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DETERMINANTS OF ESG SUSTAINABILITY IN FINANCIAL SYSTEMS: A FUZZY COGNITIVE APPROACH WITH A FOCUS ON GEORGIA

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Abstract. Sustainable finance has gained momentum over the last several years amid increasing environmental and social challenges. This research seeks to characterise Environmental, Social, and Governance (ESG) sustainability within the financial sector as a novel concept, identifying its core determinants, evaluating and modelling relationships among them, and subsequently analysing various scenarios for enhancing ESG Sustainability. To this end, a fuzzy cognitive map construction and modelling method was employed. Through a multi-stage process, a fuzzy cognitive map of ESG Sustainability was developed using Georgia's financial sector as a case study. The main findings identified ten fundamental factors influencing ESG Sustainability within the financial sector and evaluated the causal relationships among them. According to experts' assessments, the Local Sustainable Finance Regulatory Framework and the Involvement of International Financial Institutions are particularly important among these key fundamental factors. Additionally, the scenario analysis revealed that targeted improvements in the key factors could significantly enhance ESG Sustainability.

Keywords: Sustainability; Responsible Business Practice; Sustainable Finance; Environmental, Social, and Governance (ESG); Sustainability; Fuzzy Cognitive Map

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Additional disciplines: Sustainable Finance, ESG

1. Introduction

Sustainable finance has emerged as a critical area of focus in the financial sector amid the escalating need to address global sustainability challenges. With the intensification of climate change, resource depletion, and social inequities, the financial system must evolve to tackle these issues and support sustainable development objectives.

Climate change, biodiversity loss, and other environmental and social challenges pose significant risks to the economy and financial sector through various channels (Carney, 2015; IPPC 2018; NGFS 2019a; Somogyi & Nagy, 2022; Tvalodze, 2023; Yuan et al., 2023).

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These risks can become a source of financial risks leading to financial stability risks, necessitating proper identification, assessment, and management by the financial sector (Bolton et al., 2020; NGFS, 2019a, 2019b, Monasterolo, 2020; BCBS, 2021; Tvalodze & Nikuradze, 2023). At the same time, enormous financial resources are needed to address sustainable development challenges. The financial system, through the mobilisation of financial resources to promote green, stable, and inclusive economic growth, has another crucial role to play in addressing these challenges (OECD, 2024a, 2024b, 2024c; UN, 2024; Cull et al., 2024; Kakulia, 2016). Managing climate and other Environmental, Social, and Governance (ESG) risks and reorienting financial flows to support managing these risks and contributing to a sustainable future is precisely the scope of sustainable finance (Turhan et al, 2023; Dunbar et al., 2024).

The financial sector's role in combating climate change and achieving sustainable development, on the one hand, and managing climate and other ESG risks to ensure financial stability, on the other hand, is undoubtable and internationally recognised. However, what factors determine the financial sector's ability to perform these roles effectively? In other words, what are the key factors determining the sustainability of the financial sector? How are these factors interconnected? What are the effective policies to enhance the sustainability of the financial sector? These are important questions that are not well explored in the sustainable finance literature.

This paper tries to address this research gap by introducing a novel concept of ESG Sustainability and by leveraging the Fuzzy Cognitive Map (FCM) methodology to identify key determinants of ESG sustainability in the financial sector. FCMs offer a robust participatory modelling approach that uses expert knowledge to analyse complex systems. By mapping causal relationships between key ESG determinants, this study provides a comprehensive framework for understanding the dynamics of ESG sustainability. Using Georgia's financial sector as a case study, the research identifies fundamental factors influencing ESG sustainability and evaluates their interdependencies through scenario analysis.

The rest of the paper is organised as follows: Section 2 presents a detailed description of the concept of ESG Sustainability, highlighting its importance and relevance within the sustainable finance sphere. In addition, it provides the methodological foundations, focusing on the FCM approach and its relevance to the study. Section 3 introduces a multi-stage framework for constructing a fuzzy cognitive map for ESG Sustainability and presents the development of the ESG Sustainability FCM for Georgia's financial sector, showcasing the results and key findings derived from the model. Finally, the last section offers conclusions, summarising the insights gained and discussing the implications and areas for future research.

2. ESG Sustainability – concept description and assessment methodology

In accordance with various internationally accepted definitions, sustainable finance involves integrating Environmental, Social, and Governance (ESG) issues into financial decision-making, managing corresponding risks, and redirecting financial flows toward green, inclusive, and sustainable activities. These efforts contribute to long-term economic sustainability and financial stability (EU Commission, 2018; G20, 2018; ICMA, 2020; NBG, 2023).

Despite the importance of these aspects, there are no established methodologies or frameworks for assessing the sustainable state of the financial system that comprehensively address all the above-mentioned components. Moreover, reliable, consistent, and sufficiently long-term data are lacking for a quantitative evaluation of the sustainability characteristics of the financial sector. Consequently, alternative methods are needed for such an assessment.

To address these needs, it is essential to introduce a new concept—ESG Sustainability. Based on the definition of sustainable finance presented, ESG sustainability can be defined as the financial system's ability to integrate ESG factors, manage ESG risks, and channel financial flows toward sustainable activities. Accordingly, ESG sustainability can be represented as follows:

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$$ESG\ Sustainability = \varphi(I_1, I_2, I_3, \dots, I_N)$$

where $I_1, I_2, I_3, \dots, I_N$ represent fundamental factors affecting ESG Sustainability. These factors often have interdependencies and causal relationships. ESG Sustainability is a complex system, and to study this system, we need to identify indicators, measure the magnitude of their impacts, and analyse interactions between indicators.

To measure the financial system's sustainability, the framework should encompass all aspects mentioned in the definition. In other words, it should include various indicators to capture sustainable finance flows, ESG integration by financial institutions, management of ESG (including climate-related) risks, and the regulatory framework, as it may have a significant spillover effect on these indicators. With sufficient data availability, time series could be used to measure these different indicators to assess the financial sector's ESG sustainability, identify challenges, and pinpoint areas needing improvement for regulators, policymakers, and financial institutions. However, data availability is a significant challenge, especially in developing countries and emerging markets. Therefore, alternative methods and tools are necessary to assess the ESG Sustainability of the financial sector.

One such method that leverages expert knowledge in the absence of comprehensive data and can be used to analyse complex systems with multiple indicators and feedback mechanisms is Participatory Modeling, particularly Fuzzy Cognitive Maps (FCMs). FCMs, which graphically represent expert knowledge and cognitive processes, are particularly useful for modelling complex systems with various interacting elements. They depict concepts using directed, signed, and weighted arrows to represent causal relationships, forming comprehensive cause-and-effect diagrams (Kosko, 1986; Özesmi & Özesmi, 2004; Jetter & Kok, 2014).

Developing a comprehensive understanding of complex systems like sustainable finance, especially in cases of limited or absent data, requires input from various stakeholders who are part of the system. Leveraging the expert knowledge of stakeholders, which is locally relevant and contextual, can improve understanding of system dynamics and unravel complex system processes (Voinov & Gaddis, 2017; Edwards & Kok, 2021; Lui, & Zainuldin, 2024; Khamisu et al., 2024).

Using FCMs in ESG Sustainability assessments incorporates expert opinions, providing a comprehensive view of the financial system's sustainability dynamics. This approach helps to overcome data limitations, offering valuable insights into system mechanisms and enhancing decision-making in sustainable finance.

3. Building the ESG Sustainability Fuzzy Cognitive Map

Creating an FCM model involves several steps, often tailored to the research objectives and characteristics (Özesmi & Özesmi, 2004; Papageorgiou et al., 2019; Jetter & Kok, 2014; Olazabal et al., 2018). Based on the literature and research objectives, a seven-step framework for building the FCM for ESG Sustainability was developed:

1. **Determination of research objectives** - The primary objective of this research is to assess the sustainability of the financial sector through the ESG lens. This involves identifying the fundamental factors influencing ESG Sustainability, evaluating the relationships between these factors, and building a comprehensive model for scenario analysis.
2. **Selection of FCM construction method** - The construction of the FCM was based on in-depth interviews and structured questionnaires to gather expert evaluations. In particular, an expert assessment form was developed, and interviews were conducted using this form. Using an expert evaluation form simplifies the methodology for respondents and ensures that results are obtained in a consistent format, facilitating consolidation, aggregation, and further analysis.

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3. **Selection of target groups and experts** - When assessing the ESG sustainability of the financial sector, it is important to consider it from various perspectives. Different market players, such as financial institutions, investors, and regulators, may have distinct views on the fundamental factors that determine the sustainability of the financial sector, the associated challenges, and potential solutions. Therefore, considering these different perspectives and analysing them both individually and collectively is crucial for developing a holistic view of ESG sustainability in the financial sector. Consequently, it is essential to involve representatives from these different stakeholders in the assessment process.

   Accordingly, in the case of Georgia, three target groups were selected for expert assessment:
   - financial institutions as entities that implement sustainable finance standards and regulations in practice;
   - international financial institutions, as the main providers of green finance resources in Georgia and supporters of ESG standards implementation in the financial sector; and
   - the National Bank of Georgia (NBG), as the country's central bank and financial sector regulator, which is responsible for developing and implementing the regulatory framework for sustainable finance in the country.

   Specifically, five experts were selected from each target group, and therefore, the construction and modelling of the Fuzzy Cognitive Map of ESG Sustainability were based on the assessments of fifteen experts. The experts from financial institutions were heads of ESG/Sustainability departments, while high-level representatives from international financial institutions specialised in ESG/green finance. The experts from the NBG included heads of departments and divisions, as well as specialists responsible for developing the sustainable finance framework.

   After selecting the experts, the first stage involved interviewing them to explain the research objectives, methodology, and the expert assessment form. In the next stage, the assessment form was sent to the experts, and their completed forms were collected.

4. **Receiving individual FCMs and coding into adjacency matrices** - Individual cognitive maps and the corresponding adjacency matrices were collected from fifteen experts through interviews and evaluation forms.

5. **Homogenisation and aggregation of individual FCMs into a social FCM** - After homogenisation, the individual adjacency matrices were aggregated first within each target group and then across all groups, resulting in a social FCM. This aggregated FCM represents the collective knowledge and perspectives of the experts, providing a robust model of ESG Sustainability (see Table 1).

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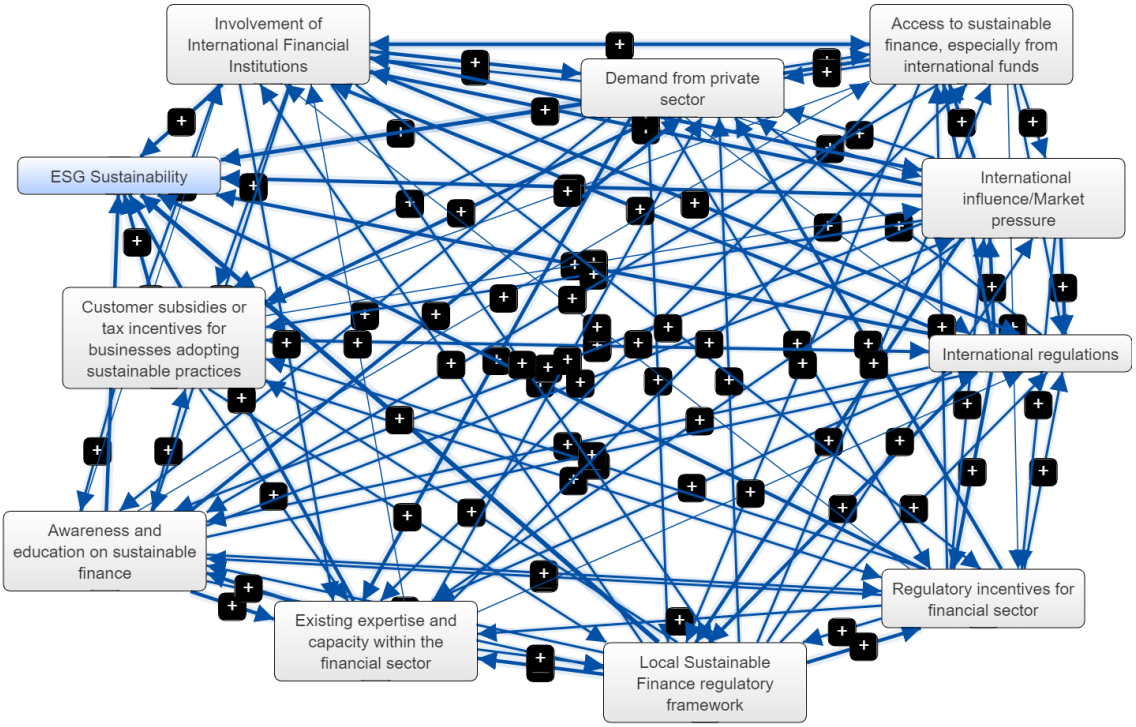


Figure 1. ESG Sustainability Social FCM

Note: Construction of FCMs, coding into adjacency matrices, and evaluation of indicators were done using the MentalModeler program, while RStudio was used to conduct simulations and scenario analysis.

Source: Authors' calculations

Table 1. Adjacency Matrix for ESG Sustainability Social FCM

	Local Sustainable Finance Regulatory Framework	Demand from private sector	Customer subsidies or tax incentives for businesses adopting sustainable practices	Regulatory incentives for financial sector	International regulations	International influence/Market pressure	Awareness and education on sustainable finance	Involvement of international financial institutions	Existing expertise and capacity within the financial sector	Access to sustainable finance, especially from international funds	ESG Sustainability
Local sustainable finance regulatory framework		0.40	0.34	0.63	0.35	0.30	0.45	0.29	0.58	0.42	0.95
Demand from private sector	0.38		0.45	0.33	0.09	0.15	0.47	0.33	0.67	0.25	0.63
Customer subsidies or tax incentives for businesses adopting sustainable practices	0.34	0.82		0.27	0.13	0.11	0.42	0.21	0.25	0.00	0.63
Regulatory incentives for financial sector	0.45	0.55	0.36		0.30	0.18	0.30	0.13	0.17	0.17	0.55
International regulations	0.77	0.40	0.38	0.52		0.67	0.33	0.75	0.33	0.50	0.67
International influence/Market pressure	0.50	0.41	0.33	0.42	0.65		0.38	0.67	0.42	0.50	0.68
Awareness and education on sustainable finance	0.33	0.57	0.37	0.27	0.25	0.20		0.13	0.67	0.08	0.70
Involvement of international financial institutions	0.42	0.50	0.38	0.17	0.63	0.71	0.33		0.67	0.25	0.88
Existing expertise and capacity within the financial sector	0.17	0.33	0.00	0.00	0.08	0.00	0.50	0.08		0.25	0.75
Access to sustainable finance, especially from international funds	0.33	0.33	0.08	0.08	0.17	0.25	0.25	0.38	0.25		0.75
ESG Sustainability											

Source: Authors' calculations

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6. **Analysis of the structure of individual and social FCMs using graph theoretical indices** - Key features of the FCMs were evaluated using graph theory (see Table 2). Graph theory indices showed minimal variation between the maps of target groups and the social map, indicating consistent results. It should be noted that no transmitter variables were found in maps, while each map contains only one receiver variable. Since the number of receiver variables exceeds the number of transmitter variables in all types of cognitive maps, this suggests that the causal relationships are well-developed, and the resulting maps are complex. This is indicated by the highest complexity score in the target groups' FCM and the social FCM. According to the results, most indicators in all types of cognitive maps are ordinary variables.

The number of connections per indicator in the target groups' maps is, on average, 7 ± 0.7 S.D., while in the social map, it is 8.7. As for the density measure, it is similar across all types of maps, with an average of 0.8. The high density indicates a large number of causal connections between variables. Since this measure is similar across different types of maps, it suggests compatibility of results among the target groups.

Table 2. Graph Theory Indices for FCMs

	Social	Target Groups		
		Financial Sector Regulator	Financial Sector	International Financial Institutions
Total Components	11	11	10	9
Total Connections	96	89	73	60
Density	0.87	0.81	0.81	0.83
Connections per Component	8.73	8.09	7.30	6.67
Number of Driver Components	0	0	0	0
Number of Receiver Components	1	1	1	1
Number of Ordinary Components	10	10	9	8
Complexity Score	Highest	Highest	Highest	Highest

Source: Authors' calculations

7. **FCM Inference** - The inference process involved analysing experts' assessments and FCMs to identify fundamental factors and their relationships. The first stage of expert evaluation included identifying key fundamental factors of ESG Sustainability. Experts assigned a value between 0 and 1 to each indicator of ESG Sustainability in the financial sector.

Table 3. ESG Sustainability Core Determinants

	Core Concepts/Indicators	Experts' Initial Assessment	FCM Inference		
			Indegree	Outdegree	Centrality
C1	Local sustainable finance regulatory framework	0.95	3.69	4.71	8.40
C2	Involvement of international financial institutions	0.88	2.97	5.05	8.02
C3	Existing expertise and capacity within the financial sector	0.75	3.75	2.16	5.91
C4	Access to sustainable finance, especially from international funds	0.75	2.92	2.95	5.87
C5	Awareness and education on sustainable finance	0.70	3.43	3.57	7.00
C6	International influence/Market pressure	0.68	2.57	4.96	7.53
C7	International regulations	0.67	2.65	5.32	7.97
C8	Demand from private sector	0.63	4.31	3.75	8.06
C9	Customer subsidies or tax incentives for businesses adopting sustainable practices	0.63	2.69	3.18	5.87
C10	Regulatory incentives for financial sector	0.55	2.69	3.16	5.85
C11	ESG Sustainability		7.14	0.00	7.14

Source: Authors' calculations

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From fifteen expert assessments, ten main fundamental factors determining ESG Sustainability in the financial sector were identified (see Figure 2; Table 3). Analysis of the expert assessments revealed that, at the social/aggregated level, the most significant indicator among the fundamental factors determining ESG sustainability in the financial sector is the local regulatory framework for sustainable finance (see Table 3). The second most important factor is the involvement of international financial institutions. Expertise and capacity within the financial sector, along with access to sustainable finance—particularly from international funds—are equally ranked in the third place. The lowest rating was given to regulatory incentives for the financial sector.

It should be noted that the assessment of the fundamental factors determining ESG sustainability in the financial sector is generally aligned across different target groups, although there are some differences. Notably, the most significant factors are similar among the target groups, which indicates the reliability of the aggregated results.

It is also worth mentioning that while subsidies or tax incentives for consumers in green/sustainable areas, as well as regulatory incentives for the financial sector, are considered relatively important factors by the financial sector target group, these factors received the lowest ratings from the target groups of financial sector regulators and international financial institutions. Nonetheless, the overall consistency in the assessment of fundamental factors across target groups indicates the validity and reliability of the aggregated results.

Certain indices from graph theory can be used to identify the most important concepts in the model based on specific characteristics. Three such indices, which are based on connection weights, include Indegree (weight of incoming connections), Outdegree (weight of outgoing connections), and Centrality. The first two indicate whether a concept is more of a transmitter (influential) or a receiver (dependent), while centrality shows the relative importance of a concept within the FCM structure (see Table 3).

In the case of the social cognitive map, the highest centrality was observed for the local regulatory framework for sustainable finance, demand from the private sector, and the involvement of international financial institutions. Similar results are found for the target group of the financial sector regulator, while for the financial sector target group, international regulations hold the top position.

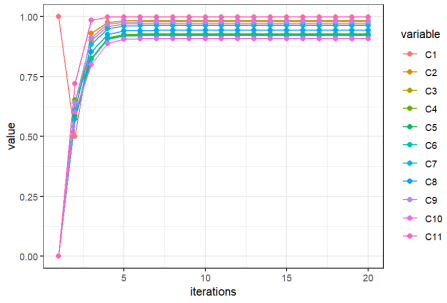
In the case of the target group of international financial institutions, awareness and education about sustainable finance are the most central. However, it should be noted that the local regulatory framework for sustainable finance is among the three most important concepts across all target groups.

Overall, the graph theory indices showed only slight variation both among the target group maps and between these maps and the social map. This indicates compatibility and robustness of the results across different types of maps. The results also demonstrated that the experts' initial assessments align with the FCM inference determined by the Centrality indicator.

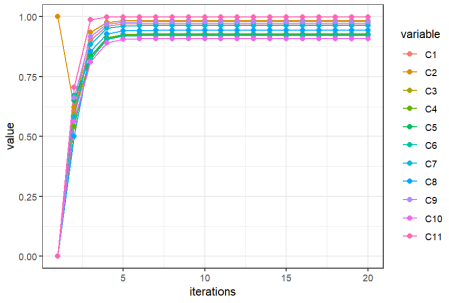
Scenario analysis, another part of FCM inference, simulated the impact of changes in each fundamental factor on ESG Sustainability. FCM-based simulations were used to understand the behaviour of concepts and their interconnections more deeply. The scenario results, using the Kosko inference function and Sigmoid transformation function (Dikopoulou et al., 2018), are presented in Figure 2.

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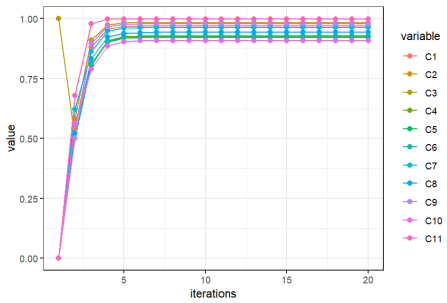
C1=1



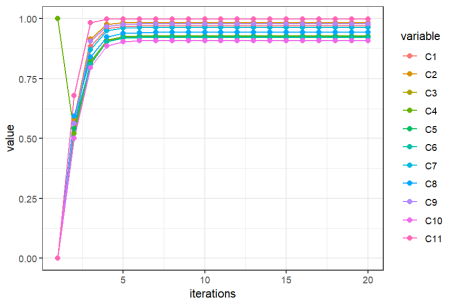
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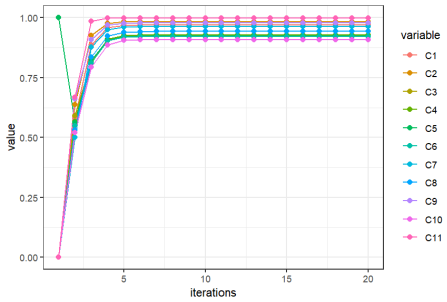
C3=1



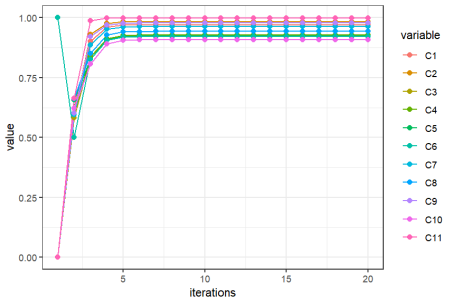
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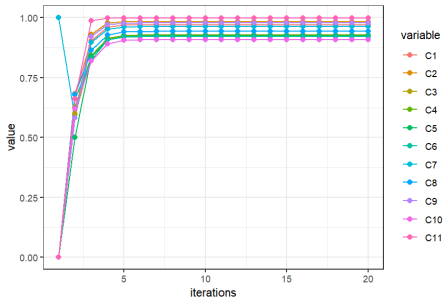
C5=1



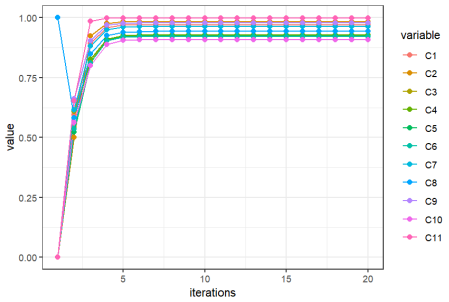
C6=1



C7=1



C8=1



C9=1

C10=1

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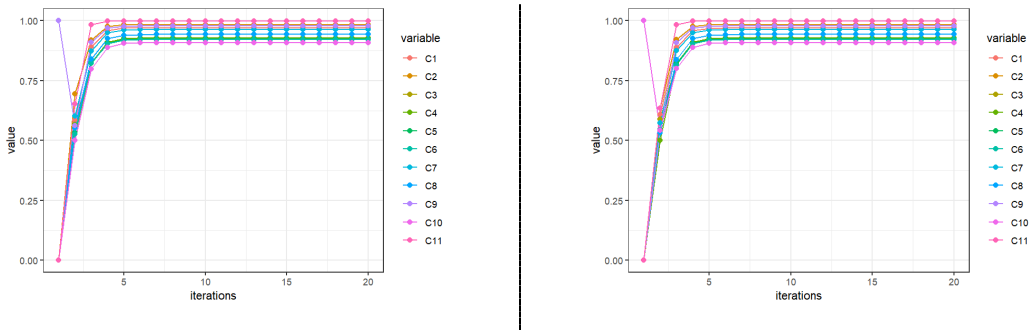


Figure 2. FCM-Based Simulations/Scenario Analysis
Source: Authors' calculations

This analysis provided insights into potential outcomes of different policy actions, helping to identify the most effective strategies for enhancing ESG Sustainability. The results indicate that growth and improvement in core factors materially impact the financial sector's ESG Sustainability, with changes in each factor positively influencing others.

Conclusions

This research contributes to the growing literature on sustainable finance by introducing the novel concept of ESG Sustainability and presenting a structured approach to identify and model its key determinants. Using expert knowledge through Fuzzy Cognitive Maps; the study identified ten fundamental factors that determine the financial sector's ESG sustainability in Georgia. The main findings highlight the significance of the local regulatory framework and the role of international financial institutions, both of which emerged as key drivers of sustainable finance. Additionally, awareness, education, and expertise in sustainable finance, international regulations and demand form private sector turned out to have substantial influence.

The scenario analysis conducted as part of this research demonstrates the potential impact of targeted policy actions on enhancing ESG sustainability. By simulating different scenarios, the research provides a valuable tool for decision-makers to evaluate the effects of interventions. The findings emphasise that a coordinated approach involving both local regulatory measures and international engagement is likely to be most effective in advancing ESG sustainability within the financial sector.

While this study provides valuable insights, there is scope for future research to further refine and expand its findings. Increasing the number of experts for each target group could enhance the robustness and generalizability of the results. Additionally, adding new target groups, such as academia, could provide additional perspectives and enrich the analysis. Expanding the study to cover other countries, particularly those in emerging markets, would help determine whether the results observed in Georgia are consistent across different contexts or whether unique country-specific factors emerge.

Moreover, while this study relied primarily on expert knowledge due to the limited availability of quantitative data, future research could integrate data where available to complement and validate the expert-driven FCM models. Combining qualitative insights with quantitative indicators would provide a more comprehensive understanding of ESG sustainability dynamics.

Overall, the insights gained from this study extend beyond Georgia, offering a framework that can be applied to assess ESG sustainability in other emerging markets. By emphasising the integration of expert knowledge in the limited environment, this research underscores the importance of adaptive, context-specific methodologies in advancing research on sustainable finance. The FCM approach utilised here has proven to be a valuable means of analysing complex interdependencies within the financial system, thus providing a robust basis for informed policy and strategic decision-making in sustainable finance. By addressing the opportunities

for future research, this study lays the groundwork for continued exploration and advancement of ESG sustainability in the financial sector.

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Data Availability Statement: Target groups' adjacency matrices and FCMs can be made available upon request.

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FINANCIAL PERFORMANCE OF SMES WINERIES IN SLOVAKIA: DUPONT DECOMPOSITION ANALYSIS*

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Abstract. Winegrowing has a long tradition in Slovakia, from the point of view of grape cultivation and wine production. The country area is divided into 6 winegrowing regions, and most wine producers are in South Slovakia and Small Carpathian regions. Around 800 active wine producers are currently operating in Slovakia. Most of them are self-employed. In the paper, we dealt with micro and SME wineries and quantified DuPont decomposition in these wineries for a period of 2013 – 2022. To reach a profit or be profitable is the companies' primary goal. If the company is gaining a profit, it is profitable. In DuPont decomposition, the peak indicator is ROE, which points out how efficiently the company uses equity to reach a profit. This indicator is spread into several levels of decomposition to partial indicators such as ROA, financial leverage, ROS, asset turnover, etc. In all three types of wineries, the significant influence of the change in ROA and the influence of the change in financial leverage prevails. From the second level of decomposition, the influence of the change in ROS prevails over asset turnover. From the perspective of individual types of assets, the most significant impact is the share of non-current assets and equity. From the standpoint of individual sales, the most important influence is the share of sales from the products and assets.

