition and law and order regulations. From an economic perspective, it is possible to relate the food safety problem area with the development and financial stability of the whole agro-food value chains.

Food production quality management in EU member countries is an important part of EU policies and it is interconnected with a food security area. The food quality can be at an individual enterprise level joint with introduced goals of business activities, i.e. after all with the system of planning of financial and non-financial indicators (Michalski, 2016). Gschwandtner and Hirsch (2018) focused directly on the company's profitability. They describe a comparison of the US and EU food processing industry in their article. They found that the profit in the food industry is lower compared to other sectors. They attribute this fact to a high degree of competitive pressure. However, low profitability of the sector is relatively stable in the context of crises. They have identified as the main drivers of profitability a firm's size and a

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financial risk in this sector. The reason is the ability of large companies to perform more advertising, have higher consumer reputation and to manage the administrative burdens and competition pressures. Among the shortcomings of their paper they report the omission of important intangible firm-specific resources such as R&D activity, patents and reputation, to quantify the impact of family / insider ownership for the EU due to data unavailability. Zielinska-Chmielewska and Smutka (2018) consider the question of profitability of the food industry as very important due to factors such as deploying of innovative technologies, compliance of food manufacturing procedures with law and order requirements, continuous process of improving quality standards of production inputs consistently with a need for following a changing conditions for meeting sustainability and also market competitiveness goals. It could be emphasized also problem area of effectiveness and efficiency of production. Gschwandtner and Hirsch (2018) provide findings on food contamination cases in the US and EU. These food safety incidents have been identified both locally and also as affecting cases for specific food industry subsectors. Inevitably they conclude on economic negative effects of involved companies. Dudek (2019) provided findings on food insecurity in the EU, when he focused on businesses settled in Visegrad 4 member countries. This author defines food insecurity as a situation when people affected by this problem cannot afford enough food of sufficient quality and quantity that would allow them to stay healthy and participate in the society. This researches' results show that households are facing food insecurity typically regarding income, level of urbanization, household type, disabilities of household members, and attributes of household head like educational attainment, gender, age, health and status of economic activity.

Nowadays discussions regarding the change of climate and the needed adoption across wider scope of mankind activities are also related to the area of food safety. It could be declared the necessity to adopt for changing conditions respective business activities in the agro-food industry. It is also accompanied with a growing trend in the global food demand because of growing population. Therefore, it is inevitable to consider as essential to reduce energy consumption and usage of other scarce inputs or reduce food waste and its management. These aspects in fact directly influence quantity, quality and safety of the food production (e.g. Malliaroudaki et al., 2022).

Aim of this article is to explore RASSF notifications provided by the Czech Republic during years 2023 and 2024 from the point of view of financial situation of respective food producers involved in this notification alerts.

2 Methods

It was explored information behind the identified businesses within breaking the food safety as reported in the Rapid Alert System for Food and Feed (RASFF) regarding the announcing country and the country of food's origin. This type of relationship was depicted using the chord chart. The available financial data for those companies were gathered from the corporate database Orbis.

The sample of business entities is covering identified companies regarding the announced breaking of the food safety in European Economic Area member countries. Specifically identified businesses were based regarding their headquarters in Brazil, Czechia, Deutschland, France, Hungary, Italy, Lithuania, Slovakia, Sweden and United Kingdom. The sample of identified businesses for further analysis covers 17 entities at total.

The key financial performance indicators employed in this paper are based on so called Kralicek Quick Test of credit worthiness (e.g. Růčková, 2021), covering both financial stability and revenue areas that was modified for purposes of this paper in partial indicators as following:

$$\text{Financial Lever Inversed} = \text{Shareholder Funds} / \text{Total Liabilities} \quad (1)$$

$$\text{Debt Repayment Potential} = (\text{Non-current} + \text{Current Liabilities} - \text{Cash and Cash Equivalents}) / \text{Cash Flow} \quad (2)$$