Keywords: financial analysis; DuPont analysis; pyramid decomposition; ROE; SME; wineries

Reference to this paper should be made as follows: Ladvenicová, J., Košovská, I., Hudáková, M. 2025. Financial performance of SMEs wineries in Slovakia: Dupont decomposition analysis. *Entrepreneurship and Sustainability Issues*, 12(3), 22-33. http://doi.org/10.9770/k7382535877

JEL Classification: M21, M41, Q1

1. Introduction and Review of Literature

In many European countries, viticulture and winemaking are important sectors (Santos et al., 2020). In Slovakia, grape has been cultivated since Roman times. Natural settings limit vineyards' distribution predominantly to its southern parts, mainly to lowlands and foothills of the Carpathians (Slámová & Belčáková, 2020). Slovakia is divided into 6 winemaking regions: Small Carpathian, Central Slovak region, South Slovak region, East Slovak

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region, Tokaj and Nitra region. The Small Carpathian region is one of the oldest winemaking regions in the Slovak Republic. The South Slovak region is the warmest of winemaking regions in the country (Garett, 2022). Climate change significantly affects the viticulture sector (Santos et al., 2020; Arsian, Yuce & Berkay, 2024; Jones & Alves, 2012)

Small and medium-sized enterprises are important market sectors of the economy. They are the driving force of business, growth, innovation and competitiveness. They have a significant socio-economic and political role (Kubíčková & Peprný, 2011). Micro, small and medium-sized enterprises (MSMEs) represent 90 % of businesses and more than 50 % of employment worldwide (Morales Pedraza, 2021; Yahya, 2023). The development of SMEs in Slovakia accelerated after 2000. Now constitute more than 99 % of companies (Číhovská & Nekolová, 2012; Popa & Ciobanu, 2014). Despite their importance, MSMEs face numerous challenges, including limited access to finance, inadequate digital literacy, and a lack of strategic business planning (Yahya, 2023; Umiyati & Zulfanetti, 2021).

Small and medium-sized enterprises often face unique challenges that can significantly impact their financial performance. The resource-based view highlights the importance of internal resources in achieving competitive advantage, which is crucial for wineries aiming to enhance their profitability (Alonso & Bressan, 2016). In their paper, the profitability and efficiency performance of different Hungarian wine regions were analysed by Szerb & Szerb (2020). They used DuPont scorecard system, which is preferred for planning and control purposes in companies. Wine regions have a significant impact on the economic performance of wineries. DuPont analysis can reveal how effectively wineries convert sales into profits, how efficiently they utilise assets to generate sales, and how much leverage they employ. These indicators are crucial for wineries (Bandieri, 2023; Alonso & Kok, 2018).

The company aims to make a profit. The profitability analysis is done to highlight business firms' current operating performance (Praveen Gujjar & Manjunatha, 2018). The DuPont business model is almost 100 years old. It provides a classic template for the decomposition that can be used to create integrated systems of performance metrics (Mitchell, Mitchell & Cai, 2013). DuPont analysis is named after the DuPont Corporation, which popularised the use of this indicator in 1919. The DuPont analysis is a helpful tool for assessing a firm's performance. Financial managers use ratios to benchmark their firm's performance against competitors and set future goals (Burns, Sale & Stephan, 2008). Unlike the traditional DuPont analysis, the modified Dupont analysis explicitly splits operating and financial performance (Rosa Soares & Caio Galdi, 2011). This analysis helps investors identify the company's financial strengths and the possibility of bankruptcy (Portia, 2021). It focuses on comparing accounting values in relative terms and lends itself naturally to compositional analysis (Saus-Sala et al., 2021).

DuPont analysis can be easily counted using basic firm data finding in profit and loss statements, balance sheets and cash flow statements (Mihola, Kotesovcova & Wawrosz, 2016). The analysis is based on company's return on equity (ROE), that is decomposed into three indicators: net profit margin, total asset turnover and the equity multiplier. The extended DuPont analysis multiplies ROE by the earnings retention rate to calculate sustainable growth (Gardner, McGowan & Moeller, 2011). ROE, ROA, and ROS are the most comprehensive measures of a company's profitability. Bhagyalakshmi & Saraswathi (2019) used correlation and regression analysis to know whether the relationship among the above variables exists or not and to know the impact of ROA and EM on ROE. Results show a positive relationship among all the variables except EM. The paper of authors Herciu et al. (2011) demonstrates that in most cases, the most profitable companies are not the most attractive to investors. By using DuPont analysis, they came to the results, that the ranking is not preserved when ratios as ROA, ROE, ROS are taken into consideration.

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2. Material and Methods

From a total number of approximately 800 active wine producers, the majority of them are self-employed. We focused on the commercial companies – joint-stock companies, limited liability companies or agricultural cooperatives- that are engaged in the cultivation of grapes, production, and sale of wine and its products. Of the total number of monitored wineries, there are 108 micro wineries, 40 small wineries and 9 medium-sized wineries. The source of information was the register of financial statements and documents of financial statements such as the balance sheet and profit and loss statement of wineries. The monitored period was 2013 – 2022.

Pyramid systems of indicators have a significant position among individual systems of indicators, whether they are matrix or parallel. The peak (synthetic) indicator is decomposed through links on analytical indicators. Among the indicators is the sign of multiplication, which is a multiplicative bond, or the sign of addition, which is an additive bond. In the case of multiplicative link, the functional method was used to calculate the influence of individual analytical indicators on the change of the synthetic indicator. The pyramid decomposition was divided into individual levels:

I. Decomposition level: ROE = $\frac{EAT}{A}.\frac{A}{E}$

Valid: A = $\frac{\Delta\frac{EAT}{A}}{\frac{EAT}{A}_0}$ B = $\frac{\Delta\frac{A}{E}}{\frac{A_0}{E}_0}$

Absolute term (€): $ROE_{\frac{EAT}{A}}$ = A.$\frac{EAT_0}{E_0}$ $(1+\frac{B}{2})$ $ROE_{\frac{A}{E}}$= B.$\frac{EAT_0}{E_0}$ $(1+\frac{A}{2})$

Relative term (%): $ROE_{\frac{EAT}{A}}$ = $(ROE_{\frac{EAT}{A}}$.(Index ROE $-1).100)) : \Delta ROE$

$ROE_{\frac{A}{E}}$ = $(ROE_{\frac{A}{E}}$.(Index ROE $-1).100)) : \Delta ROE$

II. Decomposition level: $\frac{EAT}{A} = \frac{EAT}{S}.\frac{S}{A}$

Valid: A = $\frac{\Delta\frac{EAT}{S}}{\frac{EAT}{S}_0}$ B = $\frac{\Delta\frac{S}{A}}{\frac{S}{A_0}}$

Absolute term: $ROE_{\frac{EAT}{S}}$ =A.$\frac{EAT_0}{A_0}$.(1+$\frac{B}{2}$) $ROE_{\frac{S}{A}}$ =B.$\frac{EAT_0}{A_0}$.(1+$\frac{A}{2}$)

Relative term: $ROE_{\frac{EAT}{S}}$ =$(ROE_{\frac{EAT}{S}}.ROE_{\frac{EAT}{A}}\%) : \Delta\frac{EAT}{A}$

$ROE_{\frac{S}{A}} = (ROE_{\frac{S}{A}}.ROE_{\frac{EAT}{A}}\%) : \Delta\frac{EAT}{A}$

$$\frac{A}{E} = \frac{NCA}{E} + \frac{CA}{E} + \frac{A/D}{E}$$

There is an additive link between the ratios of non-current assets and equity, current assets and equity and accruals on the asset side and equity, i.e., the procedure for calculating their impact on ROE will be as follows:

$ROE_{\frac{NCA}{E}}$= $\frac{\Delta\frac{NCA}{E}}{\Delta\frac{A}{E}}.\frac{EAT}{E\ \frac{A}{E}}$ $ROE_{\frac{CA}{E}}$= $\frac{\Delta\frac{CA}{E}}{\Delta\frac{A}{E}}.\frac{EAT}{E\ \frac{A}{E}}$ $ROE_{\frac{A/D}{E}}$= $\frac{\Delta\frac{A/D}{E}}{\Delta\frac{A}{E}}.\frac{EAT}{E\ \frac{A}{E}}$

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III. Decomposition level: $\frac{S}{A} = \frac{SoM}{A} + \frac{SoP}{A} + \frac{SoS}{A} + \frac{SoA.M}{A} + \frac{SoSS}{A}$

There is an additive link between the shares of each company's sales and total assets, so we used an additive link to calculate their impact on ROE, which is as follows:

$$ROE_{\frac{SoM}{A}} = \frac{\Delta\frac{SoM}{A}}{\Delta\frac{S}{A}} \cdot \frac{EAT}{E}\frac{S}{A} \qquad ROE_{\frac{SoP}{A}} = \frac{\Delta\frac{SoP}{A}}{\Delta\frac{S}{A}} \cdot \frac{EAT}{E}\frac{S}{A} \qquad ROE_{\frac{SoS}{A}} = \frac{\Delta\frac{SoS}{A}}{\Delta\frac{S}{A}} \cdot \frac{EAT}{E}\frac{S}{A}$$

$$ROE_{\frac{SoA.M}{A}} = \frac{\Delta\frac{SoA.M}{A}}{\Delta\frac{S}{A}} \cdot \frac{EAT}{E}\frac{S}{A} \qquad ROE_{\frac{SoSS}{A}} = \frac{\Delta\frac{SoSS}{A}}{\Delta\frac{S}{A}} \cdot \frac{EAT}{E}\frac{S}{A}$$

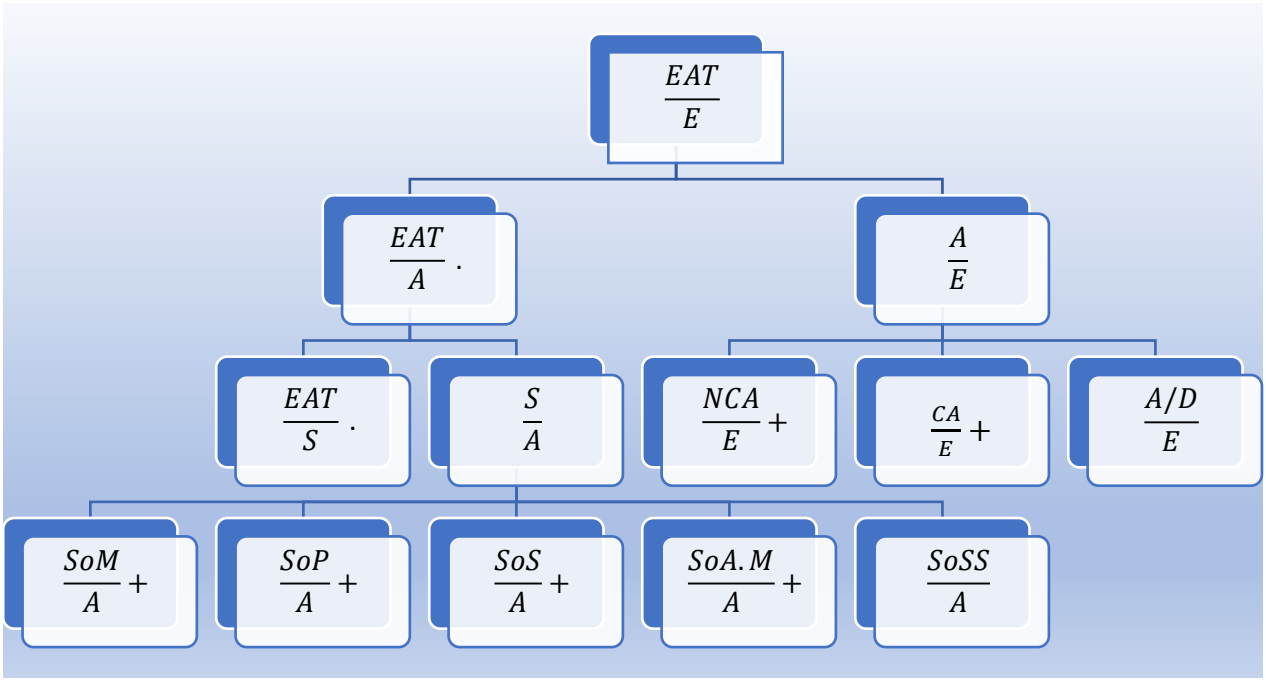


Figure 1. Pyramid decomposition of ROE
Source: own processing

Where: EAT – Earnings after taxes, E –Equity, A – Assets, S – Sales, NCA – Non-current assets, CA – current assets, A/D – Accruals/Deferrals, SoM – Sales of merchandise, SoP – Sales of own products, SoS – sales of services, SoA.M – Sales of non-current intangible assets, property plant and equipment, and raw materials, SoSS - Sales of securities and shares

3. Results

Winemaking and viticulture in Slovakia have a long tradition. Wine production is one of the most important agricultural activities worldwide (Maicas & Mateo, 2020). Enterprises operating in this sector are predominantly micro, small and medium-sized enterprises. During the pandemic period, they faced many problems, as the HoReCa segment (hotel and catering sector), where many wineries supply their products, was the most affected by the anti-pandemic measures and lockdowns. Many wineries that did not sell their products through shops, could not organise events in the form of e.g., wine tastings and wine tours, did not have enough temporary workers from abroad in the form of cheap labour, as the pandemic did not allow travel, etc., had to consider their further activities on the market, and this unfavourable situation was reflected in particular on their economic results of micro wineries, small wineries. The impact of external shocks, such as the COVID-19 pandemic, has underscored the vulnerability of wineries, particularly those that rely heavily on tourism for sales. COVID-19 pandemic forced many wineries to pivot quickly to online sales and e-commerce, showcasing their adaptability and revealing their business models' fragility (Strickland & Williams, 2022; Faria, 2023).

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In terms of the evolution of key indicators such as EAT, sales and assets, we have depicted their evolution in micro, small and medium-sized wineries over the period under review in the following figures. Figure 2 shows the evolution of EAT in the different categories of wineries. In the micro wineries, costs exceeded revenues in almost all years, meaning these wineries reported a loss. The only exception was in 2016, when the set of micro-enterprises made an average profit of €2 537. During the COVID-19 pandemic in 2019, micro wineries experienced a loss, but it did not reach the level before the pandemic period in 2018. Small wineries reported a profit in 2014, 2018, 2021 and 2022. In both pandemic years 2019 and 2020, the set of small wineries reported a loss, which deepened in 2020 to -€49,329. Medium-sized wineries performed the best of the three types of enterprises, showing a profit in all the periods analysed. During the pandemic years and subsequently after, we see an increase in profit after tax.

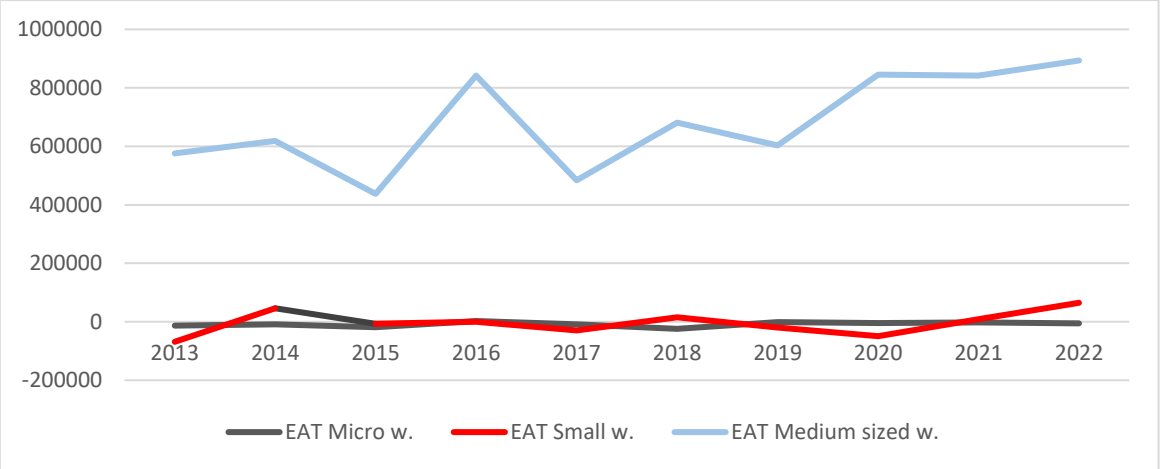


Figure 2. EAT development in € in micro, small and medium-sized wineries in Slovakia
Source: own processing

We have constructed a tree map based on the development of individual sales in wineries. As shown in Figure 3, the most represented in all three forms of wineries were sales revenues from own products, which reached an average value of 49% in micro wineries, 79.5% in small wineries and 86% in medium-sized wineries. The second highest share was in sales of goods, which averaged 37% in micro wineries and 6% in small and medium wineries. Revenue from the sale of services accounted for between 5 % and 10 % on average, and revenue from the sale of fixed assets and materials accounted for between 3 % and 7 %. Sales of securities had a slight representation of around 0.01% - 0.56%; since the enterprises are mainly oriented towards economic activity, it is logical that these sales, which are part of financial activity, will be at a very low level. Revenues are the most important item of income whether in micro, small or medium-sized wineries.

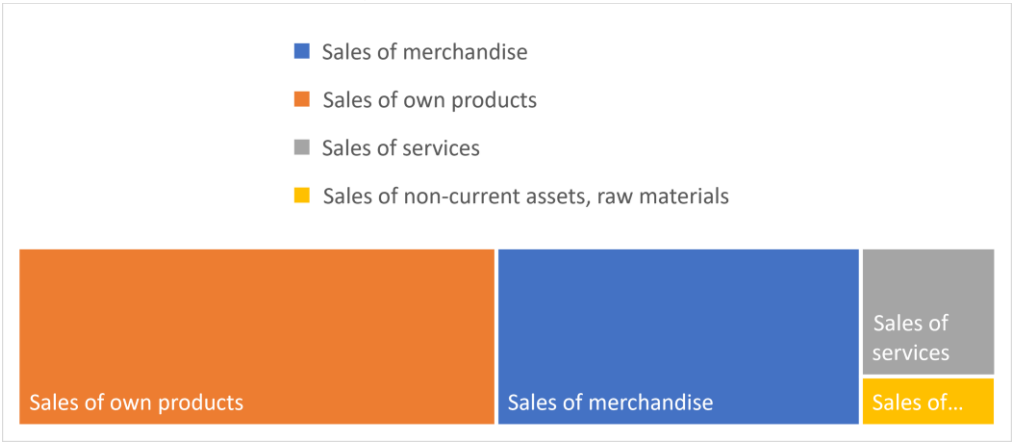


Figure 3. Sales in micro, small and medium-sized wineries in Slovakia
Source: own processing

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The assets of wineries consist of both non-current assets and current assets and accruals. Based on the quantification of the average for the period 2013-2022, we can conclude that there is a prevalence of non-current assets, which are of a long-term nature in micro (59.82%) and small enterprises (63.81%). In medium-sized enterprises, current assets (50.26%) slightly prevail over non-current assets (49.53%). Accruals had a slight representation of around 0.21% - 0.44% in all three forms of wineries.

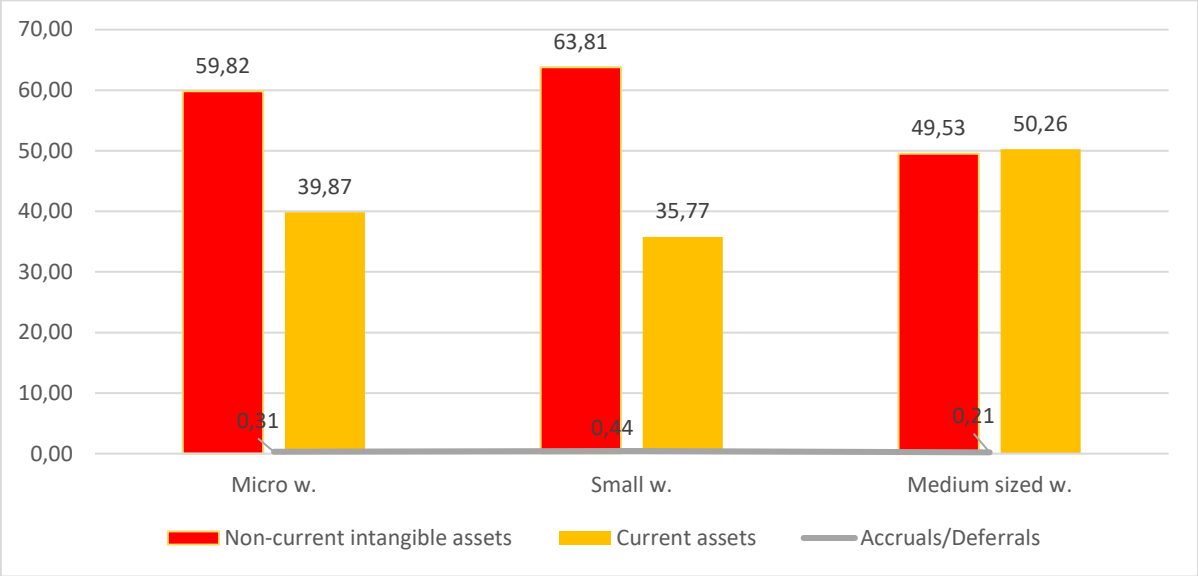


Figure 4. Average assets (%) in micro, small and medium-sized wineries in Slovakia
Source: own processing

By measuring the individual indicators, we constructed a DuPont decomposition using the functional method in the case of multiplicative linkage; its calculation in micro, small and medium enterprises is presented in the following tables. Micro wineries represent a good example of SMEs, being small realities serving the local markets and spaces that strengthen local communities (Cantafio & Parisi, 2021). The value of ROE developed at a fluctuating rate during the analysed period. We can see a decrease in the years 2015, 2017, 2018, 2020, 2022. In total, the value of ROE has decreased by 0.064 € or 162.194% over the period under review. This decrease in ROE was mainly caused by ROA. ROA is the ratio of earnings to assets. To achieve a certain level of ROA, companies with low-profit margins tend to have high asset turnover, while those with high profit margins have low asset turnover (Rakićević et al., 2016). As can be seen from Table 1, this ratio increased ROE in 2014, 2016, 2019, 2021, which can be evaluated positively in terms of profitability. The second indicator forming the first stage of decomposition is the ratio of assets to equity or financial leverage. The leverage ratio measures how much of total assets are financed by debt. Its value positively affected ROE in 2016, 2017, 2019, 2021. Overall, the value of the indicator grew by €0.024 or 3.711% over the period under review. This indicator is decomposed into the ratios of individual items of assets to equity. The influence of the share of non-current assets in equity is predominant, influencing the ROE value most significantly among the three assets. The profit margin or return on sales, given by the ratio of EAT to sales, and the asset turnover, formed by the ratio of sales to assets, represent the second level of decomposition. These two accounting ratios measure different constructs and have different properties. Prior research has found that a change in asset turnover is positively related to future changes in earnings (Soliman, 2008). The return of sales and asset turnover are the basic drivers of economic rentability. The research results show that return on sales is a key driver of wineries' economic rentability (Borisov & Radev, 2020). Overall, the indicator expresses how many euros of EAT are produced by one euro of total sales. In terms of quantifying the impact on ROE, the EAT/sales ratio has a more significant impact than asset turnover. The net profit margin (net profit margin) reduced ROE in 2015, 2017, 2018, 2020 and 2022. Asset turnover expresses how much revenue one euro of assets generates for us. It is true that the more efficiently a company uses its assets, the more revenue and profit it generates, assuming a positive return on sales (Zednicek, 2023). Asset turnover reduced ROE in 2017, 2020 and 2022, positively impacting ROE in

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other years. The indicator had the most significant negative impact on ROE in 2020, when it reduced ROE by €0.002 or 34.386%, indicating a decrease in sales in this period. The third level of decomposition is formed by the ratio of individual sales to assets. The effect of the share of sales of own products on ROE among the individual shares of sales on assets is predominant.

Table 1. DuPont decomposition in micro wineries

Indicator/year	2014	2015	2016	2017	2018	2019	2020	2021	2022	22-14
Δ ROE €	0.049	-0.165	0.294	-0.067	-0.092	0.134	-0.018	0.012	-0.015	-0.064
Δ ROE %	30.614	-149.946	107.066	-345.980	-193.094	96.013	-328.903	51.379	-131.580	-162.194
Δ EAT/A €	0.074	-0.127	0.243	-0.074	-0.082	0.128	-0.016	0.011	-0.014	-0.088
Δ EAT/A %	46.502	-115.013	88.551	-380.737	-171.373	91.040	-287.849	47.620	-119.403	-165.905
Δ A/E €	-0.025	-0.038	0.051	0.007	-0.010	0.007	-0.002	0.001	-0.001	0.024
Δ A/E %	-15.888	-34.933	18.516	34.757	-21.720	4.974	-41.054	3.758	-12.177	3.711
Δ NCA/E €	-0.015	-0.022	0.031	0.004	-0.007	0.004	-0.001	0.001	-0.001	0.014
Δ NCA/E %	-9.460	-20.452	11.237	22.035	-13.829	3.119	-24.715	2.159	-6.940	2.520
Δ CA/E €	-0.010	-0.016	0.020	0.002	-0.004	0.003	-0.001	0.000	-0.001	0.010
Δ CA/E %	-6.399	-14.342	7.227	12.676	-7.850	1.845	-16.308	1.588	-5.166	1.232
Δ (A/D)/E €	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Δ (A/D)/E %	-0.029	-0.139	0.065	0.046	-0.042	0.010	-0.050	0.011	-0.071	-0.042
Δ EAT/S €	0.059	-0.130	0.239	-0.073	-0.089	0.122	-0.014	0.009	-0.013	-0.071
Δ EAT/S %	36.970	-118.149	86.954	-375.896	-186.727	86.809	-253.463	38.847	-108.175	-145.145
Δ S/A €	0.015	0.003	0.004	-0.001	0.007	0.006	-0.002	0.002	-0.001	-0.016
Δ S/A %	9.532	3.136	1.596	-4.841	15.354	4.231	-34.386	8.774	-11.228	-20.760
Δ SoM/A €	0.004	0.001	0.001	0.000	0.003	0.002	-0.001	0.001	-0.001	-0.005
Δ SoM/A %	2.492	0.870	0.489	-1.952	6.933	1.625	-11.023	4.309	-4.895	-7.387
Δ SoP/A €	0.010	0.002	0.002	0.000	0.003	0.003	-0.001	0.001	-0.001	-0.010
Δ SoP/A %	6.210	1.676	0.866	-2.136	6.380	2.084	-19.267	2.536	-5.250	-11.460
Δ SoS/A €	0.001	0.000	0.001	0.000	0.001	0.001	0.000	0.000	0.000	-0.001
Δ SoS/A %	0.560	0.415	0.195	-0.512	1.570	0.416	-3.246	1.240	-0.766	-1.326
Δ SoA.M/A €	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Δ SoA.M/A %	0.270	0.174	0.046	-0.241	0.470	0.101	-0.850	0.689	-0.317	-0.587
Δ SoSS/A €	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Δ SoSS/A %	0.000	0.000	0.000	0.000	0.000	0.005	0.000	0.000	0.000	0.000

Source: own processing, financial statements of wineries

Table 2 shows the DuPont decomposition in small wineries. Small wineries represent an activity which is currently being developed, and it is expected that it will, as is the case in developed countries, contribute to economic development and employment (Lekić et al., 2018). ROE reached negative values in 2015, 2017, 2019, 2020.

The most significant decrease was recorded in 2017, when ROE decreased by 0.012 € or 5 116.098%. This is due to a significant widening of the loss in 2017 compared to 2016 in the set of small wineries. In the first stage of the decomposition, ROA had a more pronounced impact on ROE, reducing the value of ROE in the years mentioned above. The most significant decrease in ROE was caused by ROA in 2017.