,where:

$$\text{Cash Flow} = \text{Operating profit/loss} - \text{Interest Expenses} - \text{Tax Duty} - (\text{Investment in Working Capital} + \text{Investment in Tangible Fixed Assets}) \quad (3)$$

$$\text{Cash Flow to Sales} = \text{Cash Flow} / \text{Sales} \quad (4)$$

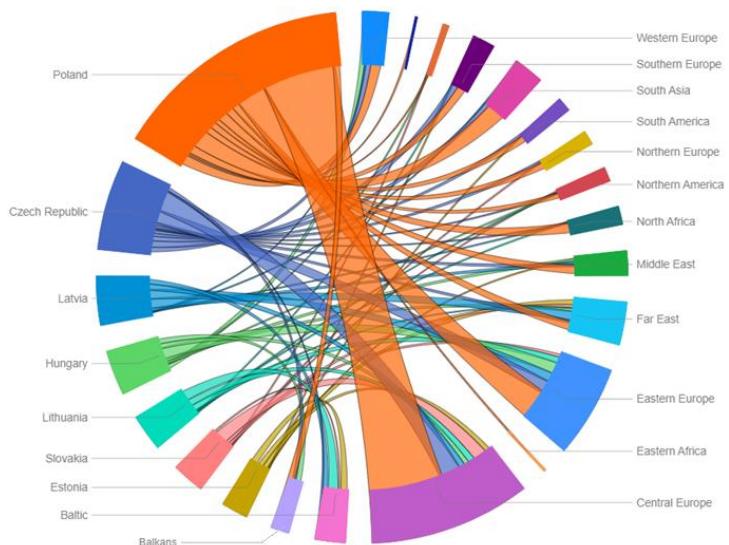
$$\text{Return on Assets} = \text{Earnings before Interest and Taxes} / \text{Total Assets}. \quad (5)$$

3 Research results

Fig. 1 provides a graphical design of relationships among announcements of breaking the food safety in identified Central and Eastern European countries (CEEC) regarding the announcing country and aggregated world-wide regions according declared country of its origin. The highest proportion of announcements regarding breaking food safety around CEEC countries was identified in Poland, followed by Czechia, Latvia, Hungary, Lithuania, Slovakia and Estonia. Out of total 255 notifications from January 2023 to July 2024 regarding CEEC countries, the highest proportion of nearly 31 % notifications were towards producers based in Central European Countries, more than 17 % notifications were towards producers based in Eastern European countries and third most frequented aggregated region of these notification alerts was Far East region with slightly over 6 % of food safety alert notifications.

Fig. 2 provides a graphical design of relationships among announcements of breaking the food safety in identified Western European countries regarding the announcing country and aggregated world-wide regions according declared country of its origin.

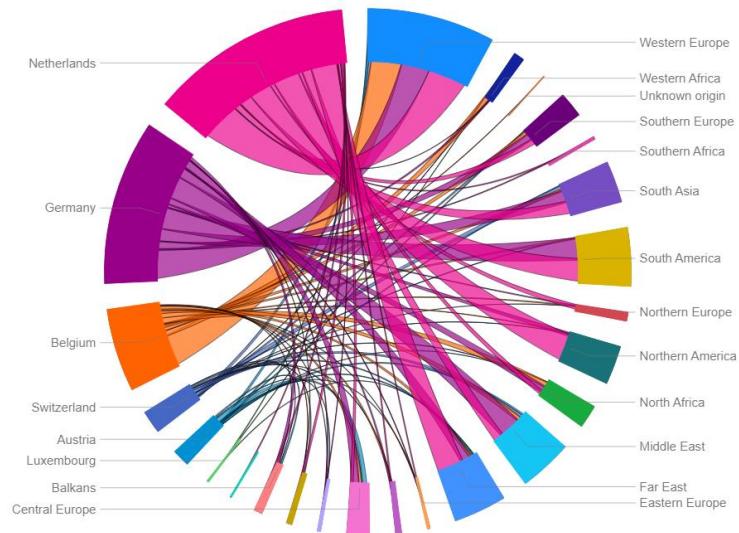
Figure 1 Chord chart for relationship between food safety break notification countries and country of food origin regarding CEEC countries



Source: Own processing using data of European Commission (©2024)

The highest proportion of announcements regarding breaking the food safety standards in Western European countries was identified in Netherlands, followed by Germany, Belgium, Switzerland, Austria and Luxembourg. From total of 1258 food safety break notifications more than 27 % come from Western Europe, nearly 12 % from South America, around 10 % from Middle East followed by Far East countries of origin with about 9 %.

Figure 2 Chord chart for relationship between food safety break notification countries and country of food origin regarding Western regions of European countries

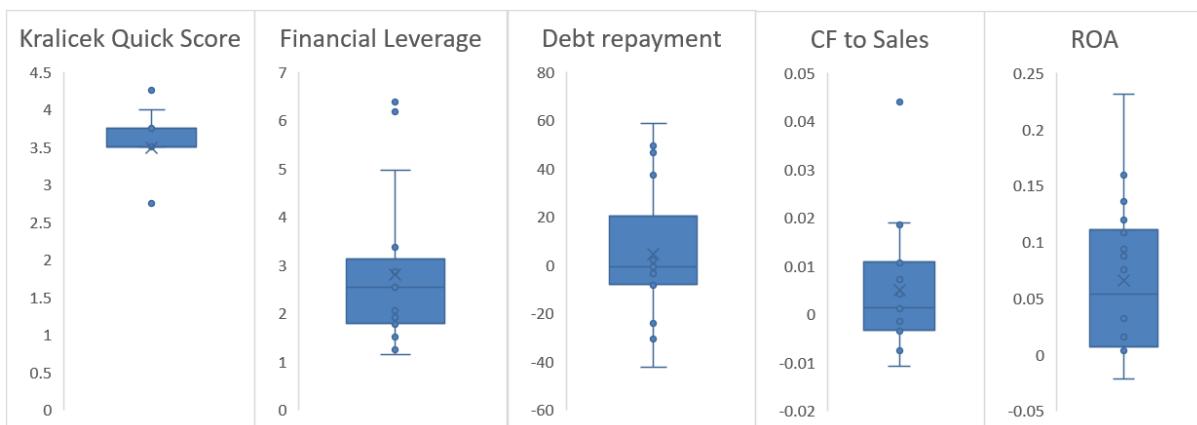


Source: Own processing using data of European Commission (©2024)

Note: Not depicted labels of the minor occurrence from the left hand side order: Australia and Oceania (0.2 %), Central Africa (1.1 %), Central America and the Caribbean (0.6 %), Eastern Africa (1.2 %)

The breakdown of the partial financial indicators constituting the Kralicek Quick Score index is provided in Fig. 3. It covers 17 specifically identified businesses involved into Food Safety Alert notifications. The overall score box-plot depicts one outlier with the best score index regarding its financial stability and revenue areas. It is namely business entity based in France, representing middle-sized traditional producer of cheese. Conversely, the outlier with the worst Quick Score index result is represented by a middle sized business entity based in Czechia, specializing on fresh fish meat.

Figure 3 Kralicek Quick Score breakdown



Source: own elaboration using data of Bureau van Dijk (©2020)

Further insight into the breakdown of partial financial indicators involved in the enumeration of the Kralicek Quick Test score reveals higher indebtedness of affected businesses with food safety breakdown accompanied with alarming debt repayment periods extents, involving also negative values (lacking ability to payback of debts). Similar negative results are identified for the proportion of cash flow to sales. On the other hand, the production power of the sample business entities is rather at normal level for food processing industry.

Jeddi et al. (2022) discuss food safety within the framework of possible impacts on their nutritional value due to the necessarily changing consumption of fertilizers and other hazardous chemicals due to climate change. Specifically, e.g. Duchenne-Moutien and Neetoo, H. (2021) draw attention to the fact that the changes in climate conditions, together with the simultaneous increase in the Earth's temperature, will have a significant impact on ensuring the nutritionally necessary

amount of food and its safety, especially in view of alimentary risks, i.e. the related effect on the persistence, virulence and, in some cases, toxicity of certain groups of disease-causing microorganisms. Food safety in a given context can then be secondarily threatened by chemical residues in food, such as pesticides, mycotoxins and heavy metals.

4 Conclusions

Current trends in the area of food quality and safety are based on the fact that the quality control of food production in EU member countries is actually part of European policies and these are further directly linked to the area of food safety control. The quality of food production from the point of view of producers can be viewed in relation to business goals, or to the systematic planning of determined financial and non-financial indicators of the performance of individual business entities. The mentioned indicators of financial stability and revenue areas can then be indirectly considered as proxy variables influencing the quality of food production with respect to the individual interest groups of the relevant food producers. The wider availability of information on the quality management of food production by individual producers can then be considered as essential aspects influencing consumer behaviour, which subsequently also contributes to shaping the supply side of high-quality and safe food. Rapid Allert System for Food and Feed is contributing also in forming consumer behaviour and indirectly also in the area of the area of wider awareness of qualitative requirements for the production of food industry enterprises.