The ratio of assets to equity had less impact on ROE than ROA. Except for 2017 and 2018, it reduced ROE in every year analysed. In terms of the share of individual assets in equity, the share of non-current assets in equity had the most significant impact on ROE. As mentioned above in the commentary, the most significant decrease in ROE was caused by ROS in 2017, when it decreased ROE by €0.013 or 5,417%; the impact of the share of individual sales on assets on ROE is tracked in the tables below. Among the individual revenues, the impact of revenues from product sales on ROE is the most significant.

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Table 2. DuPont decomposition in small-sized wineries

Indicator/year	2014	2015	2016	2017	2018	2019	2020	2021	2022	22-14
Δ ROE €	0.058	-0.026	0.003	-0.012	0.019	-0.015	-0.013	0.026	0.025	-0.033
Δ ROE %	164.412	-115.049	92.881	-5116.098	149.587	-234.118	-160.810	118.255	621.040	456.629
Δ EAT/A €	0.058	-0.026	0.003	-0.013	0.019	-0.015	-0.013	0.026	0.025	-0.033
Δ EAT/A %	164.706	-114.610	97.806	-5186.777	148.921	-233.718	-160.540	118.389	624.415	459.708
Δ A/E €	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Δ A/E %	-0.295	-0.439	-4.925	70.679	0.666	-0.400	-0.270	-0.133	-3.374	-3.079
Δ NCA/E €	0000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Δ NCA/E %	-0.200	-0.286	-3.240	46.965	0.410	-0.249	-0.167	-0.084	-2.117	-1.917
Δ CA/E €	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Δ CA/E %	-0.093	-0.151	-1.670	23.609	0.254	-0.,149	-0.102	-0.049	-1.244	-1.151
Δ (A/D)/E €	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Δ (A/D)/E %	-0.002	-0.002	-0.015	0.178	0.002	-0.002	-0.002	0.000	-0.014	-0.012
Δ EAT/S €	0.058	-0.025	0.003	-0.013	0.019	-0.015	-0.012	0.026	0.022	-0.036
Δ EAT/S %	165.580	-112.635	95.906	-5416.555	149.848	-234.058	-140.662	116.625	559.124	393.544
Δ S/A €	0.000	0.000	0.000	0.001	0.000	0.000	-0.002	0.000	0.003	0.003
Δ S/A %	-0.874	-1.975	1.900	229.778	-0.927	0.340	-19.878	1.763	65.291	66.164
Δ SoM/A €	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Δ SoM/A %	-0.054	-0,112	0.099	13.458	-0.058	0.025	-1.076	0.103	4.114	4.168
Δ SoP/A €	0.000	0.000	0.000	0.000	0.000	0.000	-0.001	0.000	0.002	0.003
Δ SoP/A %	-0.756	-1.719	1.635	187.400	-0.797	0.289	-17.574	1.542	56.268	57.025
Δ SoS/A €	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Δ SoS/A %	-0.043	-0.109	0.107	1.,923	-0.050	0.017	-0.661	0.066	2.944	2.987
Δ SoA.M/A €	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Δ SoA.M/A %	-0.019	-0.035	0.060	15.971	-0.021	0.009	-0.566	0.053	1.965	1.985
Δ SoSS/A €	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Δ SoSS/A %	0.000	-0.001	0.000	0.026	0.000	0.000	0.000	0.000	0.000	0000

Source: own processing, financial statements of wineries

Table 3 shows the calculation of DuPont decomposition in medium-sized wineries. ROE increased its value in 2014, 2016, 2018 and 2020. The most significant increase was in 2016, when there was €0.046 of EAT per euro of equity in the set of medium-sized wineries. Over the period under review, we record a decrease in the ROE ratio of €0.006 or 6.944%.

Successful farm business managers must understand the determinants of profitability and have an overall long-term or strategic management focus (Melvin et al., 2004).

From the first level of decomposition, the development of ROE was mainly influenced by the ROA indicator, which increased the value of ROE in 2014, 2016, 2018, 2020 and 2022. In 2016, by changing the ROA indicator, ROE increased most significantly by € 0.047 or 89.263 %. Despite the positive effect of ROA on ROE in 2022, the value of ROE decreased, mainly due to the influence of A/E, which decreased the value of ROE by € 0.007 or 6.787 %.

In terms of the impact of individual asset equity ratios, the ROE was influenced by the share of non-current and current assets in equity to approximately the same extent. The equity shares of all three assets increased ROE in only two years, namely in 2017 and 2018. These two years also increased the A/E ROE by €0.005 and 5.072% in 2017 and €0.008 and 12.344% in 2018, respectively.

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Table 3. DuPont decomposition in medium-sized wineries

Indicator/year	2014	2015	2016	2017	2018	2019	2020	2021	2022	22-14
Δ ROE €	0.002	-0.028	0.046	-0.034	0.027	-0.013	0.025	-0.006	-0.004	-0.006
Δ ROE %	2.751	-34.493	88.872	-34.065	40.848	-13.870	31.394	-5.453	-4.193	-6.944
Δ EAT/A €	0.005	-0.025	0.047	-0.039	0.019	-0.009	0.030	-0.005	0.003	-0.002
Δ EAT/A %	6.483	-30.886	89.263	-39.137	28.504	-10.350	38.490	-4.912	2.594	-3.890
Δ A/E €	-0.003	-0.003	0.000	0.005	0.008	-0.003	-0.006	-0.001	-0.007	-0.004
Δ A/E %	-3.732	-3.607	-0.391	5.072	12.344	-3.520	-7.096	-0.541	-6.787	-3.054
Δ NCA/E €	-0.001	-0.001	0.000	0.002	0.004	-0.002	-0.003	0.000	-0.003	-0.002
Δ NCA/E %	-1.834	-1.798	-0.187	2.314	6.118	-1.709	-3.654	-0.275	-3.498	-1.664
Δ CA/E €	-0.001	-0.001	0.000	0.003	0.004	-0.002	-0.003	0.000	-0.003	-0.002
Δ CA/E %	-1.890	-1.804	-0.203	2.747	6.190	-1.797	-3.431	-0.265	-3.282	-1.392
Δ (A/D)/E €	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Δ (A/D)/E %	-0.008	-0.005	-0.001	0.012	0.036	-0.014	-0.011	-0.001	-0.006	0.002
Δ EAT/S €	0.006	-0.020	0.047	-0.049	0.027	-0.011	0.032	-0.005	-0.004	-0.010
Δ EAT/S %	7.201	-25.204	89.810	-49.294	41.688	-12.074	40.049	-5.227	-4.329	-11.530
Δ S/A €	-0.001	-0.005	0.000	0.010	-0.009	0.002	-0.001	0.000	0.007	0.007
Δ S/A %	-0.717	-5.682	-0.547	10.157	-13.184	1.724	-1.559	0.314	6.923	7.640
Δ SoM/A €	0.000	0.000	0.000	0.001	-0.001	0.000	0.000	0.000	0.000	0.000
Δ SoM/A %	-0.045	-0.323	-0.028	0.595	-0.822	0.126	-0.084	0.018	0.436	0.481
Δ SoP/A €	0.000	-0.004	0.000	0.008	-0.007	0.001	-0.001	0.000	0.006	0.006
Δ SoP/A %	-0.621	-4.944	-0.470	8.284	-11.344	1.466	-1.379	0.275	5.966	6.587
Δ SoS/A €	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000
Δ SoS/A %	-0.035	-0.313	-0.031	0.571	-0.716	0.086	-0.052	0.012	0.312	0.348
Δ SoA.M/A €	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000
Δ SoA.M/A %	-0.016	-0.100	-0.017	0.706	-0.303	0.046	-0.044	0.009	0.208	0.054
Δ SoSS/A €	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Δ SoSS/A %	0.000	-0.002	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000

Source: own processing

From the second level of decomposition by comparing the development of the indicator's profitability of sales and the share of assets in sales, the more significant impact on ROE was the indicator profitability of sales, which increased ROE in four years of the analysed period, namely in 2014, 2016, 2018, 2020. In 2016, due to the change in return on sales, the ROE ratio changed by €0.047 or 89.81%. Based on the development of the share of individual sales on total assets, the share of sales of own products on assets on ROE had the most significant impact on ROE. This ratio increased ROE in 2017, 2019, 2021 and 2022. On the contrary, the most significant decrease in ROE due to the impact of this ratio was in 2018, when ROE decreased by €0.0007 or 11.344%.

Conclusions

DuPont analysis serves as a valuable tool for wineries to assess their financial performance comprehensively. By examining the interplay of profitability, leverage, and efficiency, wineries can identify weaknesses and strengths in their operations and strategic positioning. DuPont decomposition of ROE was quantified in a selected set of micro, small and medium-sized enterprises. Micro, small and medium-sized wineries play a crucial role in the global wine industry. DuPont decomposition helps to determine the effects of various indicators on the peak ROE. ROE is mainly influenced by the evolution of profit and equity. EAT in each year of the analysed set was achieved only by medium-sized wineries. In terms of assets and their items, the representation of non-current assets in micro and small wineries and current assets is predominant. In medium-sized wineries, current assets and non-current assets predominate. The different revenue items are represented in each group of wineries, but overall, we can say that revenue from the sale of own products is predominant. In micro and medium wineries, this is followed by sales of goods and sales of services. In small wineries, sales of services and sales of non-current assets and goods are more likely to be represented. Sales are the most important revenue item and have a significant impact on profit. In micro wineries, the lowest decrease in ROE

was recorded in 2017, when ROE decreased by €0.067 or 346%. This decrease mainly affected ROA and ROS. The same trend was observed in the group of small wineries, where in 2017 we quantified the lowest decrease in ROE of €0.012 and 5,116%, respectively, caused by ROA and ROS. In the group of medium-sized enterprises, the lowest decrease in ROE was quantified in 2015, when ROE decreased by 0.028 € and 34.493%, respectively; this decrease was caused by ROA and ROS as in the previous enterprises. Slovak wineries produce quality products. Profitability can be achieved through various strategies ranging from effective cost management (energy efficiency - e.g., renewable energy sources, optimisation of logistics by reducing storage and distribution costs). Environmental proactivity is a factor influencing winery performance. Research by authors Junguera & Barba-Sánchez (2018) indicates that wineries that adopt sustainable practices improve their competitive advantages and enhance their long-term financial performance. The highest percentage of variable costs are packaging costs. Full-time labour, cooperage, and purchasing of grapes are the next highest operating costs. Depreciation of capital assets makes up the highest percentage of fixed costs (Fickle et al., 2005). Furthermore, by improving production and quality of the products produced (modernisation of equipment for more efficient production, cultivation of varieties with higher yields, obtaining certificates such as BIP, PDO - protected designations of origin guarantee that the wine has been produced in a certain wine region in accordance with specific and officially regulated quality criteria (Moreno Gené, Solé Puiggené & Galizzo Larraz, 2024), which will make the products produced more attractive, production-oriented to limited series, organisation of tastings, wine parties for customers, the development of agrotourism, advertising to increase the visibility of winemaking, participation not only in domestic but also international wine fairs. Constant monitoring of the market and competition is an important strategy for every company.

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SENSORY MARKETING FOR PROMOTING MORE SUSTAINABLE PURCHASING BEHAVIOR

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Abstract. The article analyses sensory marketing to encourage more sustainable purchasing behaviour. The article uses the interview method to evaluate the use of sensory marketing elements to promote sustainability values. Sensory marketing affects sales and sustainability through enhanced consumer awareness of the importance of more socially responsible consumption. It is evident that the most influential of all the sensory marketing elements is sight (image), followed by hearing (sound), then smell (odour), touch (feel), and the least influential is taste (taste). According to respondents, it is acceptable that recycled materials are used to make reusable packaging, which ensures circular use of resources. Recycling gives waste a second life. Sustainable purchasing and consumption are reached by choosing products of higher quality and longer shelf life. Each person should decide whether they need a new product or service. Sensory marketing encourages a choice of higher quality, longer-lasting products. The findings show that socially responsible purchasing behaviour is still not a universal norm.

Keywords: sensory marketing; sight; hearing; taste; touch; smell; sustainability; sustainable development; social responsibility; consumers; purchasing hehavior

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1. Introduction

Sensory marketing is a marketing tool that aims to entice consumers by using their senses and influencing their feelings and behaviour. Sensory marketing consists of 5 sensors: taste, smell, touch, hearing, and vision. It is challenging for brands to attract customers' attention because they all look the same in the minds of consumers, so even with the help of various advertising methods, it does not reach potential customers or consumer consciousness. Buyers have learned to distance themselves from unwanted, redundant information and have recently been paying much attention to sustainable sustainability. For this reason, new technologies are increasingly used, influencing new ones for the emergence of marketing communication elements and the creation of non-traditional brands. Sensory marketing, which combines sensations, emotions, cognition, behaviour and rationality, has become very popular these days. Sensory marketing components effectively reach the attention of potential consumers and influence their decision to purchase a product. Still, affecting not just one but all people's senses is crucial. Considering the primary receptors, it can be understood that all five primary human senses - sight, hearing, smell, taste and touch – are essential. Therefore, all of them are closely related to sensory marketing. Sensory marketing is the application of all these human senses in the field of marketing

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to promote sales and harmony. It is noticeable that the further, the more the creators of sensory advertising use tools that indirectly affect the human consciousness and the subconscious mind, which relates to the primal human instincts and promotes sustainable harmony.

The authors seek to analyse how sensory marketing promotes sustainable purchasing decisions. To reach this aim, the following research tasks are raised: to examine the concepts of sensory marketing, sustainable sustainability and sensory marketing promoting sustainability, and to assess the impact of sensory marketing on promoting sustainability.

2. Literature review: sensory marketing and sustainability

Sensory marketing engages all five human senses – sight, hearing, taste, touch, and smell – to create an immersive brand experience. By strategically activating sensory cues, companies evoke specific emotions, memories, and associations with their brand in consumers' minds. Sensory branding elevates brand identity, builds loyalty, and differentiates it from competitors by leaving lasting impressions. Brands that master all five senses are better equipped to succeed in an increasingly competitive market (Jiménez-Marín et al., 2019; Jang et al. 2019, Vecchiato et al., 2021, Jiménez-Marín et al., 2021; Doucé, 2022; Di Cicco et al., 2024).

According to Platon (2021), marketers can adapt sensory marketing to the digital context and discover new ways to use the senses of sight, hearing, smell, taste and touch to engage consumers. Platon (2021) claim that it is essential to understand that sensory elements, in addition to images and sounds, will be helpful for customer engagement and that it is useful to integrate new technologies such as artificial intelligence, virtual reality, and augmented reality to create a multisensory experience that improves the user experience.

Sina et al. (2021) tested the relationship between trait attention and purchase intentions of sensory ads. They conducted an exploratory study to prepare participants' awareness. It showed that a high level of state awareness enhanced purchase intentions, determined by the number of sensory types.

Oduro et al. (2021) mentioned that by combining different plant raw materials and applying different sensory testing methods, sustainable alternatives to plant-based dairy products could be developed that can be further optimised.

Abdolmohamad et al. (2022) mentioned that sensory marketing has been described from both evolutionary psychology and social neuroscience perspectives; since a sensory stimulus elicits physiological and neurological responses, this entire procedure influences how the sensation is theoretically described.

Hamacher et al. (2022) stated specific sensory information on products and services can influence people's attitudes, purchasing intentions, and consumption and imagine the sound of opening and closing a car door, the smell and taste of freshly brewed coffee, or the feel of the textile structure of a new dress. According to Hamacher et al. (2022), all these sensory stimuli offer valuable information about the value of products and can significantly influence the purchasing decision process.

Pointke et al. (2022) mentioned that some studies have shown that external factors, e.g. packaging, brand, information, emotion and social environment, influence sensory perception.

Panea et al. (2023) stated that sensory analysis is a multidisciplinary field that involves measuring, interpreting and understanding human responses to the sensory properties of products and products necessary to study consumer behaviour. Panea et al. (2023) argue that understanding consumer preferences is key to the development of the food industry. Still, consumer behaviour is complex due to various factors influencing food choices. The author stresses that consumer attitudes result from several product attributes and depend on the importance attributed to each of them.

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Li et al. (2023) considered that Sensory ads provide consumers with direct or indirect sensory cues to appeal to consumers' senses, so direct sensory marketing refers to providing consumers with direct sensory products that convey sensory cues, such as magazine advertisements using perfumes using scented strips of paper to stimulate the sense of smell. Li et al. (2023) state that indirect sensory marketing refers to activating consumers' imaginations with words or images to convey sensory cues, such as depicting multisensory information through advertising copy.

According to Sun et al. (2024), future research could delve deeper into the diversity of colours and materials, the breadth of food types, and the versatility of cultures to further enrich and refine the field's theoretical framework and practical guidelines.

Kim et al. (2024) considered that sensory experiences result from sensory cues such as sound, including music, as well as colour and smell, and can influence consumers' purchasing and consumption decisions, so creating memorable experiences in the service industry is challenging. Service industry practitioners and researchers have recognised the need for new strategies and innovative customer propositions.

Summarising the above definitions by researchers, sensory marketing, also known as sensory branding, is a form of marketing that appeals to consumers through all five senses, and each sense is used to maintain an emotional connection with consumers.

The United Nations' Sustainable Development Agenda sets out 17 universal, global and interrelated Sustainable Development Goals that cover many policy areas and are designed to be achieved by 2030.

Odrowaz-Coates (2021) argues that sustainability is based on our response to environmental challenges and changes. Odrowaz-Coates (2021) points out that ecological sustainability is interrelated with social sustainability and vice versa, and the two also intersect with economic and political sustainability, which are interrelated. Vacchi et al. (2021) mentioned that the definition of sustainable development includes three dimensions of sustainability: environmental, economic, and social.

Urdea et al. (2021) argue that experiential marketing significantly impacts the consumer's decision-making process, providing many benefits, even when used in a digital environment.

Pazienza et al. (2022) stated that sustainable development is critical in managing population impacts on ecosystems, resources, food security, and sustainable economies to reduce societal pressures on the environment.

Płonka et al. (2022) mentioned that the ambiguity of the essence of the concept of sustainable development can also arise due to the differentiated emphasis on goals in three main dimensions: social, economic, and ecological. As stated by Płonka et al. (2022), many theoreticians of sustainable development support the model of simultaneous, harmonious, and equal consideration of the three mentioned dimensions.

Rosario et al. (2022) considered that the increased demand for innovative sustainable ecosystems is one of the main aspects connecting the digital transition and sustainability.

Knaapila (2022) stated that the food system's sustainability can be improved in various ways. According to him, plant-based meat and dairy analogues can help omnivores reduce their consumption of animal foods (i.e., become more flexible) and thus have a more sustainable diet since plant foods are generally considered healthier than animal foods.

Jiménez-Marín et al. (2019) state that the obtained results revealed the importance of sensory in marketing, as this study showed that sales, customer retention and customer satisfaction in the store increased significantly after implementing relevant sensory marketing strategies. According to these scientists, the sensory marketing model is suitable and reliable for increasing sales and making the store more sustainable since all the actions performed were related to reducing material resources typical of retail stores.

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Jang et al. (2019) focused on sensory marketing that appeals to the five senses of coffee shop customers ("sight", "smell", "sound", "taste", and "touch") to develop a sustainable growth model for the saturated coffee shop market. Jang et al. (2019) research found a relationship between coffee shop sensory marketing factors, emotions, such as pleasure, arousal, and dominance, flow, and behavioural intentions.

Hamacher et al. (2022) analyse that due to the increasing intensity of competition and homogenous service providers, it is becoming more difficult for service providers to capture consumers' attention in an online environment where sensory interaction is traditionally limited to mainly visual and audio input. Hence, success depends on the ability of sellers to combine textual and visual stimuli on e-commerce sites so that visitors can be effectively converted into buyers. According to Hamacher et al. (2022), sensory appeal in the online customer experience process is significant for an economically successful e-commerce platform; in addition, customers often believe that information and product visualisation do not correspond to reality and cause some uncertainty.

Li et al. (2024) mentioned that if environmentally friendly corporations motivate consumers to buy green products, it will benefit the global environmental trend. According to Li et al. (2024), consumers increasingly pay attention to a sustainable lifestyle and consider environmental protection and the personal advantages of green products. Greenness is promoted in various areas, such as green energy in manufacturing and production or environmentally friendly and waste-free packaging.

Jaeger et al. (2024) found that consumers' expectations of liking, emotional, conceptual and sustainability characteristics of yoghurts encourage consumers to use more sustainable products. Ünal et al. (2024) agree that sustainability and customer experience can be combined.

The link between sustainable marketing and the creation of sensory marketing promotes consumer engagement and promotes environmental responsibility. Sensory marketing uses sensory experiences to influence consumer behaviour and sustainable practices to encourage a more conscious consumption culture. Sensory marketing can effectively promote sustainable product choices by increasing the appeal of environmentally friendly options and thus reducing the impact of highly processed products. Integrating sensory elements into marketing increases customer satisfaction and reduces resource consumption, making retail operations more sustainable. While sensory branding can promote sustainable practices, challenges remain in ensuring that the sensory experience does not overshadow the core message of sustainability, requiring a balanced approach in marketing strategies.

3. Research methodology and research methods

A qualitative research method - interviews - was chosen for the research. The interview method was chosen for the collective research. Mohajan (2020) states that a properly selected research methodology can help achieve effective and significant research results. The sets of interview questions were developed following the latest research on sensory marketing and sustainability by Abdolmohamad et al. (2022), Hamacher et al. (2022), Pointke et al. (2022), Pazienza et al. (2022), Odrowaz-Coates (2021), Vacchi et al. (2021). These authors provided the necessary theoretical framework and proven practices that were applied to identify the most effective tools for sensory marketing and sustainable sustainability. Yusoff et al. (2021), for the development and verification of the questionnaire, also contributed to the development of the questionnaire, ensuring its methodological accuracy and validity. Research tools are necessary. The next step involved the careful definition of measurable attributes based on the analysis of literature sources.

A structured interview was chosen for the qualitative study, aiming to find out from experts what the relationship is between sensory marketing and sustainable sustainability. Qualitative research focuses on understanding the complexity of human behaviour and social phenomena, emphasising depth, context, and nuance. They are precious in revealing trends and exploring the diversity of human experiences (Lo et al., 2020). The qualitative method allows for establishing a personal relationship with the research object, diving deep and getting to know the subject's experiences, feelings, and thoughts because there are no pre-prepared answers, so the respondent

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expresses his opinion based on previous experiences (Alsoaery et al., 2023). The interview recording was transcribed and interpreted.

4. Analysis of the survey results

The study involved 10 participants/informants, five women and five men. Below is an anonymous list of participants with their social status, spheres of activity, activities sections, and work positions (see Table 1).

Table 1. Characteristics of informants

Participant	Social status	Sphere of activity	Section of activities	Type of activity	Job position
T1 (M)	Employed	Private business sector	Administrative and support service activities (N)	Employment agency activities (7810)	Owner - Director
T2 (M)	Employed	Private business sector	Wholesale and retail trade activities (G)	Retail sale of clothing in specialised stores (4771)	Head of Unit
T3 (M)	Employed	Public sector	Education (P)	Higher education (8540)	Lecturer
T4 (M)	Employed	Private business sector	Information and communication (J)	News agency activities (6391)	Journalist
T5 (M)	Employed, studying	Private business sector	Financial and insurance activities (K)	Life insurance (6511)	Insurance agent
T6 (V)	Employed	Public sector	Accommodation and food service activities (I)	Holiday and other short-stay accommodation (5520)	Accommodation provider, farmhouse owner
T7 (V)	Employed	Public sector	Manufacturing (C)	Garment sewing (1400)	Clothing designer
T8 (V)	Employed	Public sector	Construction (F)	Construction development (4110)	Construction manager
T9 (V)	Employed	Private business sector	Professional, scientific and technical activities (M)	Advertising agency activities (7311)	Owner-director
T10 (V)	Employed, studying	Private business sector	Transport and storage (H)	Passenger air transport (5110)	Transport specialist

With the increasing focus on sustainable consumption in society, it was appropriate to select representatives from different audiences who could ensure the comprehensiveness of the survey and reflect the various activities of society by participating in the survey. The survey was selected from 8 sections of the economic activities out of the 21 in the Classification. This allows for a broader range of answers to the questions posed and an assessment of the general public's attitudes towards sustainability through the personal use of sensory marketing tools.

Informants first described their views on how the elements of sensory marketing (sight (image), hearing (sound), smell (odour), taste (taste), and touch (feel)) can be used to promote sustainability values. Reducing consumption, taking an interest in sustainability, giving things a second life by recycling them, and adapting them to other uses were highlighted.

Informants stressed that sustainability is a critical issue, but unfortunately, it is not yet necessary for everyone (see results in Table 2 below).

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Table 2. Category - Use of sensory marketing elements to promote sustainability values

Category	Sub-category	Empirical study statements
Using sensory marketing elements to promote sustainability values	Elements of sensory marketing	"<...> Possible information on the sustainability of the product and its production process. Current and future sustainability issues are raised. Suggests a more sustainable product or service <...>" (T2, T3, T10); "<...> Recycled materials can be used to make reusable packaging, which ensures sustainable consumption. Recycling is promoted by giving waste a second life <...>" (T5, T9); "<...> Promotes sustainable purchasing and consumption by choosing products of higher quality and longer shelf life. The person can assess whether they need the product or service. Encourages the choice of a higher quality, longer lasting product <...>" (T1, T6, T8); "<...> I am not the most sustainable citizen. Discourages because it involves both extra costs and waste of resources <...>" (T4, T7).

The next question tackles integrating sensory marketing elements into sustainability themes, products or services. Nine informants said that they had noticed the integration of sensory marketing elements in sustainability, and only one did not see such integration (see results in Table 3 below).

Table 3. Category 3 - Integration of sensory marketing elements in sustainability

Category	Sub-category	Empirical study statements
Integrating sensory marketing elements in the context of sustainability	Sensory marketing elements	"<...> Sometimes there is a visible or perceived incentive to choose products. The advertising itself contains information related to sustainability. Sustainability symbols can be seen on the packaging. Emphasis is placed on the products being made from recycled elements. Attention is drawn to services that do not use harmful substances or energy-efficient equipment. <...>" (T1, T2, T3, T6); "<...> Packaging should be environmentally friendly <...>" (T9); "<...> A song has been created about sorting "wasteful" <...>" (T10); "<...> Uncoloured brown bags are associated with being natural. Green is associated with ecology. The use of advertising in clothes softeners often transports/relocates the character to nature <...>" (T5, T7, T4); "<...> I don't know, I haven't noticed <...>" (T8).

The next question focuses on sensory marketing elements, their impact on promoting sustainability, and the impact of integrated actions on the consumer. The informants here were divided between those who were optimistic that sensory marketing elements could encourage awareness sustainability among consumers and those who were unsure about such an impact (see results in Table 4 below).

Table 4. Category - Effect of sensory marketing elements on consumer sustainability awareness

Category	Sub-category	Empirical study statements
The impact of sensory marketing elements in promoting sustainability awareness among consumers	Elements of sensory marketing	"<...> Information on the amount of material saved or recycled increases awareness of sustainable consumption. Using several elements rather than just one will potentially attract more targeted people. The compatibility of the elements encourages consumers to choose sustainability. Sustainable relationship between urge/constraint <...>" (T1, T5, T6, T9, T10); "< > I do not think that the use of sensory marketing will affect consumer sustainability. It does not work. I haven't thought about it, but it probably won't. The presentation itself is not acceptable to the consumer in the form in which it is presented. The consumer lacks information <...>" (T2, T3, T4, T7, T8).

After finding out informants' views on how the consumer is reached and what influences or can influence conscious and sustainable consumption, it was also essential to find out how informants think about the contribution of sensory marketing to increasing consumer awareness of sustainability and social responsibility (see results in Table 5 below).

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Table 5. Category - Influence of sensory marketing elements on sustainability in raising consumer awareness and social responsibility

Category	Sub-category	Empirical study statements
The impact of sensory marketing elements on sustainability to increase consumer awareness and social responsibility	Elements of sensory marketing	"<...> Marketing campaign designers should be involved <...>" (T5); "<...> Using multiple sensory elements. Visual and auditory communication of the benefits of sustainability to society. Visually demonstrating how materials are produced, recycled and where leftovers are used <...>" (T2, T7, T8); "<...> Tactful, gentle and non-aggressive demonstration. Demonstrating sustainable and non-sustainable products that allow you to feel, smell, and see, such as a gift box that gives off the smell of freshly baked muffins and another box that gives off the smell of unrecycled rotten rubbish. Giving some concrete examples: say a campaign for schoolchildren to go to recycling sites to smell the smell and see the real environment and absorb the benefits of recycling <...>" (T4, T6, T9); "<...> This is a very complex action that depends very much on public awareness. Public education is needed. Raising sustainability issues - making them more visible <...>" (T1, T3, T10).