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Economic Viability of Farms

Radek Zdeněk¹, Petr Zeman², Jana Lososová³

Abstract: The paper assesses the economic viability of Czech agricultural enterprises and the connection between economic viability and the ability to create value. From the possible definitions of economic viability, we choose the concept of Farm Economic Viability and use IN99 to estimate the ability of the farm to create value. The empirical analysis was carried out on a sample of agricultural enterprises from the collected database from 2013 - 2022. Differences in the viability of enterprises were tested according to the enterprise's affiliation with disadvantaged areas. The results indicate a strong dependence of value creation on the economic viability of farms.

Keywords: viability, sustainability, agriculture, value.

JEL Classification: M21; Q14.

1 Introduction

Economic viability is closely related to economic sustainability and the risk of business failure. Although EU agricultural policy has focused on environmental goals in recent decades, the main goal is still to ensure the economic viability of agriculture. The literature provides several methods of measuring viability, but no universal definition exists (Špička et al., 2019). According to Barnes et al. (2015), financial viability defines the ability of a business entity to continue to achieve its operational goals and fulfil its mission in the long term. Many studies use profitability as one of the measures of farm viability (Hayden et al., 2019; Coppola et al., 2020), and one of the most frequently used indicators of farm viability is also solvency (Savickiene et al., 2016). Different approaches consider viability as a measure of farm household welfare or opportunity cost (Vrolijk et al., 2010; O'Donoghue et al., 2016; Hloušková et al., 2022). According to Frawley and Commins (1996), viability is determined by the ability to provide a minimum wage, as well as by the ability to provide additional income from non-land assets.

Viability is influenced by several factors, such as the degree of diversification and structural, biophysical and institutional factors, although their importance and extent may vary across regions (Barnes et al., 2015). Some common aspects of economic viability are also related to economic sustainability. Sustainability is perceived as viability in the long term in a changing economic context (Latruffe et al., 2016; Ribašauskienė et al., 2024). In the case of agriculture, especially family farms, economic sustainability is perceived as the ability to transfer the farm to successors (Latruffe et al., 2016), and thus economic sustainability is the long-term viability of agricultural households, while economic viability measures the farm's ability to grow (Špička et al., 2019). According to Barnes et al. (2020), succession planning positively affects farm viability. However, new entrants may lead to more innovative approaches and search for new markets (Winter & Lobley, 2016).

Economic viability is primarily measured by profitability, liquidity, stability and productivity (Latruffe et al., 2016). However, evaluation using these indicators is more financial viability but does not consider the opportunity cost of own land, labour and capital. Therefore, some authors combine financial indicators and productivity (Argiles, 2001), which expresses the ability of production factors to generate output (Latruffe et al., 2016). The predictive ability of indicator systems grouped into multivariate models is limited, especially for such a specific sector as agricultural production (Kopta, 2009), due to subsidy bias, among others. According to Špička et al. (2019), when measuring farm viability, the optimal solution is to separate family farms, which are more focused on cash flow, from non-family farms, which are focused on profit. In addition, large Czech farms farm 80% of their land on leased land, which some profitability indicators do not consider.

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This paper aims to assess the viability of agricultural enterprises and compare the relationship of viability with their ability to create value. For this purpose, we use one of the latest farm economic viability indicators proposed by Hlavsa et al. (2020).

2 Data and Methods

2.1 Data

We use farm data from our database for the period 2013–2022. The data are based on standard financial statements supplemented by production indicators. Regarding the legal form of business, on average, 40% are cooperatives, 40% are joint-stock companies, and 20% are limited liability companies. According to the EU classification (EC, 2006), 70% of farms are small and 30% medium-sized. Regarding belonging to ANC (Areas with Natural Constraints), 10% of farms farm in mountain ANCs, 52% in other ANCs and 38% outside ANC areas. The distribution according to production focus represents around 20% of farms focused on crop production (more than 2/3 of sales are realised from crop production), 35% of farms are focused on animal production (more than 2/3 of sales are realised from animal production) and 45% realise mixed agricultural production. The average area of agricultural land is 1572 ha, the degree of cultivation is 76%, and the share of leased land is 83%. Due to the nature of the data used, these are mainly larger non-family farms that keep accounts. Table 1 shows the essential characteristics of the sample.

Table 1 Basic characteristics of the average company in the sample

Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Number of farms	103	85	104	95	84	85	72	69	56	53
Agricultural land (ha)	1 712	1 639	1 614	1 594	1 536	1 542	1 556	1 483	1 509	1 373
Assets (thous. CZK)	149 874	152 924	158 315	160 194	162 691	167 921	180 355	173 284	187 442	185 514
Profit (thous. CZK)	6 442	7 411	4 234	5 148	4 639	4 497	3 091	4 237	4 783	12 530
Labour force	53	52	51	49	49	46	47	43	47	40
Subsidy (CZK/ha)	8 761	9 424	9 621	10 526	9 954	11 655	11 047	11 117	11 008	10 979

Source: Calculation on a sample of farms

The limiting factor of this work is the absence of farms of natural persons for whom financial statements are not available. However, according to the Czech Statistical Office (CZSO 2024), 69 % of the agricultural land in the Czech Republic is managed by legal entities.