The impact of the elements of sensory marketing is increasingly evident in our lives. But do we consider how they influence our behaviour and shape our values for sustainable consumption? The informants were straightforward about the perceived impacts and what influences them most in the sustainability process. It is evident that the most influential of all the sensory marketing elements is sight (image), followed by hearing (sound), then smell (odour), touch (feel) and the least influential is taste (taste) (see results in the table below).

Table 6. Category - Sensory perceptions for sustainability

Category	Sub-category	Empirical study statements
Sensory sensations to promote sustainability	Sight (image)	"<...> Interesting presentation. The information is pleasing and aesthetically pleasing to the eye. Info stands, advertising, visibility of the product itself. Sees material that is recycled <...>" (T5, T6, T7, T10); "<...> Shows an unpleasant image-not sustainable. Multimedia, awnings-unsustainable, plastic, electricity < >" (T3, T4); "< > You see the real situation. The environment we live in <...>" (T9, T2); "< > Reduces aggression <...>" (T8); "< > Not everything is beautiful that is shiny (artificial paint) <...>" (T1).
	Hearing (sound)	"<...> You are allowed to hear the damage that is being done to, say, nature - the sound of trees being crushed. Endangered animal/bird species/noises <...>" (T2, T4); "< > Positive emotionally stimulating sound to promote sustainability. Hear info and can assimilate. Awareness < >" (T5, T7, T9); "< > Multimedia, radio - unsustainable - use of electricity, use of heat. Less advertising < >" (T1, T3); "< > Less fatigue < >" (T8).
	Olfaction (smell)	"<...> The milder the smell, the more pleasant. The more pleasant the smell of goods or services. Pleasant smells are emitted <...>" (T7, T8, T10); "< > Smelling meat in the market is a barn < >" (T3); "< > Banning synthetic smells < >" (T1); "< > It is allowed to smell bad smells, such as garbage <...>" (T4).
	Touch (smell)	"<...> By touch, we can compare quality parameters. The more pleasant the touch, the better. Bringing more robust, higher quality products to market. If it does not lose its marketable appearance, it is sustainable <...>" (T13. T7, T8, T9); "< > Touching rough surfaces - pointing to the messiness, linking denial to the roughness < >" (T4).
	Taste (tasting)	"<...> Small portions, quantities <...>" (T1); "< > Sour candy/sweet candy. Which one are you? < >" (T4); "< > Disposable dishes - unsustainable < >" (T3); "< > Hard to say < >" (T9).

Sustainable consumption is becoming increasingly important in a global consumer society, as society, the consumer, increasingly faces challenges. The theme of sustainability is also being addressed through the elements of sensory marketing. These elements are a small step closer to the consumer and, simultaneously, to a more sustainable life. Sustainable consumption is the conscious use of services and goods (products) to meet our basic needs and create a better quality of life.

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Conclusions

The analysis of scientific literature showed that sensory marketing influences the choice of organic products that promote environmental sustainability. The sensory marketing model is suitable and reliable for increasing sales and making the store more sustainable.

Research data show that informants first described their views on how the elements of sensory marketing (sight (image), hearing (sound), smell (odour), taste (taste), and touch (feel) can be used to promote sustainability values. Reducing consumption, taking an interest in sustainability, giving things a second life by recycling them, and adapting them to other uses were highlighted. Informants stressed that sustainability is a critical issue, but unfortunately, it is not yet necessary for everyone.

Sensory marketing increases consumer awareness of sustainability and social responsibility. It is evident that the most influential of all the sensory marketing elements is sight (image), followed by hearing (sound), then smell (odour), touch (feel), and the least influential is taste (taste). The theme of sustainability is also being addressed through the elements of sensory marketing. These elements are a small step closer to the consumer and, simultaneously, to a more sustainable life. Sustainable consumption is the conscious use of services and goods (products) to meet our basic needs and create a better quality of life; more social purchasing behaviour still needs to be encouraged since it is still not a universal norm.

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UNDERUSED RESOURCES AND COMPANIES' GROWTH: THE INFLUENCE OF DIGITAL TRANSFORMATION AND DECISION-MAKING ABILITY

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Abstract. In the digital economy era, diverse resources remain a critical asset for businesses aiming to boost their competitiveness and secure sustainable growth. Organisational slack, as an underused resource, has increasingly captured researchers' interest, with varying impacts attributed to different types of slack. Using data from Chinese A-share listed firms from 2011 to 2019, this study discusses the influence of slack resource on companies' growth and the mechanisms of their effects in the digital setting. We conducted an empowering regression analysis with two-factor fixed effects on the dataset and found that absorbed slack facilitates companies' growth, whereas unabsorbed slack may hinder it. Simultaneously, managers with strong decision-making ability and deep digital transformation are also conducive to absorbed slack for organisational growth. A real case from a traditional coal mine company was conducted to confirm our findings and make additional discoveries. We contribute to the academic discourse by offering practical guidance for businesses on the strategic use of slack resources and integrating digital transformation initiatives.

Keywords: digital transformation; underused resources; organisational slack; organisational growth; management decision-making ability

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1. Introduction

In the digital economy era, competing for resources is still an important goal in the transformation and upgrading stages of firm development. To achieve long-term strategic objectives, firms need to utilise resources to meet the constant challenges of the market in a dynamic environment (Chen & Hao, 2022; Essuman et al., 2022). Then, more and more companies begin to notice organisational slack when taking strategic actions.

Organisational slack is often described as the excess resources a firm needs in excess of its daily operations. Existing studies have mainly focused on operational efficiency, financial performance, organisational change, R&D investment, knowledge output (Agusti-Perez, Galan & Acedo, 2020; Boso et al., 2017; Carnes, et al. 2019). However, based on Resource Dependence Theory (abbreviated as RDT), as an idle resource, organisational slack can be integrated with external technology and resources in the process of use (Suzuki, 2018; Titus, O'Brien & Dixit, 2022). It can become a valuable heterogeneous resource that affects a firm's long-term development of the firm. Nevertheless, there has not been much research exploring this topic.

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Based on Upper Echelons Theory (UET), the use of resources is closely related to managers. Managers should make heterogeneous resources valuable by regulating them rationally (Francis et al., 2022). Owing to differences in the adoption of digital technologies and managers' analytical capabilities, Different managers make different decisions (Gavetti et al., 2012). Effective decisions are directly related to short-term business performance, while major decisions will affect long-term strategic development (Francis & Wu, 2022). Thus, decision-making ability explains how organisational redundancy is used within the organisation and affects long-term organisational growth.

It is critical for firms seeking to enhance their core competitiveness by how to combining resources with digital technology to conducting digital transformation in the digital economy (Feliciano-Cestero et al., 2023; Gao, Lin & Zhai, 2022).The point of digital transformation is to introduce external digital technologies into operations, helping firms achieving more decision-making approaches and growing their performance (Ferreira, Fernandes, & Ferreira, 2019; Wu, Fu & Kong, 2022). As a result of digital transformation, Significant changes in the way organisational slack is leveraged and valued (Ferreira et al., 2019). In this context, it is a theoretical and practical question to answer how organisational slack, as an idle resource, can meet digital technology and realise effective use to promote the growth of the organisation.

Based on the above description, we propose two main research questions: (1) Whether different types of organisational slack can help organisations grow; (2) What is the role of decision-making ability and digital transformation in this process. Based on Resource Dependence Theory (RDT) and Upper Echelons Theory (UET), we established theoretical frameworks and models to explain these problems. We use a dataset of 14,041 company-year observations, containing 1,520 China's A-shares listed companies. Our results suggest that organisational slacks have negative effects on organisational growth in the long term. We also found that decision-making ability can help control the negative effects of absorbed slack on organisational growth. Moreover, the relationship between decision-making ability and digital transformation weakens the impact of unabsorbed slack on organisational growth from both internal and external perspectives, effectively mitigating the negative effects of unabsorbed slack.

This study makes several contributions to the literature. First, we explore the relationship between organisational slack and organisational growth from the perspective of multidimensional classification. Organisations' long-term growth has different organisational slack requirements. Thus, it provides empirical support for the economic and strategic impacts of different organisational slack. Second, our study provides a research approach to the cultivation process, not only of organisational slack on economic and strategic effects, but also on long-term organisational resilience. From the perspective of Resource Dependence Theory and Upper Echelons Theory, we introduced digital transformation and decision-making ability to analyse how they affect the layout and utilisation of organisational slack. Our study enriches research on organisational slack and growth by highlighting the importance of managers and digital transformation for organisational growth. Last but not least, we suggest that organisations focus on digital transformation practices. The use of digital technologies, such as big data and cloud computing, in digital transformation can help managers adjust the use of organisational redundancy in strategic decisions, assisting businesses to achieve strategic goals and organisational growth.

2. Theoretical background

2.1 The benefits of organisational slack for organisational growth

For businesses, organisational slack can be used as a motivator for survival, a buffer in the face of a crisis, and a specific strategic resource to help grow (Bourgeois, 1981; Titus et al., 2022). Unabsorbed and absorbed slacks have different effects on organisational performance, which has long been recognised by scholars (Titus et al., 2022). This is mainly due to the fact that absorbed slack is a restricted resource with a specific use, such as idle machinery, excess inventory, etc.. In contrast, unabsorbed slack is much more versatile, liquid and easy to redeploy, specifically cash and securities (Suzuki, 2018). Resource dependence theory suggests that firms are able to utilise internal resources to bring a range of competitive advantages to themselves. Organisational slacks, as idle resources, are underutilised heterogeneous resources. Rather than ordinary resources, which take a while to transform into what the firm needs, the slack can be used quickly when needed (Barney, 1991).

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In view of short-term operations, unabsorbed slack facilitates growth in business performance. Tognazzo et al. (2016) found that financial slack (i.e., unabsorbed slack) can drive firm profitability when facing external environmental shocks. However, it is worth noting that organisational growth as a long-term strategic direction, if too much unabsorbed slack is held for a long period of time, i.e., the firm owns very abundant funds, resulting in managers are prone to form a dependence on organisational slack, and thus overly develop the firm's business horizontally, massively exploit the non-core new products and uncontrollably expand the new markets, so that it is difficult to ensure that the firm focuses on the operation of its core business and the R&D investment in its core products, and the firm fails to achieve centralised development (Vanacker, Collewaert & Zahra, 2017; Duan, Wang & Zhou, 2020; Zhao et al., 2024). Having developed a dependency, managers also have a preference for high-risk investments in innovation, which is not conducive to long-term organisational growth.

Absorbed slack is known to be a slack resource for exclusive functions within a firm and is formed to meet specific purposes, such as idle inventory, specialised machinery, and special talents (Bao et al., 2020). These absorbed slacks, because they are less liquid than unabsorbed slacks, are less likely to be used at the discretion of managers, which may limit organisational flexibility and adaptability (Titus et al., 2022). In a rapidly changing market environment, highly dedicated slacks are difficult to adapt quickly to new needs, thus impeding the rapid growth of the organisation. Absorbed slack is generally directly related to the productivity and capability, and has the potential to lead organisational inertia for its embedded in organisational processes and structures. Organisational inertia can hinder necessary change and innovation and limit the long-term growth. In addition, absorbed slack may be over-invested and stored. The more absorbed slack the organisation has, the more risk-averse it will be. Excessive security inventory level makes organisations reluctant to easily abandon existing business models, which prevents them from exploring new markets and innovation opportunities, thereby limiting their growth (Leuridan & Demil, 2022; Zhao et al., 2024). In a competitive market, absorbed slack can cause an organisation to react less quickly to market changes and miss out on long-term growth opportunities. Accordingly, we propose the following hypotheses:
H1a: Unabsorbed slack is negatively related to organisational growth. Higher levels of unabsorbed slack are adverse to organisational growth.
H1b: Absorbed slack is negatively correlated with organisational growth. Higher levels of absorbed slack are adverse to organisational growth.

2.2 The moderating effect of decision-making ability

In general, organisational slack in a firm is a resource whose stock and use are subject to managerial regulation (Francis et al., 2022). The Upper Echelons theory suggests that, as the ultimate decision-makers in business operations, the differences in personal characteristics such as personality, educational background, cognitive level and values, as well as the different ways of dealing with problems, will lead to different strategic decisions made by different managers in the facing the same problem (Alessandri, Cerrato, & Depperu, 2014; Azadegan, Patel, & Parida, 2013; Demerjian et al., 2013). This ability varies from person to person, leading to different strategic choices and program implementation, which in turn affects the operation and long-term development of the firm (Anderson & Eshima, 2013; Andreou et al., 2015; Azadegan et al., 2013).

Managers who make decisions are finite-rational, so the ways in which organisational slack is used are very closely related to management decisions. Managers in the organisation decide how to allocate resources. Higher decision-making ability indicates that managers can leverage a firm's resources and rely on organisational slack to seize external opportunities. High-capacity managers adapt to environmental changes by adjusting the firm's internal and external resources and create business value by restructuring the firm's resource allocation and investment strategy to realise the firm's long-term development goals (Francis et al., 2022; Wang et al., 2016)

Organisational slack can act as a buffer to help a business weather external shocks through the properties it possesses. In this process, managers should realise efficient decision-making through the effective allocation of resources, etc., and especially in the dynamic changing environment, managers need to seize the opportunity to effectively use the unabsorbed slack with high flexibility to avoid the firm falling into a crisis (Tangpong, Abebe & Li, 2015; Fredrich, Bouncken, & Kraus, 2019) . Unlike managers with low self-control, managers with a higher level of decision-making are able to obtain more comprehensive information to effectively predict the development status of the firm to reduce the dependence on liquidity (Vanacker et al., 2017). Therefore,

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higher decision-making ability can improve the allocation and use efficiency of internal and external resources, and with a lower level of unabsorbed slack can accomplish the goal of long-term corporate growth.

On the other hand, the better the manager's decision-making ability in the use of idle inventory, machinery and special talents, the better the utilisation of the firm's absorbed slack and the mitigation of the risk shock to the firm in the case of a crisis event (Vanacker et al., 2017; Fredrich et al., 2019; Khurram et al., 2024). Typically, since absorbed slack is directly related to the productivity and capacity of the firm, managers with strong decision-making abilities are able to keenly perceive the signals of opportunities arising from external market and policy trends (Holcomb, Holmes Jr. & Connelly, 2009; Xu et al., 2015; Zhang et al., 2020; Agusti-Perez et al., 2020; Zhang, Xu & Ma, 2023), and thus rebalance the usage of absorbed slack within the organisation. Through the reconfiguration of idle resources inside the organisation, managers are constantly searching for optimal solutions for the utilisation of resources and improving the underutilisation of absorbed slacks in the firm (Suzuki, 2018). Accordingly, we propose:

H2a: Decision-making ability negatively moderates the relationship between unabsorbed slack and organisational growth. The stronger the decision-making ability, the more significant the weakening effect on the negative correlation between them.
H2b: Decision-making ability negatively moderates the relationship between absorbed slack and organisational growth. The stronger the decision-making ability, the more significant the weakening effect on the negative correlation between them.

2.3 The moderating effect of digital transformation

In the digital economy, digital transformation is an important concept that involves an organisation's internal and external aspects. Digital technology has been continuously applied to the production and operation of firms, combining it with internal resources to cultivate a digital-age firm capability. Although digital transformation has long been present in organisations, it is only in recent years that the concept of it has been formalised (Zoppelletto et al., 2023). Digital transformation in organisations mainly uses digital technologies such as automation, blockchain, and cloud computing to optimise business processes within the firm, streamline production steps, and bring new growth opportunities to the firm (Vial, 2019; Zhang, Su & Tong, 2023). Digital transformation is not just a change in the technical aspects of the organisation but also involves changes outside the scope of the organisation, which leads to profound changes in the organisation's products and operations, processes and business models, etc. (Feliciano-Cestero et al., 2023).

Digital transformation can drive companies to improve their resource management capabilities to reduce underutilisation of unabsorbed slack. Starting from resource dependence theory, research on digital transformation has mostly focused on the firm dimension, including corporate governance, economic value, and firm performance (Ji et al., 2022; Meng, Su & Yu, 2022; Wang & Du, 2022), It has been found that the deeper the degree of digital transformation, the higher the firm's ability and efficiency in managing resources. Unabsorbed slack generally represents waste caused by companies not using their resources effectively. In contrast, digital transformation can help companies manage and utilise their existing resources more efficiently, thereby reducing the need for corporate cash flow. Second, digital transformation also provides companies with more opportunities for organisational innovation (AlNuaimi et al., 2022; Gao et al., 2022; Guo & Xu, 2021; Li et al., 2018), allowing them to optimise internal information flow, strengthen data analytics, and improve decision-making accuracy through in-depth digital transformation to reduce unabsorbed slack inventory (Li et al., 2018). This ability to learn and innovate helps firms make better use of their existing resources, which also dampens the impact of unabsorbed slack on organisational growth (Wang, Guo & Yin, 2017).

Digital transformation enables the integration of digital technologies with absorbed slack to improve the productivity of manufacturing operations. From the concept of digital transformation, it is clear that in a firm, digital transformation is not simply about applying technology but also about changing the organisation's structure and business processes (Feliciano-Cestero et al., 2023; Vial, 2019). The use of digital technologies in business systems has enabled the faster inter-organisational transfer of information on organisational redundancies, helping managers keep track of the use and effectiveness of resources in real-time and to make timely adjustments to programs (Ferreira et al., 2019). This transfer allows the organisation to understand the

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external demands and internal needs of the firm, enabling it to respond more quickly to changes in the marketplace and gain a strategic advantage in the long term. In addition, in the process of digital transformation, digital technologies have driven innovation in firm business models and core products (Li et al., 2017; Li et al., 2018), The deeper the digital transformation, the more the stock that has absorbed slack will contribute to the growth of the organisation. Accordingly, we propose the following hypotheses:

H3a: Digital transformation negatively moderates the relationship between unabsorbed slack and organisational growth. The deeper the digital transformation, the more pronounced is the weakening effect on the negative correlation between them.
H3b: Digital transformation negatively moderates the relationship between absorbed slack and organisational growth. The deeper the digital transformation, the more pronounced the weakening effect on the negative correlation between them.

Combined with our hypotheses, the figure below (**Error! Reference source not found.**) explains our conceptual framework.

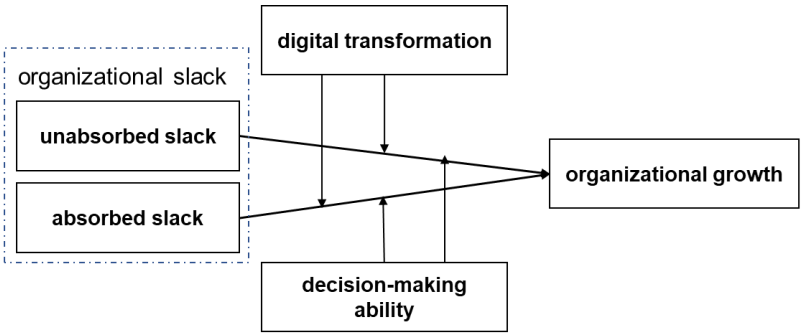


Figure 1. Conceptual Framework

3. Methodology

3.1 Sample and data

We selected all A-shares listed companies in China from 2011 to 2019 as a sample. The CSMAR databases are used to calculate main variables and control variables that represent firm and individual characteristics. Considering the deviation value, we delete data from the financial and real estate sectors and remove the sample with ST and ST* marks from 2011 to 2019. We also expurgate samples with missing variables for three or more consecutive years. Supplementing some missing data through the Internet and official corporate financial reports, we finally get 14049 annual observations of companies from 2011 to 2019. The final data sample after processing is an unbalanced panel data.

The core variable, organisational growth, is a long-term indicator. China experienced the COVID-19 outbreak in late 2019 and early 2020, and the COVID-19 outbreak that began in 2020 has had an unprecedented impact on the global economy and organisation operations. Such extreme event has led to abnormal data in the data which makes the data of the year from 2020 to 2023 incomparable to previous years, affecting the accuracy and reliability of the results. Also, this significant economic fluctuation masks the long-term impact of slack resources on companies' growth, and there are more outliers in the newer data, making the data for this period unsuitable for analysing stable trends in organisational growth. Therefore, we have used the data from 2011 to 2019 to conduct this research.

3.2 Variables and measurements

(1) Dependent variable: Organisational growth
Referring to previous studies, we regard three years as the time window for organisational growth (Ortiz-de-Mandojana & Bansal, 2016). We calculate the growth of the cumulative operating income of the firm within three years as our dependent variable (the data are collected from "Financial data database" of CSMAR). It is

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worth noting that we choose cumulative growth rather than year-to-year growth to represent organisational growth. One important reason is that year-on-year growth does not reflect the longer-term performance of the organisation, but cumulative growth reflects the organisation's long-term growth.

(2) Independent variables

We divide organisational slack into unabsorbed slack and absorbed slack (Bourgeois & Singh, 1983). Referencing to Bourgeois et al. (1981) and Duan et al. (2020), we calculate our independent variables. Unabsorbed slack is calculated using financial metrics, measured as the average of current ratio and the debt equity ratio (the data are collected from "Financial data database" of CSMAR). It reflects the company's ability to repay debts and invest. Absorbed slack is measured by financial expense rate during the sales period, reflecting organisational slack that can be reused in the absorbed slack.

(3) Moderators

Decision-making ability. Although there are various methods to measure managerial decision-making ability, Dermerjian et al. (2013) approach is widely used. The data envelopment analysis (DEA) method and Tobit model are used to calculate the decision-making ability, which is divided into two steps (Demerjian et al., 2013). This DEA method calculates manager capability by separating the impact of managers on the efficiency of the firm from the total efficiency of the firm. On the basis of avoiding missing samples, this method can simply and intuitively calculate the operating efficiency of large sample companies, and has obtained a large amount of contributions in the previous studies(Agustí, Velasco & Galán, 2021; Andreou et al., 2015; Francis et al., 2022; Holcomb et al., 2009). The DEA method is divided into two steps: first, calculate the total efficiency of the company by industry; Next, the contribution value of the separate manager. Since firm efficiency is affected by factors at both firm and manager levels, Tobit model is used to separate the effects of the two. And we assign the results of values to the residuals in order of magnitude, with a maximum value of 4 and a minimum value of 1.

Digital transformation. Traditional firm-level research on digital transformation uses questionnaires for measurement. However, this measurement method has common methodological bias and subjective bias, resulting in problems of reliability and validity (Vial, 2019). The text mining method, using multi-source heterogeneous data and machine learning algorithms, can effectively reduce theses bias. In the current research, the computational digital transformation mainly adopts the approach of text mining(Ji et al., 2022; Matarazzo et al., 2021; Tian, Li & Cheng, 2022). The CSMAR database "Digital economy database" contains the indicators of digital transformation of Chinese listed company and the database are widely used because of its authority. Digital transformation is measured by counting the frequency of keywords in a firm's annual report, su.ch as terms relate to digitalisation like artificial intelligence, blockchain, big data, Internet, etc. The statistical word frequency is the sample value of digital transformation.

(4) Control variables

We also control for variables that may affect organisational slack and organisational growth. We mainly consider the influence of firm factors on the study, such as firm size and firm age. We took the logarithm of firm size. For controlling executive characteristics, we use executive team size as a control variable, which is defined as the total number of executives. Besides, the degree of aggressiveness and depth of R&D activities varies from firm to firm. Therefore, we used the R&D investment intensity variable as a control variable. R&D investment intensity is the ratio of R&D investment expense to firm's operating income, indicating the importance of technological innovation such as digitisation. All the data are collected from “Equity and governance database” and “Listed company R&D innovation database” (CSMAR).

3.3 Estimation method

We use a two-factor fixed effects regression model to test our hypotheses. And we take natural logarithms for part of our variables in order to reduce multicollinearity before the regression.

First, we test the main effect of organisational slack on organisational growth, as shown in equation (1).

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$$OG = \frac{\beta_1 POTENTIAL_{i,t}}{SALES_{i,t}} + \sum Controls + \delta_i + \lambda_t + \varepsilon_{i,t} \quad (1)$$

Then we test the moderating effects of digital transformation and decision-making ability, as shown in equation (2) and (3),

$$OG = \frac{\alpha_1 POTENTIAL_{i,t}}{SALES_{i,t}} + \frac{\alpha_2 MA_{i,t}}{DIGI_{i,t}} + \sum Controls + \delta_i + \lambda_t + \varepsilon_{i,t} \quad (2)$$

$$OG = \frac{\alpha_1 POTENTIAL_{i,t}}{SALES_{i,t}} + \frac{\alpha_2 MA_{i,t}}{DIGI_{i,t}} + \frac{\alpha_3 POTENTIAL_{i,t} \times MA_{i,t}}{DIGI_{i,t}} + \sum Controls + \delta_i + \lambda_t + \varepsilon_{i,t} \quad (3)$$

where $POTENTIAL_{i,t}/SALES_{i,t}$ indicates unabsorbed slack/absorbed slack; $MA_{i,t}/DIGI_{i,t}$ represents decision-making ability/digital transformation; OG denotes the independent variable; $\sum Controls$ are sets of control variables; δ_i denotes fixed individual effect aim to control for factors that do not vary over time but are related to individual; λ_t indicates fixed time effect, controlling for correlational variables that vary over time but not with individuals; we let $\varepsilon_{i,t}$ on behalf of random error to ensure the reliability of evidence. Table 1 lists all the variables and their abbreviation.

Table 1. Variable description

	Variable Name	Abbreviation
Dependent variable	Organisational growth	OG
Independent variable	Unabsorbed slack	POTENTIAL
	Absorbed slack	SALES
Moderating variable	Digital transformation	DIGI
	Decision-making ability	MA
Control variable	Firm characteristics: Firm age	AGE
	Firm characteristics: Firm size	LNSIZE
	R&D activities: R&D investment intensity	RD
	Executive characteristics: Team size	TMT

4. Results and discussion

4.1 Hypothesis tests

Table 2 displays the sample characteristics and the correlations for the variables, indicating that there is no multicollinearity between the remaining variables.

Model 1 in Table 3 tests the effect of unabsorbed slack on organisational growth, and shows that unabsorbed slack has a negative effect on organisational growth (B=-2.067; p <0.01). Model 6 in Table 4 tests the effect of absorbed slack on organisational growth, and indicates that absorbed slack has a negative effect on organisational growth (B=-233.958; p<0.001). Thus, both H1a and H1b are supported.

Table 2. Descriptive Statistics and Correlations

	Mean	SD	Min	Max	OG	POTENTIAL	SALES	DIGI	MA	AGE	LNSIZE	RD	TMT
OG	23.75	86.10	-184.5	567.6	1								
POTENTIAL	1.226	1.157	0.242	8.026	-0.1217***	1							
SALES	0.0179	0.0365	-0.0606	0.215	-0.0221	-0.3362***	1						
DIGI	1.129	1.311	0	4.812	0.0787***	0.0287**	-0.1440***	1					
MA	2.437	1.136	1	4	0.0259*	-0.0342***	-0.0885***	0.0429***	1				
AGE	17.26	5.630	1	43	0.0417***	-0.1726***	0.1394***	0.0756***	0.1000***	1			
LNSIZE	3.105	0.0590	2.704	3.355	0.4760***	-0.2792***	0.1966***	0.0849***	0.0159	0.1482***	1		
RD	3.903	4.120	0.0101	25.03	-0.1321***	0.2775***	-0.1685***	0.3358***	-0.2443***	-0.1434***	-0.2232***	1	
TMT	16.98	3.698	10	29	0.1792***	-0.1652***	0.1273***	-0.0582***	-0.0211	0.0298**	0.4208***	-0.0787***	1

** T-statistics in parentheses, *** p<0.01, ** p<0.05, * p<0.1*

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"Decision-making ability" is introduced in Model 3 and Model 8 to test H2a and H2b. Model 3 in Table 3 illustrates that there exists a substitution effect between decision-making ability and unabsorbed slack, supporting H2a (B=-1.403; p<0.01). The stronger the decision-making ability, the greater the weakening effect on the negative relationship between unabsorbed slack and organisational growth. In Model 6, we have tested H2b. The interaction coefficient also provides evidence supporting this hypothesis (B=-40.329; p<0.1). The stronger the decision-making ability, the greater the weakening effect on the negative relationship between absorbed slack and organisational growth. Thus, both H2a and H2b are supported.

"Digital transformation" is introduced in Model 5 and Model 10 to test H3a and H3b. Digital transformation has a significantly positive effect on the relationship between unabsorbed slack and organisational growth (B=1.303; p<0.01), as presented in Model 5 in Table 3. Digital transformation exhibits a substitution effect with unabsorbed slack.. But Digital transformation has an insignificantly negative effect on that between unabsorbed slack and organisational growth (p>0.1), as shown in Model 10 in Table 4. The possible reason is that digital transformation has limitations across enterprises, industries and regions. Large enterprises or technology-intensive enterprises are advancing in digital transformation faster than small and medium-sized enterprises (SMEs), leading to an imbalance in the degree of digital transformation among businesses. Furthermore, there are differences in the effectiveness of digital technology utilisation among different enterprises. Some enterprises face difficulties in technology integration and fail to achieve effective integration of technology with unabsorbed redundancy, which limits the enhancement of resource management capabilities through digital transformation. Thus, H3a is supported, but H3b is not supported.

Table 3. Regression results: Unabsorbed slack and organisational growth

	M1	**M2**	**M3**	**M4**	**M5**
VARIABLES	**OG**	**OG**	**OG (with MA)**	**OG**	**OG (with DIGI)**
POTENTIAL	-1.309e+08**	-8.876e+07	-2.111e+08*	-1.375e+08**	-1.470e+08**
	(-2.42)	(-1.54)	(-1.90)	(-2.53)	(-2.28)
MA		-5.645e+08***	-6.298e+08***		
		(-8.21)	(-7.38)		
POTENTIAL×MA			49846853.675		
			(1.29)		
DIGI				-1.544e+08**	-1.651e+08**
				(-2.47)	(-2.24)
POTENTIAL×DIGI					8681636.310
					(0.27)
AGE	76411472.282***	85144362.123***	84200012.129***	93424005.338***	93398235.489***
	(3.10)	(3.27)	(3.23)	(3.65)	(3.65)
LNSIZE	-7.523e+10***	-7.824e+10***	-7.820e+10***	-7.430e+10***	-7.428e+10***
	(-31.82)	(-31.58)	(-31.56)	(-31.04)	(-31.00)
TMT	-9.982e+07***	-1.005e+08***	-1.006e+08***	-9.807e+07***	-9.815e+07***
	(-4.19)	(-4.06)	(-4.07)	(-4.11)	(-4.12)
RD	51130438.036***	33720637.827**	34871513.127**	52020604.140***	51610357.192***
	(3.85)	(2.39)	(2.47)	(3.92)	(3.86)
Constant	2.312e+11***	2.418e+11***	2.418e+11***	2.282e+11***	2.281e+11***
	(32.64)	(32.53)	(32.54)	(31.75)	(31.72)
Observations	12,593	12,080	12,080	12,593	12,593
R-squared	0.135	0.142	0.144	0.135	0.137
Number of id	1,547	1,523	1,523	1,547	1,547
Company FE	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES

** T-statistics in parentheses, *** p<0.01, ** p<0.05, * p<0.1*

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Table 4. Regression results: Absorbed slack and organisational growth

	M6	M7	M8	M9	M10
VARIABLES	**OG**	**OG**	**OG (with MA)**	**OG**	**OG (with DIGI)**
SALES	6.522e+09***	6.289e+09***	-2.341e+09	6.490e+09***	3.182e+09**
	(5.14)	(4.77)	(-1.12)	(5.12)	(2.18)
MA		-5.471e+08***	-8.368e+08***		
		(-7.96)	(-9.55)		
SALES×MA			3.404e+09***		
			(5.31)		
DIGI				-1.432e+08**	-3.390e+08***
				(-2.29)	(-4.47)
SALES×DIGI					2.500e+09***
					(4.53)
AGE	70577365.884***	76185150.583***	80634019.472***	86729855.313***	90853055.237***
	(2.87)	(2.93)	(3.10)	(3.39)	(3.55)
LNSIZE	-7.396e+10***	-7.725e+10***	-7.804e+10***	-7.307e+10***	-7.313e+10***
	(-31.44)	(-31.31)	(-31.61)	(-30.66)	(-30.71)
TMT	-1.004e+08***	-1.013e+08***	-1.000e+08***	-9.868e+07***	-1.013e+08***
	(-4.21)	(-4.10)	(-4.05)	(-4.14)	(-4.25)
RD	35619759.964***	20294403.882	24249960.779*	36376191.330***	34671083.973***
	(2.65)	(1.43)	(1.71)	(2.70)	(2.58)
Constant	2.268e+11***	2.383e+11***	2.414e+11***	2.239e+11***	2.243e+11***
	(32.24)	(32.25)	(32.61)	(31.34)	(31.42)
Observations	12,593	12,080	12,080	12,593	12,593
R-squared	0.135	0.142	0.144	0.135	0.137
Number of id	1,547	1,523	1,523	1,547	1,547
Company FE	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES

** T-statistics in parentheses, *** p<0.01, ** p<0.05, * p<0.1*

4.2 Robustness and endogeneity check

Replacing independent variables. The above empirical study found that redundant resources have a significant effect on organisational growth, but the research results may be affected by endogeneity issues. Although a series of organisation-related variables have been controlled in our model, there may still be endogeneity issues. In response to the potential problems, we used industry-level adjusted financial indicators as instrumental variables to eliminate differences between industries. Therefore, we measured unabsorbed slack by using the quick ratio of enterprises minus the industry median or mean (QR), and absorbed slack by using the ratio of sales and administrative expenses (SALESRATE) to operating income minus the industry median or mean (Table 5).

Table 5. Replacing independent variables

	(1)	(2)	(3)	(4)
VARIABLES	**QR**	**SALESRATE**	**QR**	**SALESRATE**
QR	-1.100***		-0.405*	
	(-4.96)		(-1.79)	
SALESRATE		-139.967***		-81.233***
		(-6.70)		(-3.68)
AGE			-1.775***	-1.584***
			(-4.90)	(-4.38)
LNSIZE			1,029.479***	1,023.645***
			(29.14)	(28.96)
TMT			1.319***	1.327***
			(3.69)	(3.72)
RD			-1.756***	-1.550***
			(-5.30)	(-4.60)
Constant	19.298***	25.168***	-3,150.441***	-3,131.697***
	(11.26)	(12.15)	(-29.81)	(-29.61)
Observations	14,040	14,036	11,918	11,918
R-squared	0.032	0.033	0.114	0.115
Number of id	1,618	1,618	1,502	1,502
Company FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES

** T-statistics in parentheses, *** p<0.01, ** p<0.05, * p<0.1*

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Lagging dependent variable. When conducting robustness tests, we introduced the dependent variable lagged by one period (**F. Growth**). The theoretical basis for this approach is that strategic decisions and organisational growth of enterprises often require a certain amount of time to be implemented and to manifest their effects. Therefore, we believe that lagging the dependent variable by one period can more accurately capture the long-term impact of corporate decisions. In Table 6 columns (1) to (2), the impact of unabsorbed slack and absorbed slack on organisational growth lagged by one period is reported, showing that both unabsorbed and absorbed slack have a negative effect on organisational growth, thus validating the robustness of the results.

Adding control variables. To further control other factors that may affect corporate performance, we included the Book-to-Market Ratio (MBA) and Debt-to-Asset Ratio (DEBTASSET) as control variables in the model. The Book-to-Market Ratio can reflect the financial structure and investment value of an enterprise, while the Debt-to-Asset Ratio can reveal the financial leverage level of an enterprise. The inclusion of these two variables helps us to more comprehensively understand the factors affecting corporate performance. In Table 6 columns (3) to (4), the regression results with added control variables are reported, showing that both unabsorbed slack and absorbed slack have a negative effect on organisational growth, thus validating the robustness of the results.

Controlling for industry fixed effect. In the main effect regression model, we considered the dual fixed effects of time and individuals but did not fully account for the heterogeneity between industries. To address this issue, we introduced industry fixed effects (Industry FE) in the robustness test. By controlling for industry effects, we can more accurately assess the impact of corporate organisational growth on performance and eliminate the interference that industry-specific factors may bring. In Table 6 columns (5) to (6), the regression results with added control variables are reported, showing that both unabsorbed slack and absorbed slack have a negative effect on organisational growth, thus validating the robustness of the results

Table 6. Lagging dependent variable, adding control variables and controlling for industry fixed effects

	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	**F. Growth**	**F. Growth**	**Add Control**	**Add Control**	**Growth _Industry**	**Growth _Industry**
POTENTIAL	-1.790**		-1.572*		-7.280***	
	(-2.07)		(-1.83)		(-11.36)	
SALES		-175.136***		-308.681***		-86.210***
		(-4.92)		(-9.12)		(-3.59)
AGE	-0.634	-0.455	-1.793***	-1.505***		
	(-1.46)	(-1.06)	(-4.98)	(-4.23)		
LNSIZE	625.752***	655.967***	1,208.385***	1,194.615***		
	(15.20)	(15.93)	(31.93)	(31.66)		
TMT	0.019	-0.031	1.082***	1.000***		
	(0.05)	(-0.08)	(3.06)	(2.84)		
RD	-1.084***	-1.094***	-1.668***	-1.378***		
		(-2.84)	(-5.08)	(-4.20)		
DEBTASSET			3.142	39.816***		
			(0.48)	(5.76)		
MBA			-76.666***	-74.641***		
			(-15.21)	(-14.86)		
Constant	-1,893.231***	-1,989.200***	-3,653.506***	-3,630.352***	7.594**	-3.434
	(-15.37)	(-16.18)	(-32.55)	(-32.48)	(2.32)	(-1.22)
Observations	10,202	10,202	11,918	11,918	14,040	14,036
R-squared	0.063	0.065	0.134	0.141	0.064	0.056
Number of id	1,478	1,478	1,502	1,502	Cluster	Cluster
Company FE	YES	YES	YES	YES	YES	YES
Year FE	YES	YES	YES	YES	YES	YES
Industry FE	NO	NO	NO	NO	YES	YES

** T-statistics in parentheses, *** p<0.01, ** p<0.05, * p<0.1*

Changing the sample period. To assess the robustness of the results of this study, we drop the years of the sample for robustness checks. The reason is that Industry 4.0 officially started in 2013, and countries have begun to advocate the application of digital technologies to all walks of life. China proposed the concept of digital transformation in recent years and that firms define their digital transformation. Therefore, we delete a time

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window (3 years from 2011 to 2013) of years and reperformed the two-factors fixed effects regression. As presented in Table 7, H1a, H1b have still be supported.

Table 7. Changing the sample period

VARIABLES	(1) **Growth**	(2) **Growth**	(3) **Growth**	(4) **Growth**
POTENTIAL	-4.456***		-0.191	
	(-3.66)		(-0.13)	
SALES		-252.360***		-365.365***
		(-7.64)		(-8.63)
AGE			2.020***	1.962***
			(3.78)	(3.69)
LNSIZE			1,298.739***	1,272.868***
			(24.00)	(23.62)
TMT			1.121**	1.073**
			(2.39)	(2.30)
RD			-2.499***	-1.909***
			(-5.90)	(-4.48)
DEBTASSET			-26.388***	9.371
			(-2.97)	(1.02)
MBA			-76.872***	-73.411***
			(-11.47)	(-10.99)
Constant	21.349***	21.086***	-4,000.366***	-3,932.017***
	(10.15)	(12.70)	(-24.62)	(-24.33)
Observations	9,313	9,312	8,095	8,095
R-squared	0.050	0.056	0.136	0.145
Number of id	1,603	1,603	1,488	1,488
Company FE	YES	YES	YES	YES
Year FE	YES	YES	YES	YES
Industry FE	NO	NO	NO	NO

** T-statistics in parentheses, *** p<0.01, ** p<0.05, * p<0.1*

5. Case study

In this part, we conducted a one-case study, that is, using multiple methods to test the robustness of our findings. More specifically, we interviewed the senior managers of Company H, a coal mine enterprise which is a traditional enterprise from China. They are exploring the digital transformation of traditional enterprises.

5.1 Company profile

Company H is a subsidiary of a central enterprise. As of the end of 2023, there are 682 employees and its revenue exceeds 190 million *yuan*, which belongs to the standard of small and medium-sized coal mine enterprises. In the era of digital economy, Company H, as a traditional coal mine enterprise, realises the importance of digitalisation for organisational resource utilisation and organisational growth. At the end of 2023, relying on the cloud platform, the construction of the "Sunshine Project" was launched, in order to speed up the transformation and upgrading of one's own business, rationally utilise the internal resources of the organisation, and finally improve the company's operating efficiency then accomplish their organisational growth.

"Sunshine Project" is a digital decision-making system co-developed by Company H and *MingdaoCloud*. The system embeds various processes involved in daily management, simultaneously establishing a cross-departmental collaboration mechanism. It integrates data resources scattered in different departments and business lines, achieving centralised management and analysis of data. By July 2024, the construction of the "Sunshine Project" system involves 18 business applications, 522 work forms, and 777 workflows.

5.2 Case analysis

We conducted in-depth interviews with the main persons in charge of eight key departments of Company H, including the planning and operation department, financial operation department, comprehensive management department, human resources department, supervision department, material processing center, production technology department and the "Sunshine Project" digital management decision-making system construction team. "Sunshine Project" has been used in all links, realising real-time monitoring of resources and multi-

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department approval circulation. Consistent with our empirical findings, respondents said that digital transformation is critical for enterprises to use organisational redundancy to respond to market changes and improve competitiveness. Besides, in the actual operation of Company H, digital transformation has penetrated into every link of operations. Managers pointed out that companies are facing dual pressures from technological updates and market competition, which facilitates the implementation of digital transformation practices. In particular, Company H has strengthened the informatisation and digitisation of internal management by implementing the "Sunshine Project". This strategic move has played a key role in promoting digital transformation practices. Managers emphasised that data governance and cross-departmental collaboration consolidate fragmented data resources and identify organisational slacks in the process of digital transformation. Thereby they have improved the efficiency of decision-making and the ability to respond to market changes. Factors such as internal management improvement, data governance, cross-department collaboration are classified as an enhancement of internal management capabilities in our empirical research. All the managers indicated that these factors have a positive impact on the implementation of digital transformation. Managers shared their experiences on how to incorporate digital transformation into daily management, and optimise business processes, which are considered critical to developing the relationship between digital transformation practices and company performance. In addition, managers also shared how they can improve the utilisation efficiency of absorbed slack through internal improvements, such as optimising management processes and upgrading employee skills, which is consistent with the positive effects of absorbed slack on organisational growth in our empirical research.

However, the case of Company H also reveals the challenges that unabsorbed slack can pose. As the empirical study shows, unabsorbed slack may hinder the growth of an organisation if it is not effectively managed and utilised. In the interviews, managers mentioned that the lack of information technology foundations and cross-departmental collaboration mechanisms causes waste and inefficiency when digital transformation starts. Data silo and disjointed processes weaken the company's competitiveness and growth potential, and the negative impact of unabsorbed slack has been thoroughly reflected. However, "Sunshine Project" has been continuously promoted, and Company H successfully improved its internal management capabilities. Therefore, Company H has enhanced its internal collaboration and optimised its resource allocation, transforming the unabsorbed slack into a force for organisational growth. Gradually, Company H overcame these obstacles to achieve the effective use of resources and continuous growth.

6. Conclusions

6.1. Interpretation of main findings

In the context of digitisation, it is necessary to delve into the significance of organisational slack for organisational growth as an important resource for companies when it comes to operational management. We focus on the relationship between organisational slack and organisational growth, as well as how two factors management decision-making capability and digital transformation, affect this relationship. We find that both unabsorbed and absorbed slacks have a negative effect on organisational growth. Decision-making ability play a negative moderating role between organisational slack and organisational growth, suggesting that stronger decision-making ability can enhance the positive impact of slacks on growth. Similarly, we find that digital transformation negatively moderates between unabsorbed organisational slack and organisational growth.

6.2. Theoretical contributions

Based on our findings, this study has three main theoretical contributions. First, we classify organisational slack, starting from unabsorbed and absorbed, and explore the differential impact of different organisational slacks on organisational growth. Although there are studies that discuss the economic consequences of different organisational slack, they are just categorised from a functional perspective, such as financial slack, operational slack (Azadegan et al., 2013). This study reveals that the long-term growth of organisations differs in the need for different organisational slacks, which facilitates a more comprehensive academic evaluation of the value of organisational slack in organisations and provides empirical support for the economic effects and strategic implications of different organisational slacks on organisations.

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Second, our study extends the influences related to organisational growth, which is beneficial for firms to develop their own long-term resilience capabilities. Organisational growth, as a long-term strategic goal of a company, requires a company to take a long-term view and not be short-sighted in exploiting and arranging slacks within the organisation. In the short term, organisational resilience is the ability of an organisation to recover from shocks in an uncertain environment; in the long term, it is the ability to help a business continue to survive and thrive. Thus, using organisational slack as a baseline, this study enriches the research context of organisational slack on organisational growth, thereby expanding the ways in which resources can be used to develop resilience competencies.

Third, broadly speaking, this study provides empirical support for the further development of Resource Dependence Theory and Upper Echelons Theory by validating the applicability of these theories in the context of the digital economy. In organisations, digital technology is introduced as an external technological resource to achieve the digital transformation of the organisation by integrating it with slack resources within the organisation; and managers, as the decision makers who coordinate the strategic behaviors of the organisation, have a decisive role in the allocation of resources. Through empirical analysis, we have enriched the applied research on Resource Dependence Theory and Upper Echelons Theory in the area of digital transformation and management decision-making capabilities affecting organisational slack and organisational growth, and provided new perspectives for theoretical research.

6.3. Managerial implications

This study has important implications for management practices in companies. First, the rational use of organisational slack facilitates the implementation of strategic goals and can help companies thrive. Organisational slack is the accumulation of resources beyond the daily operational needs of a firm over a certain period of time; therefore, it can be used as a buffer in unexpected situations to help the firm tide over a crisis. Firms can utilise funds from unabsorbed slack in the short term to respond flexibly to changes in market demand, and in the long term, they can utilise talent pools and R&D budgets from absorbed slack to promote innovation. Through the targeted use of organisational slack, companies are able to cope with external and internal uncertainties, improve organisational responsiveness to the changes, and ensure sustainable growth.

Second, in the background of the digital economy, firms need to pay attention to the positive effects of digital transformation practices on resource utilisation and management decisions. The results of this study suggest that digital transformation can contribute to the positive effect that absorbed slack has on organisational growth. As a result, companies can use big data and analytics tools to fine-tune organisational slack, while market trends can also be analysed through a range of data technologies, which digital tools can help managers collect information to make more accurate predictions and improve the speed of information transfer. Firms need to take into account their own reality and gradually carry out their own digital transformation to improve their competitiveness in the digital economy, so as to realise their long-term growth goals.

6.4. Limitation and future research

However, our study also has a set of limitations like others. First, due to the lack of individual industry samples, we have only considered industry-wide data samples under the context of digitisation and have not examined a particular industry in more detail. Therefore, future researchers can continue to collect large samples of different companies in the same industry and extend the study horizontally to organisational slack practices in individual industries.

Second, we tried to explore the impact of organisational slack on organisational growth, and this study also discussed the classification of organisational slack, which was not comprehensive enough. At the same time, some of the scholars in the existing research articles on organisational slack affecting the economic consequences of organisations found a non-linear effect of action(Anderson & Eshima, 2013; Duan et al., 2020; Fredrich et al., 2019), which we did not consider further. Therefore, future researchers can continue to explore the mechanism of the impact of different types of organisational slack on organisational development, and horizontally expand the research content of organisational slack; then, researchers can also explore the possibility of whether there is a non-linear relationship between organisational slack on organisational growth, and further in-depth discussion of the mechanism of the role of redundancy between the two.

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Finally, though we have analysed the factors affecting organisational slack and organisational growth from the internal and external perspectives of management decision-making ability and digital transformation, we haven't considered other internal and external factors that could have significant impact on the relationship between organisational slack and organisational growth. In the era of digital economy, people are more aware of environmental protection and pay more attention to the public welfare behavior of companies. The use of green technologies and corporate social responsibility (CSR) may also affect the allocation of slack resources in organisations (Ji et al., 2022; Khurram et al., 2024). We also have not discussed other external factors that are more macro, such as macroeconomic factors, industry characteristics, and market dynamics (Boso et al., 2017; Kuusela, Keil, & Maula, 2017; Leuridan & Demil, 2022; Tognazzo, Gubitta, & Favaron, 2016). Changes in the economic cycle can affect companies' investment decisions and resource allocation (Khurram et al., 2024), thus could affect companies' growth. The maturity and competitive intensity of the industry may also lead to differences in the efficiency of resource utilisation, influencing organisational growth (Agustí et al., 2021; Hong & Shin, 2021). These limitations have restricted the general applicability of our findings. Therefore, future researchers may consider including these factors to provide a more comprehensive analysis.

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BANKING DEVELOPMENT PECULIARITIES: BLOCKCHAIN, ARTIFICIAL INTELLIGENCE (AI) AND CYBERSECURITY ISSUES

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Abstract. The banking sector is seeing an epochal shift underpinned by the incessant march of technology, specifically financial technology. These innovations have dramatically improved operational efficiency and customer experience. That said, they have also opened up vast cybersecurity and compliance problems. This publication overlooks a methodical approach to the banking innovation trends that take shape over increasing frequency and provides one strong critical reflection on how many challenges traditional financial institutions face. Strategic adaptability is essential as a long-term, dynamic strategy consistent with the concepts of evolution through comprehensive analysis and synthesis.

Keywords: Finance; innovations; AI banking; cybersecurity; financial technologies; blockchain; FinTech

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JEL Classifications: B17, B27, F37, F38

1. Introduction

The potential future of banking is approaching a new age, thanks to the rapid advances in FinTech, artificial intelligence (AI) and blockchain technologies. This evolution of financial institutions potentially marks the beginning of a new era in the global financial system, in which traditional financial institutions are applying innovative technologies to simplify operations and reduce the risks associated with cybersecurity and institutional regulatory compliance (Gomber, Koch & Siering, 2017; Adeniran, Jadah & Mohammed, 2020). The emergence of rather unconventional FinTech companies that take advantage of technological innovations more closely related to conventional banking and payment infrastructures has increased the competitive challenges in financial services. These FinTech companies are partially changing the environment of financial activity, creating new challenges for traditional banking models and possible new financial services (Hornuf et al., 2021).

A fundamental change in this FinTech is integrating aggregated data and artificial intelligence into financial services. This direction is evident in FinTech lending services that use artificial intelligence and digital development technologies to improve decision-making processes, tailor services to individual needs, and improve operational efficiency (Jagtiani & Lemieux, 2019; Mugunzva & Manchidi, 2024). Classical banks are increasingly adopting open banking strategies and working with FinTech companies to maintain their competitive edge in the new digital financial services environment (Omarini, 2018).

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However, this advance in FinTech poses new challenges, in particular by creating institutional regulatory frameworks that can foster innovation while protecting consumer interests and ensuring the stability of the overall financial system (Zetzsche et al., 2019).

The primary purpose of this article is to study the impact of innovation changes on the banking sector. The article provides a detailed review of the existing literature, partially supplemented by a comparative analysis based on reliable scientific sources. This study's main focus areas are blockchain, artificial intelligence, and cybersecurity.

The rapid pace of digital innovation is revolutionising the banking sector. Since financial institutions use these newly emerging technologies, this not only increases the efficiency of the activities of organisations but also changes the behaviour of customers and the business methods of commercial banks. According to Gomber, Koch and Siering (2017), the fusion of FinTech and digital finance significantly changes financial institutions' activities, improves services' availability, speeds up the conclusion of transactions and reduces operating costs. Such progress by financial institutions is promoted by artificial intelligence technologies that allow banks to provide personalised services, detect possible fraud and optimise risk management strategies.

Digital learning has achieved a lot in the field of FinTech. Platforms like LendingClub use alternative data to offer more personalised borrowing solutions that match the findings of authors Jagtiani and Lemieux (2019). The emergence of a new style of banks is exacerbating these trends and correlating with digital banking models, which often overtake the already-known physical infrastructures of the banking business.

Hornuf et al. (2021) explore how already well-known traditional banks work with financial institutions and new startups to adapt to the rapidly changing digital banking environment. Given the frequent flexibility of FinTech companies, so-called conventional banks are often forced to adopt new strategies to remain competitive in such an environment. Omarini (2018) highlights the growing importance of digital, openly accessible banking, which has become a key strategy for banks to maintain relevance in this rapidly changing environment.

More importantly, new digital technologies also play an important transitional role, especially in settling and financing payments and trade transactions. The ability to increase transparency, security and efficiency, notably through new technologies, is transforming these essential banking functions (Chen & Bellavitis, 2019). As Zetzsche et al. (2018) noted, blockchains' decentralised and controlling nature can disrupt traditional financial systems. However, significant challenges remain, such as changing the mindset of transactions, the need for energy consumption, and the need for unified regulatory frameworks.

As this innovative development continues to evolve, cybersecurity and the critical need for regulatory compliance have potentially become the main problems of the next generation of digital banking. The increasing dependence on interconnected digital platforms often exposes financial institutions to higher risks related to data privacy and cybersecurity threats. Therefore, to protect against cyber-malicious attacks, strong protective measures should be implemented (Sullivan, 2019).

In an additional overview of the regulation of activities in financial institutions, some authors advocate a more balanced regulatory approach that promotes innovation. Ensuring this balance is essential for the development of an operating environment in which both progress in financial activities and regulatory oversight can successfully exist.

These ongoing changes in technology and oversight partly reflect the crucial role of artificial intelligence, blockchain and FinTech in shaping the future of new banking. This article looks at how these innovations are transforming financial institutions and creating new standards for consumer service and regulatory compliance in financial activities.

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2. Research methodology and methods

The method of scientific literature analysis helps to develop new ideas and helps to understand how much the area of interest to the researcher has been studied. Literature analysis helps to get acquainted with the works of predecessors and research methods, find material confirming or contradicting the facts of the study, and plan work. As stated by Kardelis (2002), literature analysis describes the situation and achievements of the selected research area. Literature review realises several goals: it introduces the reader to the results of other studies closely related to the specific study, encourages dialogue with already published material, fills gaps, and expands the studies conducted. According to Žydžiūnaitė (2011), literature analysis makes it possible to structure the basis of the relevance of the study and the criteria according to which it will be possible to compare the results of the study with the results of other studies.

According to Tidikis (2003), comparative method – sociological research, when information obtained: a) in various periods of historical development is combined; b) from various social systems (institutes, groups, territories, administrative units, countries, etc.); c) from different authors or research teams; d) by various collection or measurement methods. Tidikis (2003) stated that the comparative method can be used to achieve various methodological or methodological solutions to problems: descriptive (identification of similarities or differences) or analytical (interpretation, prediction, practical recommendations). These circumstances determine the implementation of comparative methods, actions, analysis and organisation of the study. While analysing scientific literature, 82 articles were selected and found in the EBSCO, Scopus, and Web of Sciences databases. Databases were identified, and keywords such as finance, innovations, AI banking, cybersecurity, and financial technologies were selected based on the literature review. Databases such as Web of Science (WoS), Scopus, and EBSCO were used for the study. These databases were selected to complement each other and provide access to scientific articles, which was also the first step in ensuring the inclusion of high-quality articles. The selected articles were mainly from the years 2020-2025.

3. Theoretical Aspects of Innovations

The FinTech Revolution

FinTech corporations are disrupting the traditional banking panorama by leveraging new technology to provide services inclusive of payments, loans, and wealth management with decreased operational expenses (Zhang, 2021). The rise of mobile banking, P2P lending, and virtual wallets has prompted elevated financial inclusivity, especially in growing countries (Philippon, 2016; Gomber et al., 2017). Banks should select between participating with or competing in opposition to those new entities to maintain marketplace relevance (Lee & Shin, 2018).