2.2. Methods

To determine the economic viability of farms, we use the approach according to Hlavsa et al. (2020). They performed their analysis on data from the Farm Accountancy Data Network. They developed the Farm Economic Viability (FEV) indicator based on the Modified Farm Net Value Added approach (MFNVA). MFNVA should cover employee wages, the expected wages for the unpaid labour force and opportunity costs of equity and own land. Considering the opportunity cost of equity, labour and land, a farm is viable when

$$FNVA - (IP + OCC) - (RP + OCL) > W + UL,$$

where *FNVA* is Farm Net Value Added, *IP* is Interests Paid, *OCC* is Opportunity Costs of Equity (Non-Land), *RP* is Rent Paid, *OCL* is Opportunity Costs of Own Land, *W* is Wages, and *UL* is Expected Wages for Unpaid Labour.

Hlavsa et al. (2020) further define the FEV indicator as

$$FEV = [FNVA - (IP + OCC) - (RP + OCL)] / (W + UL).$$

FEV varies in the interval $(-\infty, +\infty)$, with $FEV = 1$, meaning that MFNVA covers employees' wages, including the opportunity cost of unpaid work (Hlavsa et al., 2020). A farm with $FEV > 1$ is considered economically viable, and a farm with $FEV < 1$ is not.

The sample on which we process the evaluation differs from the data for which the *FEV* indicator was derived by Hlavsa et al. (2020). This is connected with the necessary adjustments in the definition of the content of net added value, which is based on the financial statements. Net value Added is determined as profit after tax + interest expenses + personnel expenses. Furthermore, we do not determine the alternative costs of own land (or we work with them in the costs

of equity). Because family farms do not appear in the sample, neglecting the expected wages of unpaid workers is possible. The result is a relationship

$$FEV = (PAT + W - OCC) / W,$$

where PAT is profit after tax.

OCCs are determined by the product of equity and the cost of equity rate. Mařík et al. (2011) recommend that risk premiums be calculated from world or, even better, US market data when applying the capital asset pricing model. Therefore, we adopt the cost of equity rates from Damodaran online (2024). We follow values for the Farming/agriculture sector for Europe for the years 2013 to 2022, which are shown in Table 2.

Table 2 Costs of Equity

Year	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Cost of Equity (%)	7.46	7.59	8.31	7.09	6.55	7.94	6.56	4.59	5.08	10.08

Source: Damodaran online (2024)

We estimate the ability of a company to create value for its owners using the $IN99$ model (Neumaierová & Neumaier, 2002). The model is following

$$IN99 = -0.017 x_1 + 4.573 x_2 + 0.481 x_3 + 0.015 x_4,$$

where x_1 is Assets / Total debt, x_2 is Operational profit / Assets, x_3 is Revenues / Assets, and x_4 is Current Assets / Short-term Liabilities.

If the $IN99$ value is higher than 2.07, the firm has a positive economic profit value (creates value for the owners); if the $IN99$ value is below 0.684, then the firm shows a negative economic profit (Neumaierová & Neumaier, 2002).