Blockchain Technology and Decentralised Banking

Blockchain holds the promise of enhancing banking efficiency and decreasing transaction prices. Its distributed ledger machine presents a transparent and secure framework for numerous domain names, collectively with move-border payments and alternate finance (Tapscott & Tapscott, 2016). Demanding situations together with chronic regulatory ambiguity (Pinna & Ruttenberg, 2016) and technological integration within cutting-edge banking infrastructure (Zohar, 2015) ought to be overcome to recognise its complete capacity (a summary of the current literature is provided in Table 1 below).

Table 1. Blockchain Technology and Decentralised Banking

Author	Highlights
Polyviou et al. (2019)	Blockchain technology was initially used as a public ledger of cryptocurrency transactions. However, many other applications have recently used cryptocurrencies and blockchain technology. In addition to greater security, decentralisation increases recorded KYC/KYB information consistency.
Stoica et al. (2021)	Advanced online and mobile banking platforms are constantly improving and can surprise customers.
Habib et al. (2022)	Blockchain has moved beyond using cryptocurrencies to find implementations in other real-world applications.
Jena (2022)	Blockchain technology is focused on decentralisation, a tool that is open to all users and easily accessible to build trust in an insecure environment without an intermediary.
Kitsantas et al. (2022)	Typically, private blockchains are centralised, while public blockchains are decentralised.

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Coutinho et al. (2023)	Bitcoin is a decentralised payment network that independently handles accounting, clearance, and settlements.
Wenhua et al. (2023)	provided a decentralised, trustless solution without third-party guarantees
Tse et al. (2024)	One of the most well-known use cases of blockchain – cryptocurrencies – has attracted significant interest from social media users and customers.
Alamsyah et al. (2024)	In addition, blockchain technology, as a powerful tool, boosts anti-corruption efforts and adds another layer of societal significance.
Theodorakopoulos et al. (2024)	Third parties are no longer required to act as intermediaries in a blockchain system, making the blockchain decentralised.
Bhumichai et al. (2024)	Blockchain technology increases the security and transparency of transactions through cryptographic algorithms, decentralisation, and consensus mechanisms.
Prokopenko et al. (2024)	Decentralisation eliminates the need for intermediaries, reducing the risk of fraud and manipulation.
Kotey et al. (2024)	Decentralisation is a key feature of blockchain.
Almarri et al. (2024)	Decentralisation is one of the most essential advantages of blockchain systems, as it increases the security of IoT.

Summarising the opinions of researchers about blockchain technology can be used in many other applications recently because it has unique properties, including decentralisation, security, transparency and protection against counterfeiting. Advanced online and mobile banking platforms are constantly evolving and can surprise customers. Desirable properties of blockchain systems include decentralisation, integrity, immutability, verification, fault tolerance, anonymity, verifiability, and transparency. Blockchain technology is focused on decentralisation, a tool that is open to all users and easily accessible to create trust in an insecure environment without an intermediary. According to the opinion of scientists, one of the most famous use cases of "blockchain" - cryptocurrencies - has attracted a lot of interest from users and customers of social networks. Blockchain offers many gains, including transparency, accessibility, and cost-effectiveness, making it a viable solution to the ongoing financial inclusion challenge faced by the unbanked population. Blockchain technology is widely used in various sectors such as education, healthcare, and finance, and cryptographic algorithms, decentralisation, and consensus mechanisms demonstrate its versatility and relevance.

AI in Banking: Possibilities and Issues

AI is more and more essential to banking operations, optimising customer support through chatbots and digital assistants, and enhancing credit score danger assessment; but it additionally introduces disturbing conditions inclusive of algorithmic bias and moral issues regarding facts usage. The integration of AI wants to be approached with warnings to preserve transparency and defend stakeholder pastimes (an overview of the latest literature is provided below in Table 2).

Table 2. AI in Banking

Author	**Highlights**
Ghandour (2021)	Massively deploying AI systems in the banking sector means greater automation of various tasks, so employees affected by task reallocation and job cuts may react hostilely and resign.
Noreen et al. (2023)	The use and application of artificial intelligence have helped financial institutions to protect themselves from fraud and work competently.
Mytnyk et al. (2023)	To ensure banks' effectiveness and ethical work in the financial sector, the resistance associated with the use of artificial intelligence in fraud detection needs to be addressed.
Radenković eat al. (2023)	The usage of artificial intelligence in the financial sector can help banks achieve balance and maintain the current level of trust.
Aleksandrina et al. (2023)	Artificial intelligence is used in the financial sector to control process administration and information management, improve customer service, increase customer satisfaction, and promote financial inclusion.
Shiyyab et al. (2023)	AI increases process speed, reduces cost issues, reduces operational risk, and improves customer experience through chatbots and robo-advisor services.
El Hajj et al. (2023)	Artificial intelligence can sometimes be helpful in creating long-term strategies.
Lazo et al. (2023)	The application of Artificial Intelligence in banking shelters several functional areas of a bank's operations, such as client service, customer relationship management (CRM), fraud detection, risk management, marketing, payment services, back-end operations, and data collection.
Tulcanaza-Prieto et al. (2023)	The appeal of AI-enabled financial institutions is based on lesser operating costs, better customer alignment, and higher revenues.
Fares et al. (2023)	Implementing AI in banking is wide-ranging: voice assistants and biometrics, anti-fraud risk monitoring, legal and compliance workflows, and credit underwriting using smart contract infrastructure.

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Ridzuan et al. (2024)	Artificial intelligence (AI) has exploited its ability to analyse large amounts of data, recognise trends, and make insightful decisions.
Mei et al. (2024)	Artificial intelligence can redefine banking services to improve operational efficiency.
Naik (2024)	AI allows banks to assess customer satisfaction levels and proactively address issues, reducing customer service time.
Hidayat et al. (2024)	Implementations of artificial understanding include algorithmic buying and selling, threat management, fraud detection, credit evaluation, and customer service.
Abdulsalam et al. (2024)	AI supports various banking systems, particularly those related to consumer behaviour, but there are also challenges, such as limited access to advanced technologies, inadequate infrastructure, and insufficient digital literacy, that hinder the implementation of artificial intelligence.
Addula et al. (2024)	Artificial intelligence allows simulation of cognitive functions such as knowledge, reasoning, and problem-solving.
Nobel et al. (2024)	Reliable sham detection systems based on automatic learning algorithms can adapt to changing fraud patterns, reduce false negatives, and detect fraudulent behaviour.

Summarising the opinion of researchers about the application of artificial intelligence technologies has helped banks to protect themselves from fraud, have efficient operations, reliability and accuracy, and high speed.

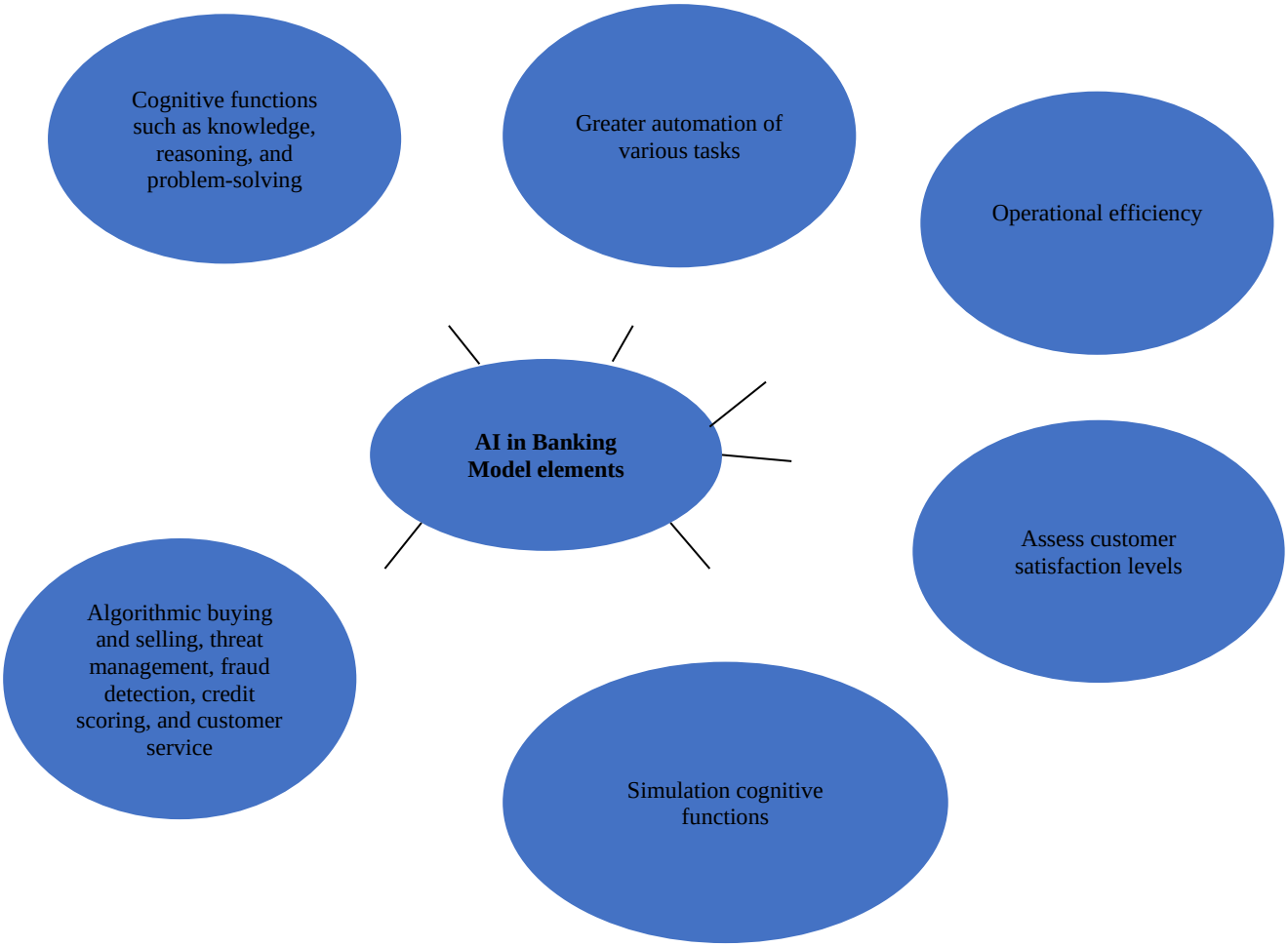


Figure 1. AI in Banking Model elements

Figure 1 presents AI in the banking model, which consists of greater automation of various tasks, lower operating costs, better customer alignment, higher revenues, operational efficiency, ability to analyse significant amounts of data and make insightful decisions, algorithmic buying and selling, threat management, fraud detection, credit scoring, and customer, cognitive functions such as knowledge, reasoning, and problem-solving.

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Cybersecurity inside the digital banking generation

The shift towards virtual banking has amplified the significance of cybersecurity. Banks remain liable to cyber-intrusions regardless of the sophistication of artificial intelligence and cryptographic ledger. We need an adaptable and long-term solution to confront these issues. We have to find solutions that can challenge new threats sufficiently and remain within legal standards (Bonneau et al., 2015).

Moreover, in the fiercely competitive contemporary economy, regulatory hurdles once more come—good material for another conversation. Consequently, banking was just about to dive headfirst into disruptive technology such as AI, blockchain, and FinTech. It is a conversion, and it goes more or less without saying that this requires re-evaluating our trust in the regulatory mechanisms we took for granted. Financial institutions have a hard time ahead as they try to fit these digital innovations within and around an existing legal framework that, let's face it, typically moves a bit slower than technology (Arner et al., 2017). This paper will delineate the many challenges that arise at the intersection of disruptive innovation and legacy governance frameworks. Overview of cybersecurity facets is provided below in Table 3.

Table 3. Cybersecurity inside the digital banking generation

Author	Highlights
Zabala Aguayo et al. (2020)	The digitalisation of banks is an essential economic process.
Shulha et al. (2022)	IT security innovations to ensure personal data security, information leakage prevention, data storage, and backup.
Sahi et al. (2022)	Due to deficiencies in data protection regulations, it is becoming increasingly difficult for customers to exercise their rights in e-commerce. This increases customer concerns due to regulatory uncertainties in mobile payments. Despite technological improvements, e-commerce still faces significant concerns about trust and perceived risk and their relationship to consumer satisfaction.
Saeed et al. (2023)	Cybersecurity can protect data.
Mishra (2023)	Cybersecurity is fundamental to protect systems, networks and technology from unauthorised access.
Tariq et al. (2023)	"The Internet of Things" (IoT) has become an essential technology with significant implications for cybersecurity.
Dawodu et al. (2023)	Planning for responding to cybersecurity incidents in banking with a well-developed cyberattack response plan minimises damage.
Ahmed et al. (2024)	Defends customers from various risks related to digital banking.
Metin et al. (2024)	Financial institutions must ensure that any digitalisation process is related to cybersecurity risks.
Dang et al. (2024)	An effective regulatory framework is needed to ensure sufficient customer confidence to share their data with the bank.
Lund et al. (2024)	Deploy cyber security systems and environments without trust.
Lamey et al. (2024)	Banks should adapt to advanced FinTech.
Trim et al. (2024)	New technologies protect against criminals.
Asmar et al. (2024)	Cybersecurity continues to be a serious issue for financial institutions, and adequate security measures must be adopted to protect sensitive financial data and customers from potential harm.
Daah et al. (2024)	Zero trust is a strategic cybersecurity tool that can ensure an organisation's security by eliminating blind trust and constantly verifying every step of digital interaction.
Vourganas et al. (2024)	Cybersecurity strategies emphasise the importance of technologies, raising consumer awareness, and implementing proactive threat detection and mitigation measures.
Dakić et al. (2025)	A hybrid approach to ZTA in the financial sector is inspected, and the blockchain system is integrated to ensure a more resilient security architecture.
Regueiro et al. (2025)	EMERALD is a safety system based on a continuous and automated evidence collection and evaluation process to ensure a safe operational service that would be certified using a specific conformity assessment method.

To sum up, the scientific opinion on cybersecurity mainly includes secure payment, online user privacy, antivirus firewalls, mobile phone security, security locks, data protection, computer protection and specific universal shields. Digital banks must manage challenges and focus on safeguarding clients to establish trust and encourage the widespread use of digital banking.

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4. Regulatory Challenges in a Financial Landscape

The wave adopting new applied sciences such as artificial intelligence (AI), blockchain, and financial technology (FinTech) is a game changer, forcing reconsidering current regulatory frameworks. In this challenging environment, these financial bodies are now forced to attempt an impossible task: reconciling their digital transformations with dilapidated institutional infrastructure that regularly struggles to remain current (Arner et al., 2017). This paper will explore the layers of regulation issues compounded within banks due to the marriage between innovation and traditional governance.

This is particularly true of FinTech agencies, which frequently exist on the margins of conventional regulatory constructs and lift sizable purchaser safety issues and monetary balance worries. The concerns illustrate the tension between innovation and regulatory imperatives. To combat such challenges, governments and regulatory bodies must formulate new forms of regulation (regulatory paradigms) that may tackle the emerging problems. One good illustration is the European Union's General Data Protection Regulation (GDPR), which protects data privacy and impacts how personal information is handled in banking. Everything is changing with all new regulations and the rise of crypto & digital assets. The blockchain era that underlies those digital currencies makes transactions expedient and handy. However, some problems are also money laundering, fraudulent activities, and marketplace volatility. Governments are trying to create new regulatory paradigms that can protect citizens from harm and help aid innovation in a coordinated fashion. This balance is significant to ensure that the digital asset space does not become a locus for illicit activity while still allowing financial innovation" (Tapscott & Tapscott, 2016). To account for the complexity of this relational dating, we group the demanding situations into four excellent domains:

I. Collaborative engagement between established banks and FinTech companies — Technological progress in the banking field naturally dictates an integration strategy for digitalisation systems to operate within the conditions of traditional financial institutions, strengthening innovation. Decently, these associations could also mean more prominent administration-related offers, such as those with portable banking and advanced instalments. This does not mean that regulations are easily "compliant", especially concerning data protection and money laundering (Lee & Shin 2018), but FinTech solutions have got to respect them.

II. The Promised Disruption in Financial Offerings: Although the pace of blockchain adoption has been more rational than many hoped a year ago, it nonetheless promises to overhaul every enterprise. That will enable real-time agreement mechanisms and decorate transparency throughout many verticals such as cross-border bills, exchange finance, asset management, etc. Yet the approval of the blockchain system is burdened with problems due to underdeveloped regulatory frameworks and challenges posed by aligning it with existing infrastructure (Zohar, 2015).

III. The role of substitute intelligence in optimising the banking transaction in operations and customer relations: Banking operations can gain tremendously out of AI practically through automation, thereby enhancing revenue and lowering costs, including the many ways AI can effectively identify frauds and handle risks. However, with the increase in the application of artificial intelligence, there are some ethical concerns and privacy issues with transparency; caution has to be taken to ensure algorithmic decision-making is fair and sensitive data is secured.

IV. AI can flourish by automating work processes within banking operations, yielding more significant revenue and lower costs. However, AI projects suggest that industries must be wary of ethical concerns and privacy issues and ensure the security of sensitive data.

As a result, the baking industry is currently at a crossroads. It's being influenced by how swiftly technology develops and how easily customer behaviour can shift. FinTech, or financial technology, has grown in popularity, and other technologies like blockchain and artificial intelligence (AI) have also gained traction. These are all upending the established banking business and posing many opportunities and difficulties.

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Banks must approach innovation more carefully if they want to survive and grow in this shifting environment. They must carefully balance incorporating these new solutions while keeping an eye out for any potential problems that may arise. It's not enough to get on the latest tech bandwagon.

When you look at how FinTech, blockchain, and AI are coming together in banking, it's clear that we're on the brink of some significant changes in the financial services industry. Suppose traditional banks want to stay ahead of the game and make advancements. In that case, they can't just use these technologies—they need to figure out how to integrate them to respond to the market while being mindful of various risks, especially regarding cybersecurity, regulations, and adapting their models.

A primary strategy employed by banks is partnering with FinTech companies. These collaborations promote an inventive way of thinking. Together with developing and integrating blockchain technology, they'll also need to manage resource allocation to effectively and adequately use AI. Harasim (2021) mentioned that studies on this topic can be divided into two main directions: i.e., related to reasons for cooperation between banks and FinTech, its benefits, and their scope, areas, and forms. Fang et al. (2024) stated that it has become difficult for commercial banks to develop FinTech applications and innovations relying on their resources and capabilities. Le et al. (2021) examine the causal relationship between the recent development of FinTech credit platforms and the banking system. Noreen (2024) considered that FinTech enables and helps create a stable and technologically enriched financial ecosystem. Oh et al. (2024) mentioned that open banking API technology is changing the distribution structure of the financial market, separating the production and distribution of financial products and intensifying competition between traditional financial institutions and FinTech companies. Hommel et al. (2020) stated that for conventional financial institutions, FinTechs can be a great source of new competitive innovations, and FinTechs can also create technical processes for banks to improve their data security and privacy. Professionals must navigate intricate regulations to ensure compliance with evolving legal frameworks associated with these technologies. Additionally, the ethical dimensions cannot be overlooked; employing these tools necessitates adherence to integrity, transparency, and accountability principles. Balancing these responsibilities is undoubtedly challenging, reflecting the complexities of the modern technological landscape.

All in all, the relationship between innovation and governance in the banking world is quite complex. Banks need to have a well-thought-out strategy for integrating technology. Only by doing this can they hope to establish a strong foothold in the future financial ecosystems, ensuring they remain relevant and viable as technology keeps pushing forward.

Conclusions

Based on the analysis of scientific literature, it can be stated that:
1. Blockchain technology provides greater security, transparency, and efficiency. The blockchain allows for safe and reliable transactions without intermediaries, and due to its decentralised nature, users can better control their data.
2. Cybersecurity is an important area for banks, and it is also one of the most important conditions for maintaining customer trust and successful operations. In the era of digital advancements, cybersecurity has become more relevant, starting from storing money in accounts or online transactions and ending with ensuring the confidentiality of information.
3. Artificial intelligence helps detect fraud in banking.

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DID BULGARIAN INNOVATIVE BUSINESS MANAGE TO COPE WITH COVID-19 CRISIS – A POINT OF VIEW OF THE FUTURE GENERATION OF BUSINESS MANAGERS*

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Abstract. It is hard to measure just a few years after the pandemic the negative impact in its all dimension that COVID-19 and all restrains and social isolation measures had on the economy in all levels (national, international, global). Nevertheless, the current paper presents the attitude and opinion of the Bulgarian students in Business Administration assessing whether Bulgarian business managed to cope successfully with all challenges during and immediately after the COVID-19 pandemic. There is a special focus on the innovative intensive sector of the economy and the ability of the companies in their sectors to cope with challenges, comparing with the rest business organizations. The paper presents results of 2-years conducted survey among students in their final year of Bachelor degree in Business Administration. Our results reveal that students assess very positively the decisions and changes that management of the explored companies had made in order to cope with the difficulties coming from COVID-19 restrains and crisis. According to them, companies in innovative intensive sectors were more able, flexible and change oriented during crisis. Therefore, companies in these innovative intensive sectors were more prepared for the challenges of pandemic crisis and their level of recovery is higher than the companies in the rest of sectors. However, students show great confident to the decisions of the company's management and the majority accept all activities made by the management to overcome the negative consequences of COVID-19 without any further comments or recommendation. Their average score is Very good 5,06 (in maximum 6,00). Our conclusions are that this very highly positive assessment could be explained in two major lines: firstly, students do not have sufficient business experience in real environment and therefore they are more willing to trust and accept the management decisions. Second line: this very positive result could be based on the lack of sufficient critical thinking and here is the crucial role of the academic education.

Keywords: digitalization; higher education institutions; digital educational resources; digital education, COVID-19

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1. Introduction

Undoubtedly, the years during the COVID-19 pandemic were one of the biggest challenges that businesses had to deal with in the recent past years. The real disruption of social and economic life, along with the overall uncertainty about the disease and its impact on business life, made the years during the pandemic some of the most challenging for companies to survive. Several years after the official exit from restrictions, the damage that the pandemic has had on economic life is yet to be calculated in all its dimensions.

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Current paper is an attempt to present the point of view of future generation of business managers and their assessment whether Bulgarian business managed successfully to cope with all difficulties imposed by the pandemic. Special attention is made by the companies in the innovative intensive sectors and their ability to cope with the crisis.

Here we have to consider that the phenomenon as full lockdown was totally new both for citizens and companies in global scale and its negative impact on the economy will be the subject of many scientific researches. In fact, only a few sectors of the economy were slightly affected by the pandemic crisis (such as ICT and high-tech) and we can comment that it was only pharmaceutical companies that grew massively during these turbulent years. In their background there were a lot of companies in tourism, aviation business, trade, which directly closed or suffered significant losses as a result of the crisis, from which it would be difficult to recover in the next few years.

Despite many difficulties COVID-19 crisis has allowed us to draw many conclusions, including regarding the unpredictability of the business environment and the greater opportunity for flexible business management, especially in the innovative intensive sectors of the economy. In this regard the opinion and overall assessment of our next generation business managers is important due to the fact that they will be the people who have to deal with the coming business challenges and their proper evaluation today will allow to be more prepared, adaptive and ready for future.

2. Theoretical background

Despite the fact, that the impact of the pandemic COVID-19 crisis in economic terms has not yet passed, there is already a wealth of researches looking at different aspects of its influence.

2.1. COVID-19 and the role of leadership in sound management

Some scholars consider the important role of leadership in company`s management during COVID pandemic crisis. According Alo et al. (2023) who explore business to business companies in Chana and Nigeria that have failed to survive the crisis, the lack of balance between market and non-market measures and strategies is the key element which is important and has to be taken into consideration in order to avoid future failure. In this regard Zia and al. (2023) define pandemic as digital accelerator and consider that digital dynamic capabilities are a possible solution for avoiding future failures.

The role of leadership is considered as a crucial in terms of education and adaptivity of future specialist to be better prepared for new challenges of the environment (Brown et al., 2023). After very comprehensive research, covering data from 48 countries and 32 sectors of economy, a research team concludes that directive leadership increased drastically during the pandemic period. Authors claims the following: We also find that this relationship is moderated by COVID-19 deaths per country, the sectoral working from home potential, and the organizational level of management (Garretsen et al., 2022). It is not surprising the fact that many scholars explore the role of e-leadership and the direct role that COVID-19 pandemic had on the force of development of this e-leadership (Chamakiotis, Panteli & Davison, 2021; Kotula, Kaczmarek-Ciesielska & Mazurek, 2021).

In this line of consideration, some authors delve into the term digital leadership. For instance, Jameson et al. (2022) define digital leadership as a new trend in research with interdisciplinary character, which is based on the previous analysis on e-leadership as well as related to this term concepts in management of technologies and administration. Hung et al. (2023) explore the digital transformation of companies and digital leadership. Their focus was on the relation between digital leadership, cloud-based accounting effectiveness and the quality of the decision-making process. They found that companies which have strong digital leadership have the amplified effect on the explored aspect of the company`s management.

Chatterjee et al. (2023) pay attention on some very serious challenges considering digital transformation and digital leadership – such as how to secure the confidentiality of the information between all employees and their managers in distance working environment; how to guarantee from one side the access to the trade information and trade secret, but from the other – to keep this information within the authorized and responsible people,

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different aspects of intellectual property, working in high confidential project (for instance for government and in some more sensible sectors as energy system etc.).

For Tagscherer and Carbon (2023) the key element in the process of digitalization is the "true leadership" not "mete management", due to the fact that this leadership has to be very sharp, flexible and sensitive in a changing circumstance and to have the capacity to build real teamwork and collaboration. Benitez et al. (2022) analyze the role of platform digitization capability, digital leadership and innovation performance. Authors conduct a quantitative study (sample=117) among European companies and conclude that digital leadership improves innovation by digitalizing the firm's platform. Many scholars have contributed with their analysis on different aspects of digital leadership and digital transformation. Interesting conclusions and discussions could also be found in researches presented by AlAjmi (2022), Weber, Büttgen and Bartsch (2022), AlNuaimi et al. (2022), Aránega, Montesinos and del Val Núñez (2023), Bastidas et al. (2023) as well as many other.

2.2. COVID-19 and the most affected sectors of economy

There are many serious researches dedicated to the most affected sectors of economy from COVID-19 crisis, presenting the conclusion and recommendation of their authors for recovery measures. In tourism for instance Wickramasinghe and Naranpanawa (2023) consider the role of domestic tourism as one of the very appropriate mechanism for survival in the context of small and emerging economy countries. According to Osorio and al. (2023), who explore the carbon footprint in Spain and in this line the possible paths for recovery, serious efforts and qualitative major changes are needed in order to achieve sustainability in tourism and to reach the pre-pandemic levels of consumption.

Some scholars have different approach to this general negative effect that COVID-19 caused on the tourist sector. Shareef et al. (2023) have elaborated a specific model in attempt to understand the behavior of people and their attitude towards tourism during and post Covid-19. They argue that changed behavioral model of people towards tourism could have impact on their future decisions for holidays and vacations. For many people pandemic years were along with frustration of losing job and loss of secure incomes, which caused emotional insecurity and mental stress of regular citizens. On the other hand, imposed social distance and different precaution measures further deepened the seriousness for personal decision of having vacation and rest. The scholars share the opinion that Covid-19 may have an enduring impact on the mobility of people in the future due to the change of human attitude and life pattern (Shareef et al., 2023).

Restaurant business also was one of the most affected sectors during COVID-19 and it is explicable the attention of scholars in the situation and the possibilities of recovery after pandemic. In this line Lee and Choi (2023) probe the role of franchising in restaurant business and possibility for social support from a side of franchisor. Wang and al. (2023) explore the different levels of recovery among restaurants in USA and found that in USA more expensive restaurants were more seriously affected by pandemic. Lee et al. (2023) analyze the impact that vaccination had on the restaurant business during COVID-19. They conclude that when some nation succeeds to achieve high vaccination rate thus will directly reflect to the reducing risks, including in restaurant business. Liu et al. (2023) explore the role of customer trust, online restaurant business and online community. In this line of considerations, Xie, Ma and Tong (2023) delve into green restaurants and their relations with customers. Authors concluded the following: risk perception moderates the impact of counterfactual thinking on one's willingness to consume green restaurant products.

2.3. COVID-19, innovations and innovative companies

Pandemic and post pandemic years forced companies and their management to be proactive, including in the field of innovations and innovative practice. It also could be considered that in some aspects the pandemic crisis played as a catalyst for innovations. Greco et al. (2022) explore namely this relationship and concluded that COVID-19 pandemic triggered countless innovation projects. Yun (2023) also claims that the COVID-19 pandemic had immense role on the development of science and technology innovations. Sahi, Modi and Mantok (2023) probe the innovative level of women entrepreneurs during the pandemic crisis and found that the lockdown had more negative effect on the industrial companies than the consumer business. Scholars also claimed that women entrepreneurs launched innovations (product innovations) as an attempt to survive the crisis.

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The direct connection between innovations and resilience or lack of resilience of the companies to the pandemic is comprehensively explored by Lim and Morris (2023). Scholars made very interesting conclusions: firstly, they found that cost innovations which are undertaken before the start of the pandemic, could have negative impact on the company`s overall development. Secondly, the scholars revealed that the entrepreneurs who invest wisely in innovations, have a real chance to gain profit and sustainability in post pandemic outbreak.

Ahmad at al. (2023) explore the role of innovations and their impact on the possibility of achieving sustainability of the companies in tourist sector. Authors reveal that innovations play more positive role and have more prominent effect in short-term perspective, rather than long term. Based on this finding, scholars conclude that the negative effects on the pandemic could be overcome through the help of innovative solutions. Bachmann and Frutos-Bencze (2022) focus attention on the role of universities as research centers and their efforts to help developing innovations during pandemic. Specific researches in this line are developed also by Carpenter at al. (2022), Ijarotimi & Ubom (2023) and others.

3. Methodology of the research

The study was conducted two consecutive academic years among students in Bachelor degree of Business Administration in their regular course in Change Management (2020 and 2021) in the University of National and World Economy, which is the largest Business university in the country in terms of number of students and in the Technical University of Sofia (which is the biggest technical university in the country). Students had a specific task to explore comprehensively one business company (selected by their own choice) and to provide research on how this company has changed during lockdown and post-COVID situation. Based on concrete questions (predefined and equal for all of the students for this task) and gathered information from the company and its managerial body, each of the students had to conclude and assess finally if the management of this company is successful and has applied flexible and adaptive approach to the changing business environment.

All students were explained and therefore, they were well aware, as well as the managers of the companies that the results of this research are gathered and used only for scientific objectives.

The research is based on the 223 opinions of students (113 received in 2020 and the rest – in 2021). Selected companies explored by students in Business Administration cover different sectors of Bulgarian economy, presented on table 1.

Table 1. Allocation of the explored companies in terms of sector of economy

N	Name of the sector	Number of explored companies
1	Trade	57
2	Production	45
3	Services	45
4	Restaurant and Hotel Business	15
5	Transport and logistics	14
6	ICT and software	11
7	Banks and Finance	10
8	Construction	6
9	Tourism	5
10	Insurance	4
11	Energy	4
12	Health	3
13	Agriculture	3
14	Culture	1
	Total	223

Considering the profile of the Bulgarian national economy, this allocation of companies in the current research is not surprising – the major part of Bulgarian companies are micro and small companies in trade and services sectors. On the other hand, the relatively small number of companies in agriculture, where Bulgaria has long standing traditions, could be explained with the fact that young people (in our case students) do not show sustainable interest in agriculture and rural business activities.

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4. Survey Results and Discussion

4.1. Obtained results and data analysis

In order to have proper understanding on the obtained result, we have to focus on some of the specific characteristics of the explored Bulgarian companies. First in this line is the question on the location of the head office of the company. The responders have to choose from redefined responses and the results are presented in Fig. 1.

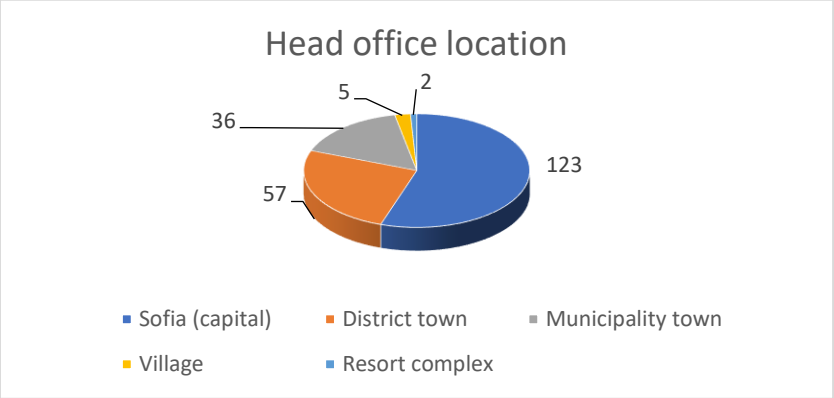


Fig. 1. Location of the head office of the companies in survey

The major part of the companies explored by the students for the needs of the current research have head office in Sofia. This finding again is not surprising in two major lines: firstly, Sofia as a capital concentrates the major economy focus and power. This is the biggest Bulgarian city, with many opportunities (including central administration, infrastructure, many universities, qualified employees etc.) and it is logical that many companies prefer to register exactly in Sofia its economy activity. Secondly, both - the University of National and World Economy and the Technical University of Sofia is situated in the capital and therefore it is relevant for students to choose company in Sofia to complete the task on which is based the research.

Second question collects information on the subjective assessment of the managers if they define company as innovative or not. The results are presented in Fig.2.

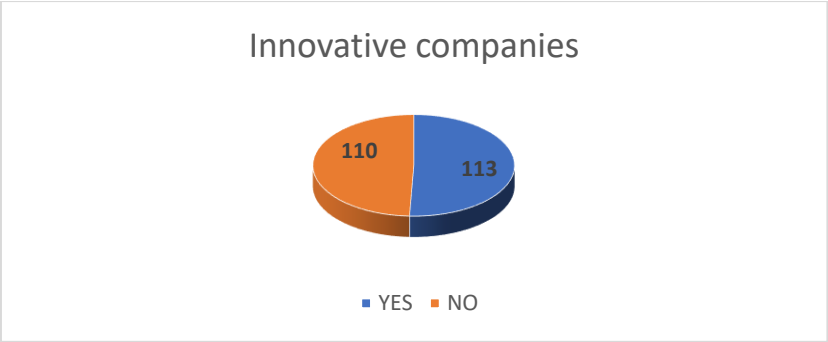


Fig. 2. Number of innovative companies assessed by their management

As it can be seen from the figure above, the results are almost equally allocated with very slight predominance of the innovative companies. This result is very curious especially comparing to the official data from the Bulgarian statistic which shows unequivocally that Bulgarian enterprises are not among the most innovative. On the other hand, here, we have to consider the fact that this is self-assessment, made by the management of the studied companies without giving any additional clarification (for instance based on the number of the innovations during the last year etc.). Thus, reflects on the relatively high level of positive answers. However, we also

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have to pay attention to the fact (admit by many scholars) that COVID-19 pandemic had a catalyst role and forced companies to make different innovations in order to survive.

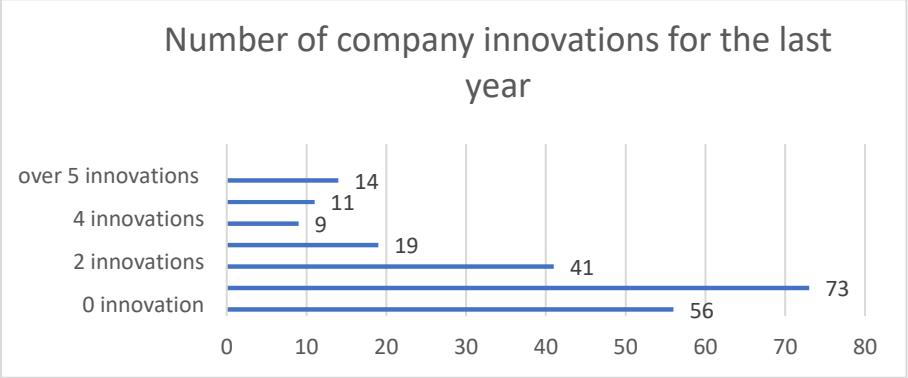


Fig. 3. The number of innovations implemented by the companies for the last year

Next question is directly connected to the number of innovations made by the company during the last year. The responses in this question could be considered that are in total dissonance with the results in previous one question (Fig. 3). Only 14 managers of the companies admit that they have more than 5 innovations for the last year, which could be accepted as real innovative companies, which means 6% from all participating companies in our survey. On the other hand, this 6% is far away from the almost 51% of managers claiming that the company is innovative. Another 39 managers admit that the company implement 3 to 5 innovations for the last year. This makes 17% of explored companies which could be considered as having good potential to become innovative companies. Here the major fact is that 56 managers (or 25%) of the companies participating in the survey admit that there did not have any innovation activity for the last year. This finding could be defined as rather alarming for the level of their adaptability and flexibility especially in such very difficult business environment. We have already accepted the fact (proven by many scientific researches) that pandemic crisis forced companies to be innovative, to make innovative and outboxes management thinking. On the other hand, these 25% from the explored companies represent a relatively high level that special attention has to be payed on. Here could be the role of governmental authority to enhance and support innovative policy of such type of more conservative enterprises to make needed changes and to be more competitive on national, regional and European level.

Students are asked to assess the extent to which the major activity of the company is affected of the COVID-19 precaution measures. Results are presented on Fig. 4.

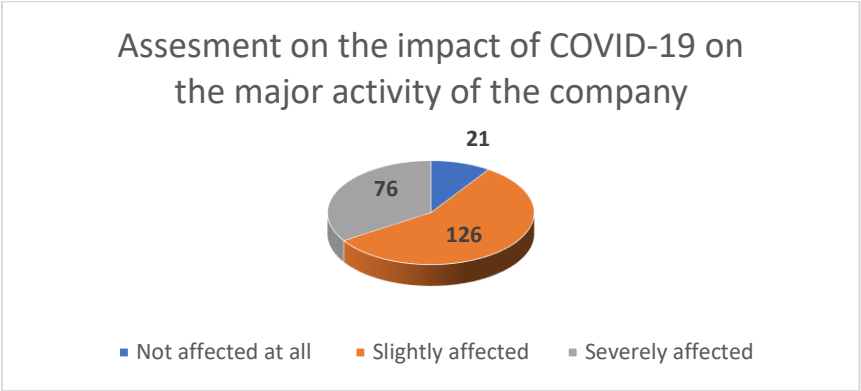


Fig. 4. Assessment on the impact that COVID-19 has on the major activity of the explored company

In this question students had the opportunity to choose between 3 options of responses: slightly affected, severely affected and not affected at all. The results are very interesting: the major part of the students assess that the company they explored are slightly affected from the precaution measures of COVID-19 (126 number or

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approximately 57%) while 9% (or 21 number) responds that the company is not affected at all from all restrictions. In this background only 76 persons (or 34 %) claim that the company they explored is severely affected by the measures. Considering the lockdown, different forms of social isolation, restrictions in numerous sectors, this result is very curious. One of the possible explanations is that there is no proper definition for "slightly" and "severely" and everyone assess by own proper understanding. In this line of consideration, it could be concluded that young people have a significantly higher tolerance for change and, in fact, in order for a phenomenon to be defined as significant, it really has to bring about a lasting change in the organization's activities.

Here it is interesting to understand the impact that the COVID crisis had on the innovation intensive sectors and on the rest of the economy. The results are presented in the Fig. 5.

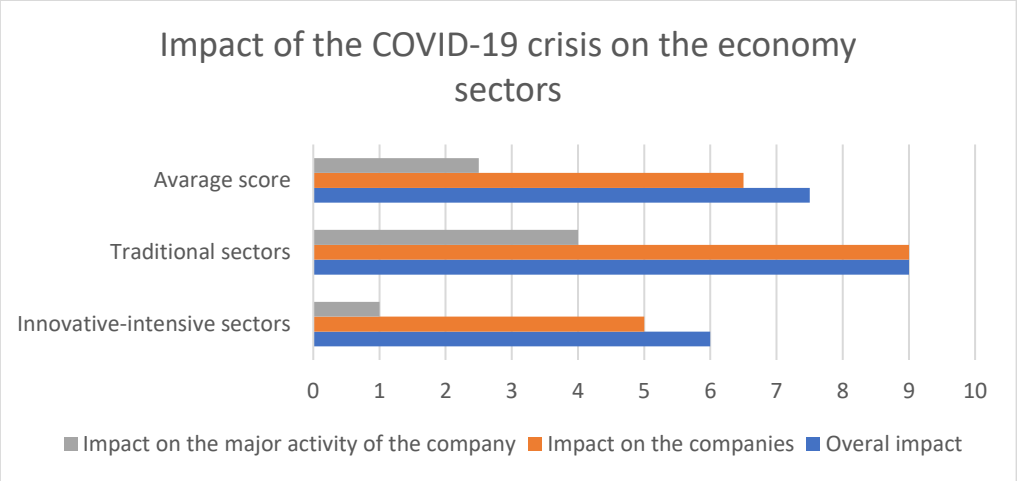


Fig. 5. Negative impact on the COVID-19 crisis on the different types sectors of economy – non-innovation intensive and innovation intensive sectors

According to the assessment of the managers, the companies which are in traditional sectors of economy suffer more from the negative impact of the pandemic restrictions and crisis, while companies in innovative intensive sectors are not so negatively affected. To respond to this question managers had to rate on a scale from 1 to 10 where 10 is the highest negative impact and 1 is the lowest negative impact. Each of managers had to give his opinion for the overall impact for both types of sectors and at the same time to assess impact on the companies and on the major activity corresponding to the company it represents.

Analyzing the achieved results, it is obvious that companies within innovative intensive sectors according to all managers perform better than the rest of the companies. This fact is not surprising and could be explained in more than one logical line such as: the management of companies in innovative-intensive sectors are used to work in high competitive business environment, which leads to overall capability to make rapid decision for changes. Applying innovation as a organizational policy requires very specific set of managerial skills, including very clear relation between managers and staff, based on confidence and trust (without any level of anxiety of losing job, any type of bonus and/or privileges). Therefore, in order to survive in normal business circumstances, the average company in such innovative intensive sectors of economy has to be by default flexible, adaptable and agile.

The next question reveals the specific of changes which companies were forced to implement because of the measures related to the COVID-19 pandemic (Fig. 6).

Here responders have multiple choice and the first three activities are connected to the reduction of production and/or services; changing the way of work and changing business process. At the same time students have the possibility to add their own response and the following very interesting answer have to be mentioned:

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- Change of working hours - different shift times. This observation is very relevant especially for the companies in restaurant business due to the fact that Bulgarian authorities restrained the opening hours which fact reflect to the working hours of employees.
- Reducing the staff salary but manage to keep the same number of employees. Obviously, some of company`s management prefer to reduce the salary of the staff (temporary) instead of release some of the employees. This policy and strategy of the company could be considered as loyal to the employees and could have positive effect in long term.
- Discontinue its advertising communication and use only its own channels. Some students reported that company they explore reduce to minimum additional expenses – and in this line in the time of social channel communication the costs for advertising especially in such difficult times are suitable to be cut off.

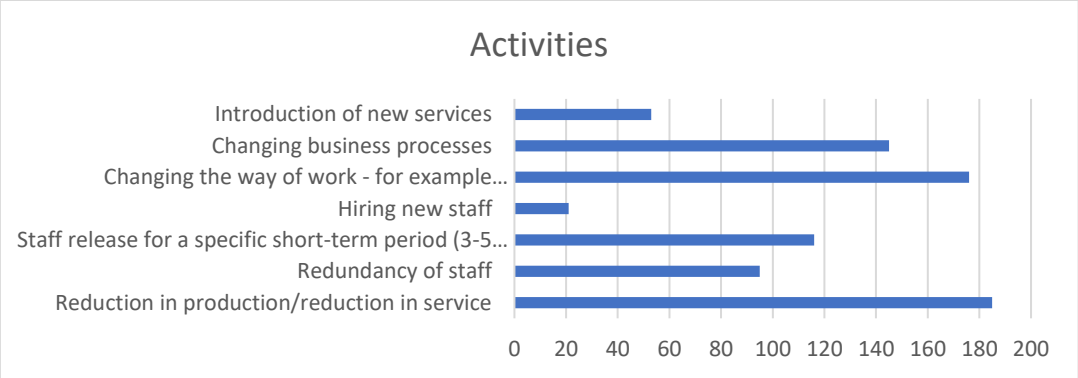


Fig. 6. Major changes that companies were forced to implement due to the COVID-19 restrictions

The next question presents the assessment of the management of the company if the company has managed to recover after the changes imposed by the COVID-19 (fig. 7). The major part of responders (55%) claim that the company is in the process of recovery, which means that in their opinion the worst period has passed. For 36% of responders the company has managed completely to recover from the negative effects of pandemic, while for 9% of management of the explored companies the situation is not good and the company continues to suffer. Considering the really serious business environment caused by the COVID-19 and different restrictions, the obtained results here could be accepted as rather positive. This could be explained with different social programmes and measures dedicated to support business, financed predominantly with European funds.

Next figure (fig. 8) presents the stage of recovery according to the type of sector (innovation intensive or not) and according to type of the company (innovative or not).
Again, analyzing these results, we have to consider that if the company is innovative and in innovation-intensive sector is defined by the manager itself. Therefore, from all 223 responders, only 37 of them claim that company they represent is in innovation-intensive sectors. Here the interesting finding is there is no one company in innovative-intensive sectors whose manager claims that is not managed to recover from the pandemic crisis. On the other hand, the majority of managers admit that the company is absolutely recovered (54%), while for the rest of the managers their companies are in the process of recovery.

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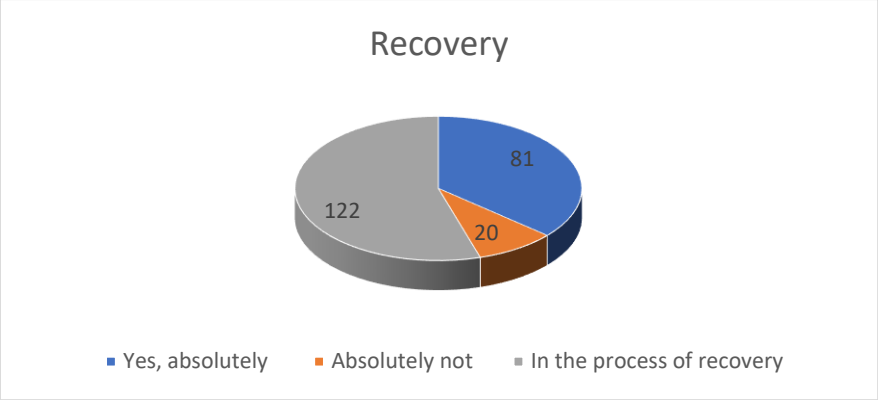


Fig. 7. Managerial assessment if the company has managed to recover after the changes

The situation for traditional sectors is different – here we have 186 managers who position the company they manage in traditional sectors of economy. 8% of them think that the company did not manage to recover and the consequences still are very severe. However, it is encouraging that 52% of the managers of companies in traditional sectors found that the company is fully recovered from the crisis. This percentage is relevant for the level of successful management in the innovation-intensive sectors. Third category of figure represents the opinion of managers who claim that company is innovative. According to them, we have exactly 50% of successful recovery, almost 40 % in the process of recovery and 10% which suffer from crisis.

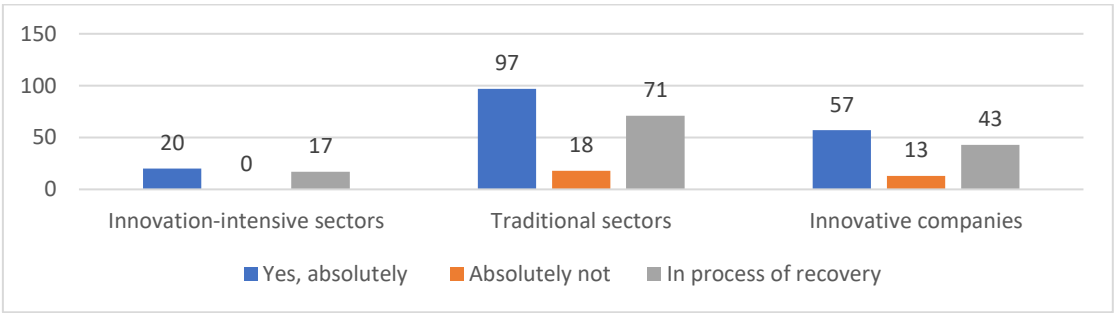


Fig. 8. Number of companies and their level of recovery according the type of sector and company (innovative company and innovation-intensive or traditional sectors of economy)

Next question reveals the assessment of the students and it is the following: If you had to rate the performance of the organization's management in the face of a pandemic, how much would you write (with a 2 being the weakest and a 6 being the highest rating)? The achieved results are presented on fig. 9.

Interesting fact here is that the majority of the students assess very positively the decision of the management of the companies they explore. No student rated management's actions with the lowest score. This on the one hand may indeed be due to acceptance and conviction on the part of the student as to the correctness of the management's actions. On the other hand, however, it may also be due to a lack of sufficiently developed critical thinking. The average score of the assessment is 5,07 which could be considered as very high and positive.

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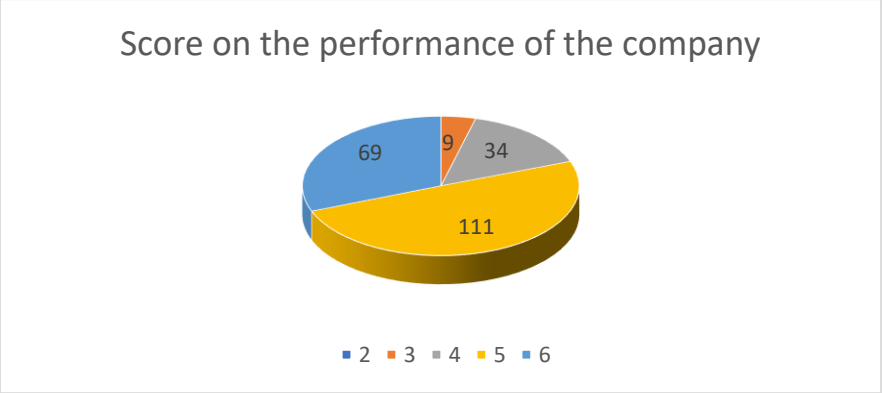


Fig. 9. Students` assessment of the managerial activities of the company

The next step students were asked to assess the adaptability of the company by the following question: If you had to rate the organization's adaptability to working in specific pandemic conditions, how much would you write (with 2 being the weakest and 6 being the highest rating)?

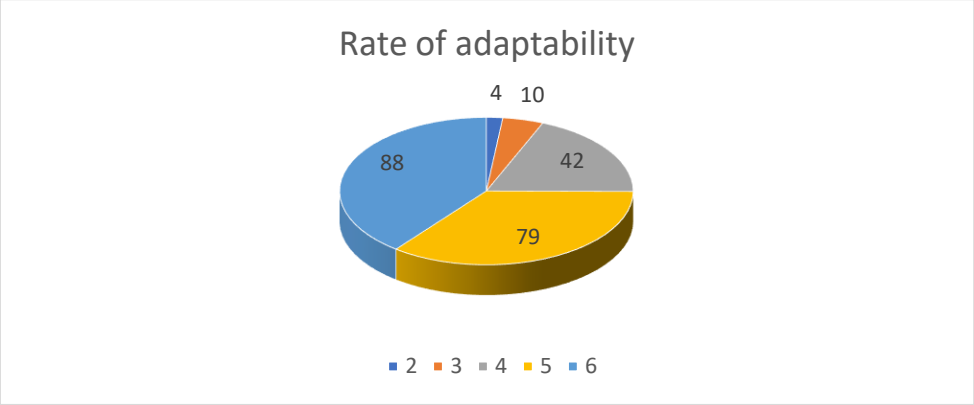


Fig. 10. Rate of the assessment of students on the adaptability of the company

Results reveal interesting picture, especially comparing to the results in the previous question. Here we have for the first-time weakest rating (2%), but at the same time, the highest rate is increased – almost 40% of students claim that the companies they explore are were very adaptive during the pandemic and post-pandemic period. At the same time here, the average score is 5,06 (from 6,00 maximum), which is very close to the previous question and again too generous from the students. Again, this result could be explained both – with the confidence to the decision and actions of the company`s management and on the other hand – with the lack of sufficient level of critical thinking.

Next question concerns the assessment made by the students of the rapidity of the changes in the company during COVID-19. The question is the following: If you had to rate the rapidity of the changes that the organization's management has made in the face of a pandemic, how many would you write (with a 2 being the weakest and a 6 being the highest rating)?

The results are relatively closed to the previous question with very slight changes. For instance, here, the negative assessment – companies which have with the weakest score according to the assessment of the students, are 7 (or 3%), while the question of adaptability the weakest rate has 4 companies. The similar situation is with score "3" – 13 companies have received such rate for rapidity comparing to 10 for adaptability. The number of companies with rate 5 in rapidity is 87 in total which is more than the companies with rate 6 (81), while the companies with excellent score 6 for adaptability is bigger that the companies with rate 5 (88 with 6 comparing to 79 with 5). It could be concluded that although the positive assessment still is prevailed, students were more demanding in terms of rapidity of the changes made by the company`s management. This result could be

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explained with the specifics of these 2 characteristics – adaptability is more complex than the rapidity and therefore it is difficult to be briefly assessed while the rapidity is clear as term and therefore more easily assessed by students.

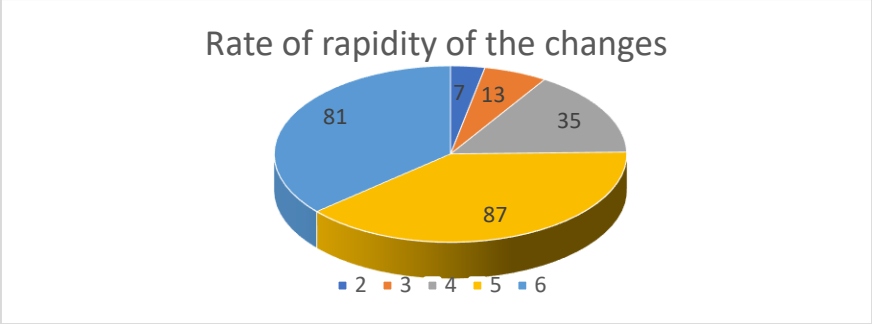


Fig. 11. Rate of the assessment of students on the rapidity of the changes made by the company

Next question reveals the critical thinking of students and it needs to assess from one side – the quality of changes and from the other – if these chances correspond to the business environment. The question is the following: In your personal opinion and evaluation, are the changes the company has made to deal with the COVID-19 crisis adequate? The students have to choose one from predefined several options as answers (fig.12).

Again, the results present the massive support and approval which students demonstrate to the company`s management and their activities on changes during COVID-19. However, it should be noted that for 87 students (or almost 40%) the changes are effective, but not entirely. Therefore, according to these students, the management could be even more proactive in future. Here the good fact is that only 8 students or 3,6% chose the answer "I don`t know". This is a clear indicator that the representatives of the new generation have clear position and use situation to claim this position. At the same time, their critical thinking is not well developed. Only 12 students claim that the company did not acted adequately to the changing environment and only 11 students think that the measures taken by the company's management are not effective.

Comparing these results to the official statistic data we could see the differences between real companies' performance and students` assessment. This observation once again leads to the conclusion that in our academic programme we have to include in different cases studies, tasks and practical initiatives the possibilities for student to develop their critical thinking.