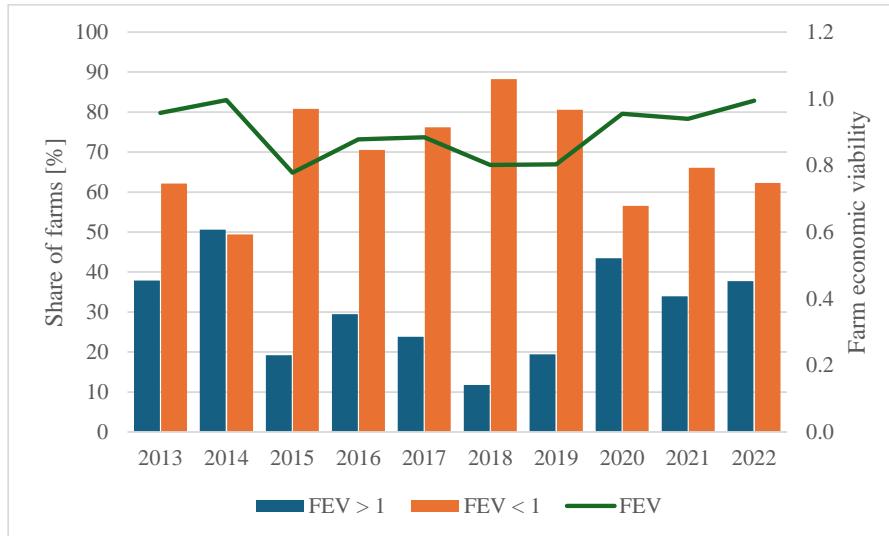
3 Research results

3.1 Farm Economic Viability

The viability of the average farm was the lowest in 2015 (0.778) and the highest in 2014 (0.996), and thus, the FEV value did not reach one during the entire period under review. Regarding the average farm by ANC affiliation, the FEV was greater than one only in 2022 for NON ANC. When broken down by production focus, the FEV is greater than one for crop production in 2013 and 2022, for mixed production in 2014, and for livestock production in 2022. The lowest FEV (0.56) was in 2018 for the average crop-oriented enterprise production, where the most pronounced year-to-year fluctuations in the FEV value were manifested. On the contrary, the smallest differences between individual years were manifested in the average farm focused on animal production.

The number of enterprises considered economically viable ($FEV > 1$) ranges from 12% to 51% in individual years (Fig. 1). From the point of view of viability during the observed period, 2018 was the worst year, and 2014, on the other hand, was the most favourable. Nevertheless, it meant almost half unviable enterprises, even in the most favourable year.

Figure 1 Farm Economic Viability and share of viable and unviable farms



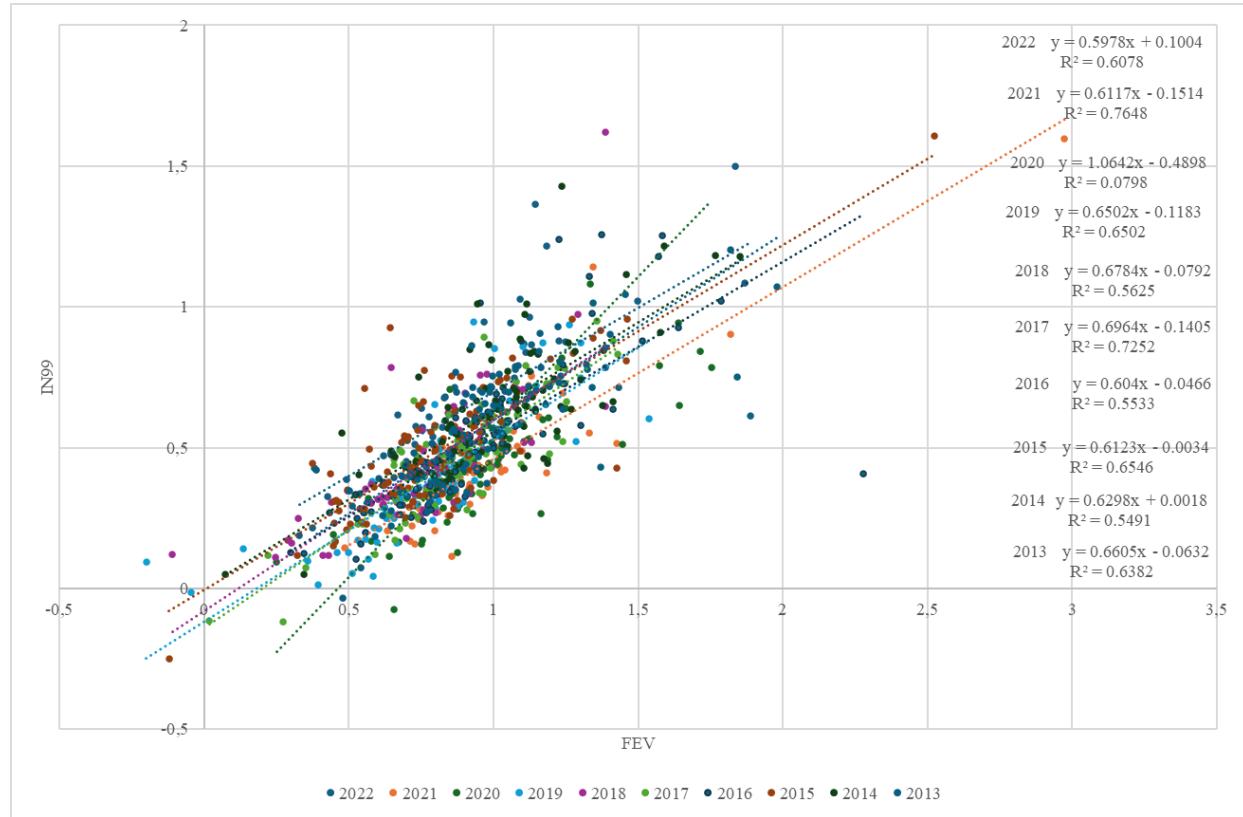
Source: Calculation on a sample of farms

The differences between the two groups of companies relate mainly to financial indicators. Differences between economic size, acreage, farming conditions (ANC), production focus and other production climate indicators seem minimal. Therefore, we sorted out enterprises whose $FEV < 0.5$ and compared their indicators with viable enterprises and the whole sample. Surprisingly, enterprises operating in ANC are not significantly represented in this group, but significant differences were not found in the size of the enterprise, the share of foreign land, or even in labour productivity. Only the representation of enterprises dealing mainly with plant production is more significant at 46%, in contrast to the entire set, where they are represented by only 22%. This is related to the lower altitude and lower subsidies per hectare in this group of enterprises. Focusing on crop production seems to make farms much more sensitive to changes in external farm conditions, especially price volatility and conditions affecting in-kind yields.

3.2 The relationship between FEV and the company's ability to create value

The dependence of value creation (measured by *IN99*) on farm viability (measured by *FEV*) varies from year to year and is relatively strong overall ($r = 0.52$). The lowest dependence appeared in 2020 ($r = 0.28$) and the highest in 2021 ($r = 0.87$). The high dependence (fig. 2) of the two concepts makes sense because both are based on an economic model that adds the cost of equity to the accounting model.

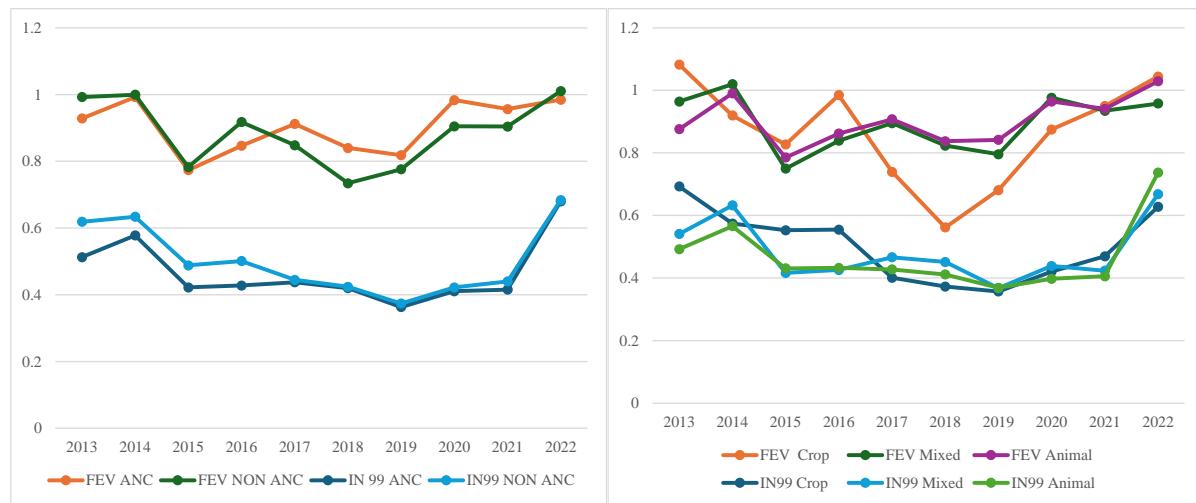
Figure 2 The dependence of the enterprise's ability to create value on economic viability



Source: Calculation on a sample of farms

The development of *FEV* and *IN99* of an average enterprise according to ANC affiliation and production orientation is shown in Figure 3. As mentioned above, this graph shows a significant drop in *FEV* for an average enterprise focused on crop production between 2017 and 2020. In these years, the share of enterprises with mainly crop production and *FEV* < 1 was the highest (table 3). Regarding the breakdown by affiliation to the ANC, the differences are minimal, and the development trends are almost the same. The shares of enterprises with *FEV* < 1 are higher in NON ANC in 2018-2021, the biggest difference can be seen in 2016, when in ANC the share of enterprises with *FEV* < 1 was higher by 21% than in NON ANC.

Figure 3 Development of *FEV* and *IN99* according to ANC and production focus



Source: Calculation on a sample of farms

Table 3 Share of farms with $FEV < 1$ according to production focus and affiliation to ANC (%)

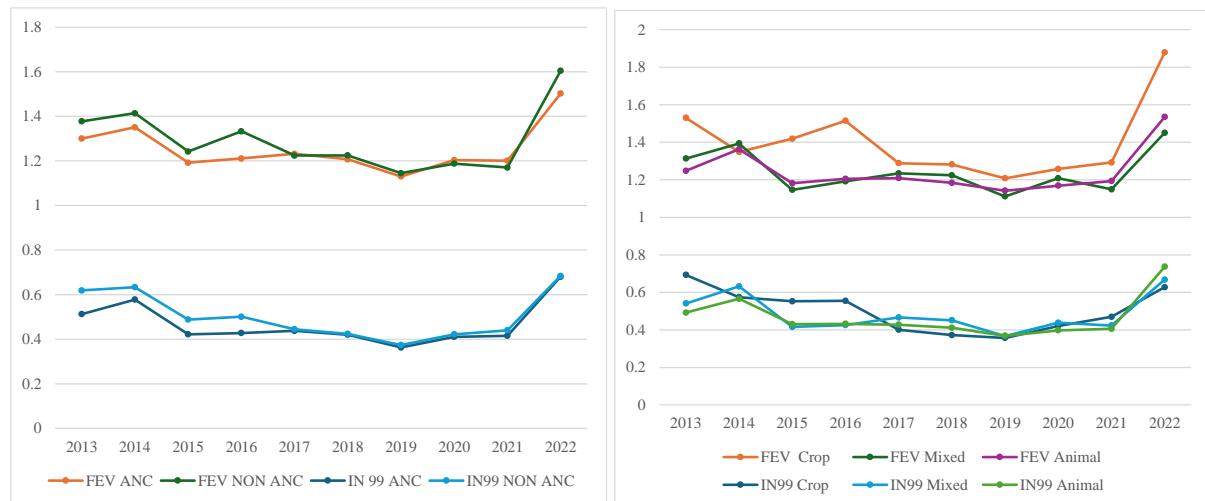
Group	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Crop production	33.3	46.7	74.1	45.8	78.6	94.1	87.5	57.9	71.4	58.3
Mixed production	63.0	50.0	88.1	82.1	77.1	89.2	78.6	43.5	66.7	54.2
Animal production	77.8	50.0	77.1	75.0	74.3	83.9	78.6	66.7	61.1	76.5
NON ANC	55.8	50.0	83.3	58.5	71.4	90.3	81.5	57.7	78.95	50.0
ANC	66.7	49.0	78.6	79.6	79.6	87.0	80.0	55.8	59.46	69.7

Source: Calculation on a sample of farms

3.3 Viability of farms without the opportunity cost of capital

If we do not consider the cost of equity capital when expressing viability, then the dependence of $IN99$ on FEV will decrease ($r = 0.445$). In this case, the proportion of viable businesses will increase, with the lowest being 47% in 2021 and the highest in 2013, when 96% of businesses are viable. In this case, if we divide the companies according to affiliation to the ANC, the differences decrease even more, and the development shows an almost identical trend. In the case of breakdown according to production orientation, the FEV is highest in almost all years for enterprises focused on crop production. Therefore, the opportunity cost of equity capital is most pronounced when the company is oriented towards crop production (Fig. 4).

Figure 4 Development of FEV without OOC and $IN99$ by ANC and production focus



Source: Calculation on a sample of farms

4 Conclusions

The economic viability of agricultural enterprises depends on a combination of internal and external factors. Effective management, production modernisation and adaptation to changing market and environmental conditions are essential. Emphasis on innovation, diversification and strategic cooperation between businesses can lead to long-term sustainability and competitiveness.

In this paper, we found that economic viability and the ability of a business to create value are closely related. The connection between the viability of the enterprise and the affiliation of the enterprise to the ANC has not been proven. Higher subsidies, in this case, probably offset the effects of natural constraints to a large extent. Whether a business is viable depends mainly on the opportunity cost of equity, which was most evident in companies focused on crop production. The drop in FEV for enterprises focused on crop production in some years also indicates a higher sensitivity of crop production to changes in external economic conditions.

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