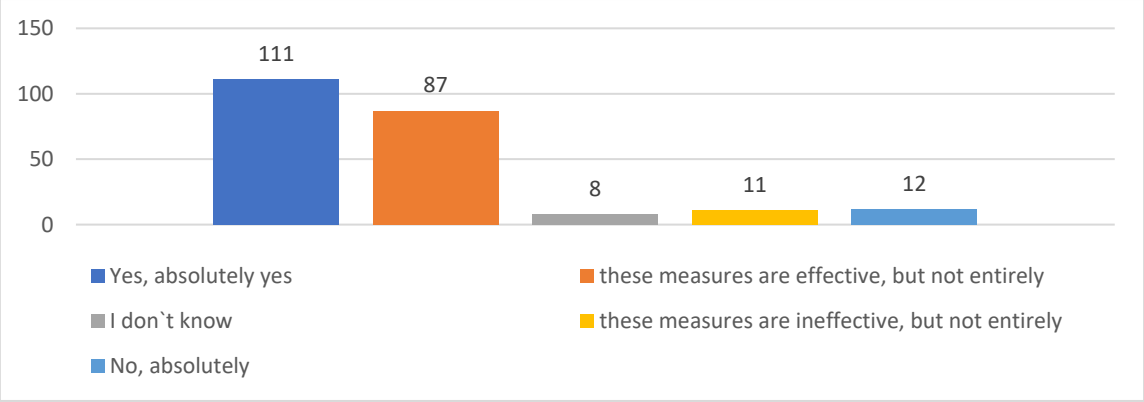


Fig. 12. Evaluation by the students of the adequacy of the changes undertaken by the company management

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The very last question of the study was directed entirely to the students and their proper opinion. The question was the following: If you were the manager of this company, what would you do to strengthen and develop the organization?

Major part of the students uses the answer of this question to claim once again the real support of the actions and activities of the company`s management. This part of students accepts without any additional comments or recommendation the changes of the companies during COVID-19 and post-pandemic year and confesses that they do not have further ideas for company`s development. This line of consideration once again leads to the observation for the lack of critical thinking of students.

This finding in fact could be accepted as very disturbing phenomenon – the majority of young people who have to have creative, new, progressive ideas, in fact remain silence and without any effort in this. On the other hand, this phenomenon could be also explained with the internal barrier of the student to present some wrong decisions.

4.2. Identified idea for further development of the companies

However, small part of the students presents further ideas for company`s development. These ideas could be summarized in the following main categories (fig. 13).

4.2.1. Ideas for keeping the initial job positions of all employees of the company

Many ideas, presented by students are focused on the different policy of the enterprise – to keep all staff of the company despite the existing limitation and recovery measures. The reasons they made are the following: keeping the same number of staff as before the crisis, despite all difficulties of the company, is a crystal-clear sign that the staff is very important to management (not only in words, but in reality). This will lead to enhancing overall motivation among all employees and will strengthening their engagement to the company. On the other hand, students are very clearly aware that the costs of such a decision may include going through salary cuts for an unknown period of time. However, they believe that this is the right way to act in times of crisis.

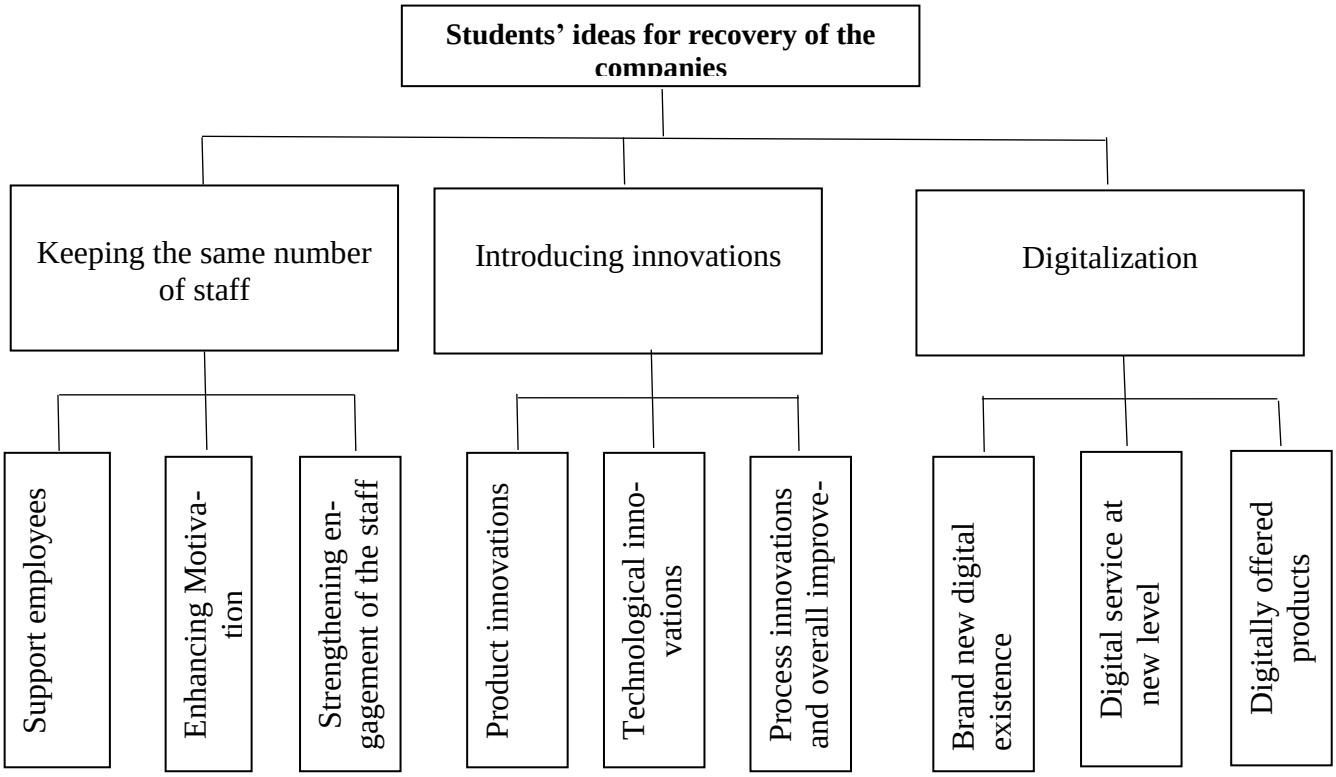


Fig. 13. Students' proposal for companies` activities for recovery

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4.2.2. Ideas for introducing innovations

Students are very well aware that innovations have the potential to gain competitive company`s advantage and to secure at least for the short-time period the sustainability of company. All this is in case that the innovation coming after very precise decision-making process. Students propose all types of innovations: for services and goods, technological and also process innovations. By introducing process innovations, students admit that the part of the fixed costs of the company could be reduced.

4.2.3. Further Digitalization

The third line, which is among most common proposals of students is the digitalization of the company. Being part of information society and child of high technologies, students pay serious attention on the digital transformation of the company. According to them, this digitalization has in fact many dimensions: one is the possibility of distance working (in cloud organization of data etc.), the second is the product and service to be offered online – with different social media, apps and sites for e-trade. On the other hand, students go forward of digitalization – some of their ideas are connected to the more broadly usage of 3d visualization and augmented reality for instance in marketing activities of company. There were several proposals for usage of Artificial Intelligence in planning and company`s strategic development etc.

5. Conclusion and recommendations

The presented study aimed to investigate the attitudes, opinion and assessment of the students in the Bachelor degree of Business Administration in terms of whether the Bulgarian business has acted adequately to the challenges related to the COVID-19. Our results reveal that student assess very positively the decisions and changes that management of the explored companies had made in order to cope with the difficulties coming from COVID-19 restrains and crisis. According to managers of the studied companies, the enterprises in innovative intensive sectors are more flexible and with better recovery level from the rest of the companies.

This observation is explained in several lines: first one, such type of companies is used to deal with high level of competitiveness; secondly – companies in innovative intensive sectors implement changes as a part of their regular policy, therefore they have knowledge and experience as well as organizational culture to make decision to change and to implement this change. Thirdly, the staff of these companies has the needed experience for change (resistance to change is usually only technical), there is a built trust and confidence between direct manager and his employees.

The average evaluation score achieved by Bulgarian business, according the students' opinion, is Very good 5,06 (in maximum 6,00). Our conclusions are that this very highly positive assessment could be explained in two major lines: first one – students do not have sufficient business experience in real environment and therefore they are more willing to trust and accept the management decisions. Second line: this very positive result could be based on the lack of sufficient critical thinking and here is the crucial role of the academic education.

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INSTITUTIONS' QUALITY AND ECONOMIC PERFORMANCE IN THE EU: INSIGHTS FROM A CLUSTER ANALYSIS*

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Abstract. The article examines the complex relationship between institutions and economic performance in the EU. Institutions' quality will be measured by corruption (measured by the Corruption Perceptions Index) and so-called "state fragility" (measured by the Fragile States Index); economic performance will be measured by GDP per capita in PPP. Using hierarchical cluster analysis, the study classifies the EU countries into two groups: (1) countries with high corruption, low quality of public institutions and low economic performance, and (2) countries with low corruption, strong public institutions and high economic performance. This method reveals differences in the impact of corruption and fragile states on economic performance, making the analysis more comprehensive than linear regression models. The study results show that in countries with high corruption and low quality of public institutions, economic performance is significantly lower, and corruption has a more significant negative impact on the economy. At the same time, in the more developed countries, where corruption is low, economic performance is related to the Fragile States Index. These differences underscore that in less developed countries, the fight against corruption should be a key priority, while in more developed countries, the focus should be on strengthening public institutions to sustain high economic performance. The results of the study have important foresight conclusions. In countries with high corruption and low level of quality of public institutions, without decisive measures to address them, economic performance could be expected to continue to decrease, leading to greater economic and social imbalances. For countries with high economic performance and strong public institutions, the emphasis on institution-building will contribute to more sustainable economic performance in the long term. It is expected that countries that effectively combat corruption and strengthen their public institutions will be able to improve economic performance, attract more investment and increase global competitiveness. The study provides a new perspective on the relationship between corruption, fragile states and economic performance, for the first time classifying the EU countries on the basis of these indicators. The results of the study point to the need to develop adapted policies aimed at strengthening public institutions and reducing corruption, which are important for sustaining and increasing economic performance in different groups of the EU countries.

Keywords: institutions; corruption; fragile states; economic performance; interconnection; cluster analysis; EU countries.

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1. Introduction

The topic of economic performance is a crucial concern in today's society. The global experiences indicate that economic performance and growth are determined by investments (Ocolisanu, 2022; Cano et al., 2023), including foreign direct investments (Saksonova et al., 2023; Tvaronavičienė et al., 2024; Preepremmote, 2024) which are stimulated, including through mergers and acquisitions of enterprises (Saksonova & Kantāne, 2017), as well as other factors. Among researchers become more actual research the fields of the relationship between economic performance, financial development, and institutions' quality, characterized by corruption (Leitão 2021; Thạch & Ngọc, 2021; Song et al., 2021; Lucarelli et al., 2024; Vyas-Doorgapersad, 2024). Studying the interconnections between institutions' quality, expressed by corruption (measured by the Corruption Perceptions Index); state fragility (measured by the Fragile States Index) and economic performance (measured by GDP per capita in PPP) allows us to better understand the causes of economic problems, and also helps to develop effective strategies for their solutions (Krivins et al., 2023; Koeswayo et al., 2024). The presence of corruption leads to inefficient allocation of resources, distorts competition and discourages investors. Studying these relationships helps develop strategies to combat corruption and strengthen state institutions that promote economic development. In this study, the authors use two concepts to characterize the economy: economic development (the process of increasing economic indicators (economic growth) without reducing social, environmental and other indicators) and economic performance (the static level of "current" economic development).

Corruption increases inequality and undermines citizens' trust in state institutions. This can lead to social protests, instability and conflict. If the state is fragile and corrupt, this is not just a theoretical problem. Imagine a country where officials make decisions in the interests of bribers, not citizens. This can lead to taxpayer money being wasted on ineffective projects, roads, schools, and hospitals deteriorating, and foreign companies ceasing to invest. All this worsens economic performance and quality of life.

Understanding the interconnection between corruption and state fragility will allow us to develop policies aimed at strengthening state institutions and improving citizens' trust in governance. Within the EU, countries cooperate on common issues, including fighting corruption and strengthening state institutions. Studying the experiences of various EU countries will also help identify successful methods of combating corruption and its applicability in other countries. Reducing corruption and strengthening state institutions helps create a more business-friendly environment. This attracts investment, promotes business development and increases countries' competitiveness.

Delia Ferreira Rubio, a recognized specialist in anti-corruption and transparency, emphasizes that combating corruption is crucial not only for improving economic metrics but also for ensuring national security and maintaining social stability. She emphasizes the importance of having reliable anti-corruption mechanisms and independent oversight bodies to effectively use state resources. Ferreira Rubio also notes that corruption undermines democratic foundations and supports populist candidates, further weakening democracy and increasing the risk of authoritarianism (Transparency International, 2024).

The article aims to study the complex relationship between corruption (measured by the Corruption Perceptions Index), state fragility (measured by the Fragile States Index (The Fund for Peace 2024a)) and economic performance (measured by GDP per capita in PPP).

A cluster analysis was selected to answer the research question about the impact of corruption and fragile states on the economic performance of the EU countries. This advanced analytical method classifies countries into groups with fundamentally different characteristics of corruption and public institutions. Clustering avoids averaging conclusions that do not consider differences between countries with different economic performance and political stability. Alternative approaches, such as linear regression analysis, could conceal these differences and lead to less precise conclusions. Cluster analysis thus provides the most appropriate and accurate tool to

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identify the differentiated impact of corruption and state fragility on economic performance. The cluster analysis considers heterogeneity, i.e., significant differences between countries in levels of corruption in fragile states and economic performance. This method helps to avoid averaging problems that arise in linear regression approaches. The cluster analysis is also well suited to analyzing groups with different characteristics, as the EU countries differ greatly in their levels of economic performance and corruption, making it difficult to use common models for all countries. Clustering allows you to examine each group separately, making the findings more accurate. The comparison of effects is also well suited to cluster analysis. Clustering makes it possible to analyze how the same factors (e.g. corruption) may have different effects in more and less developed countries. This is particularly important for economic policy, as it allows for more targeted recommendations. Thus, the econometric approach based on cluster analysis is most appropriate, as it is better suited to the economic issue and allows for a more detailed examination of the differential impact of corruption and state fragileness on economic performance of the EU countries.

2. Literature review

An important study on the interconnection between corruption and GDP growth was carried out by Mauro (1995), who found that the impact of corruption on GDP growth is largely indirect through its impact on investment, and the direct impact of corruption on growth is small.

Earlier, Rose-Ackerman (1999) found the mechanisms of the impact of corruption on state institutions, social stability and economic performance. Corruption often leads to the degradation of state institutions. When state officials use their positions for personal gain, it undermines citizens' trust in governance and state institutions. Corruption also leads to unfair distribution of resources and lack of transparency in decision-making, making state institutions less effective in carrying out their functions. Corruption can also cause dissatisfaction and negative reactions from citizens, especially those who suffer its consequences in the form of inequality, injustice and lack of opportunity. This can lead to social conflicts, protests and even political revolutions. Citizen dissatisfaction can also undermine the stability of state and its institutions. It has been found that corruption also negatively affects economic development since it creates an unfavourable environment for business and investment. Corruption increases the costs of business, distorts competition, reduces the investment climate and reduces the confidence of foreign investors. Moreover, corruption leads to misallocation of resources and slows down economic development.

Kaufmann et al. (1999) identified how higher levels of corruption, combined with ineffective governance, influence economic growth. They posited that corruption adversely affects economic growth and that this negative impact intensifies when the quality of public administration is subpar. Conversely, Houston (2007) contended that in nations characterized by low quality of governance, corruption often rises, suggesting that efforts to combat corruption should be focused selectively. Perhaps Meon and Sekkat made such conclusions because the economic models used in these two articles differ from each other.

Ehrlich and Lui (1999) and Mendez and Sepulveda (2006) conducted analyses using panel data to explore the endogeneity of corruption across different nations. In their study involving 68 countries, Ehrlich and Lui (1999) posited that while corruption influences GDP levels, it does not impact GDP growth, and they characterized corruption as an exogenous factor. Mendes and Sepúlveda (2006) concluded that in “free” countries (as measured by Freedom House International's Political Rights and Civil Liberties Index), there is an inverse and nonlinear interconnection between corruption and GDP growth. In nations classified as "not free," the relationship between corruption and GDP growth lacks statistical significance.

Mo (2001) presented evidence indicating that corruption hampers economic development by obstructing the growth of human capital and eroding political stability. It has been established that a 1% increase in the level of corruption reduces GDP growth rates by 0.72%. Political instability accounts for 53% of the effect of corruption on economic growth. Corruption is most prevalent when there are bureaucratic delays and fragility in the

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legislative and judicial systems. However, corruption, government regulation, bureaucratic delays, and the strength of legislative and judicial systems tend to reinforce each other, and multicollinearity prevents determining the degree of individual influence.

Meon and Sekkat (2005), using a neoclassical model of economic growth, found the direct influence of corruption on economic growth, considering the quality of public administration.

Collier (2007) found that the role of fragile states and corruption in impeding economic development is most clearly illustrated in the least developed countries, which he called the "bottom billion". Many countries in the bottom billion are characterized by underdeveloped or ineffective state institutions. This can manifest itself in the form of a lack of strong legal systems, insufficient protection of property and contracts, and low levels of governance efficiency and transparency. The failure of the state to provide basic services typically results in low levels of human capital and social infrastructure, which is an obstacle to economic development. Corruption often flourishes in these countries due to low quality of institutions and insufficient control over power. Collier emphasized that corruption has a destructive impact on economic development because it discourages investors, reduces the efficiency of government spending, increases the costs of business and distorts market mechanisms. Moreover, corruption leads to inequality and lack of trust in society, which undermines social stability. Low level of quality of state institutions and widespread corruption may also hinder social infrastructure development and the creation of a business-friendly environment. This impedes access to markets, services and resources, which in turn limits opportunities for economic performance and development. Overall, state fragility and corruption severely constrain economic development in least-developed countries, creating negative cycles of poverty and underdevelopment. To overcome these challenges, it is necessary to strengthen the institutions of the law state, fight corruption and develop policies that promote economic development and inclusive growth.

Swaleheen and Stansel (2007) employed an econometric model that considers the relationships among corruption, GDP growth, and investment, incorporating economic freedom as a variable in their analysis. Their study, which utilized data from 60 nations, revealed that corruption hinders GDP growth in countries with low economic freedom. Conversely, in nations with high economic freedom, corruption can actually promote faster economic growth. These findings contradicted the generally accepted view that corruption leads to slower GDP growth. Swaleheen and Stansel (2007) believed that, other things being equal, corruption leads to a decrease in GDP growth rates when the choice of economic agents is sharply limited (i.e., with a low level of economic freedom); however, when people have more choices (that is when economic freedom is high), corruption promotes GDP growth by circumventing state regulations.

Acemoglu and Robinson (2012) studied the theory of institutional development, which explains why some countries are rich while others are poor and suffer from instability. They also put forward the thesis that a nation's prosperity or poverty depends on its political and economic institutions. Acemoglu and Robinson (2012) distinguished two types of institutions: inclusive and exclusive. Inclusive institutions are characterized by broad citizen participation in the political process, protection of property rights and the real possibility of individual and economic freedom. On the other hand, exclusionary institutions limit access to power and resources to a small elite, often leading to corruption, inequality and economic decline. Acemoglu and Robinson analyzed historical and contemporary examples from various countries and regions of the world to support their theory by examining how institutional factors shape economic performance. They found how the role of political revolutions, civil rights, property rights, taxation systems and other aspects of governance and law implementation contribute to economic development. Acemoglu and Robinson paid special attention to the thesis about the importance of the institutional structure for economic performance and development.

The key finding of the Mustapha (2014) study is that all three methods used (The Fixed Effect, the Random effect estimations, the pool OLS) on a panel data sample spanning from 2003 to 2011, revealed a significant and strong negative effect of corruption on GDP per capita. Other authors, Begu et al. (2019), also confirmed the close direct interconnection between the corruption perception index and GDP in Europe in 2017.

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Song et al. (2021) established the theoretical framework that links economic growth to financial development and corruption. They note that while financial development is often seen as a catalyst for economic growth, corruption can undermine this relationship by distorting market mechanisms and eroding trust in institutions. To analyze the relationships among the three variables – corruption, economic growth, financial development, – the authors employ a panel data approach, utilizing a dataset encompassing 142 countries from 2002 to 2016. This methodology allows for a comprehensive examination of the effects of corruption and financial development on economic growth, controlling for various confounding factors such as governance quality, institutional frameworks, and macroeconomic stability. The study highlights that corruption has a detrimental effect on economic growth. The authors provide evidence that higher levels of corruption are associated with lower economic performance, as corrupt practices tend to divert resources away from productive uses and create inefficiencies in the economy.

Lucarelli et al. (2024) note one of the characteristics that distinguish the various countries in the Balkan region is the level of corruption, which many scholars have highlighted as a significant factor impacting the countries' economic growth. Both theoretical perspectives and empirical evidence suggest a negative relationship between corruption and economic development. The substantial social costs tied to corruption pose challenges in maintaining political, economic, and social stability, leading to increased corruption. Chaudhary and Paudel (2024) note that countries affected by high levels of corruption often face decreased investment, higher transaction costs, and diminished productivity, which obstruct economic growth.

The question arises: why do some EU countries perform better than others? To find an answer, we have explored how corruption and fragile states hinder economic performance in different countries. We divided them into two groups (those with greater challenges and those with fewer ones) and found that in countries with high corruption and low level of quality of public institutions, economic development is much more slowed down.

3. Research design and the sample

In the framework of this study, the corruption is measured by the Corruption Perceptions Index, fragile states – by the Fragile States Index, economic performance – by GDP per capita in PPP (in current prices).

The Corruption Perceptions Index (CPI) is compiled by Transparency International, an international non-governmental organization, to measure the level of perceptions of corruption among experts and business people on a hundred-point scale every year since 1995. The CPI is based on 11 different sources, which are numerical scores from corruption perception surveys of experts and business people interviewed by, among others, the Asian and African Development Banks, the World Bank and the American organization “Freedom House”. The minimum number of sources per country is 3. The index represents a score from 0 (maximum perceived corruption) to 100 (no perceived corruption), which is the average of the source indices.

In addition to the multi-layered essence of the association of European countries, additional difficulties arise due to the development of information technologies. In the new environment, corruption schemes are becoming global in scope, so the EU governing bodies have to address corruption not only within individual countries of the EU or within the EU as a whole but also at the global level.

Corruption can be defined as the exploitation of public office for personal benefit. It arises at the intersection of society's desire for stated inefficiencies and the results that would emerge under an entirely free economy. However, this intersection is unclear, as people's aspiration for economic freedom and its advantages often motivate them to bypass government regulations restricting lawful market activities. Therefore, both corruption and its economic impacts are influenced by the level of economic freedom accessible to market participants (Swaleheen & Stansel, 2007).

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In turn, fragile states can be characterized by the Fragile States Index (formerly Failed States Index), which was developed by the American Fund for Peace and the American magazine "Foreign Policy" and was first published in 2005. "The Fragile States Index is based on a conflict assessment framework – known as "CAST" – that was developed by FFP nearly a quarter-century ago for assessing the vulnerability of states to collapse. The CAST framework was originally designed to measure this vulnerability and assess how it might affect projects in the field and continues to be used widely by policymakers, field practitioners, and local community networks. The methodology uses both qualitative and quantitative indicators, relies on public source data, and produces quantifiable results" (The Fund for Peace 2024a).

The analysis is based on 12 indicators of state "vulnerability" divided into three groups: social, economic and political. Social indicators: level of demographic pressure, migration of refugees, presence of discontented groups, emigration. Economic indicators: uneven economic development, level of economic instability. Political indicators: delegitimization and criminalization of state structures, quality of public services, human rights violations, influence of security forces, group and clan elites, interference of other states.

Experts assess the ability of five key institutions (political leadership, army, law enforcement, judiciary, civil services) to provide security. Open sources of information are analyzed, positive and negative scores on the indicators are calculated, and a final index is calculated on a scale from 0 (highest stability) to 10 (lowest stability). The evaluation is done using CAST, which utilizes three types of data: quantitative data, data for a content analysis and data for a qualitative review. Quantitative data: data from international statistical agencies are normalized and scaled. Data for content analysis: each of the 12 indicators is broken down into sub-indicators for which logical search phrases are applied to global media data. Between 45 and 50 million articles are analyzed annually. Data for a qualitative review: researchers-sociologists investigate each of the 178 countries, assessing the key events of the year. These data are triangulated to identify dynamic trends, and then the final indexes are calculated. The final index is designed for more in-depth analysis and planning, helping to identify problems and improve the resilience of each country.

To investigate the interconnection between corruption (measured by the Corruption Perceptions Index), fragile states (measured by the Fragile States Index) and economic performance (measured by GDP per capita in PPP), the authors use cluster analysis and regression analysis on a sample of 27 EU countries based on 2022 data. The study delves into the specific context of the EU countries, covering a wide range of more and less developed countries within one region. This makes it possible to identify how different levels of corruption and fragile states impact economic performance within a unique political and economic system.

The division of EU countries into two clusters based on corruption, state fragility and GDP per capita represents an original methodological approach. This division allows for a more comprehensive analysis and comparison of the interconnection between these indicators in different types (clusters) of countries.

4. Research results

The theoretical relationship between corruption, fragile states and economic performance is complex. The authors found that the "more fragile" the state, the higher the level of corruption and the lower values of GDP per capita. This hypothesis is also confirmed in two clusters of EU countries in the framework of the three above-mentioned indicators. These findings echoed other studies (Mauro & Yontcheva, 2017; Glaeser & Shleifer, 2017; Kaufmann & Kraay, 2018; Huang & Zhang, 2021), which found that corruption and low level of quality of public institutions either affected or were associated with low economic performance, especially in low-law-enforcement countries. The authors' calulations are provided below, see Appendix A, Figures 1,2.

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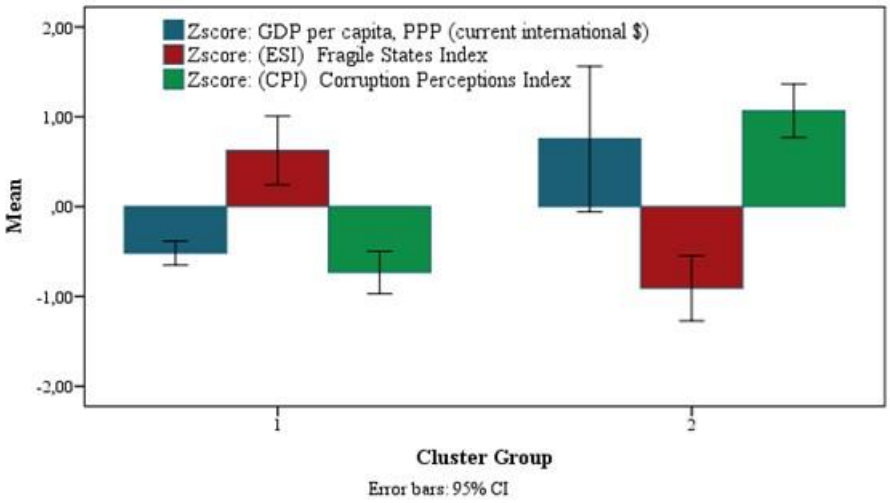


Figure 1. Average values of GDP per capita, the level of state fragility and the level of corruption perception in the 1st and 2nd cluster of the EU countries, 2022

Source: calculated by the authors using the IBM SPSS software based on the data

Cluster 1: GDP per capita is lower than the EU average, fragile states (insecurity) is above average and corruption perception is above average. Cluster 1 includes the following states: Bulgaria, Croatia, Cyprus, Czechia, Greece, Hungary, Italy, Latvia, Lithuania, Malta, Poland, Portugal, Romania, Slovakia, Slovenia, Spain.

Cluster 2: GDP per capita is higher than the EU average, fragile states (insecurity) is below average and corruption perception is below average. The second cluster includes: Austria, Belgium, Denmark, Estonia, Finland, France, Germany, Ireland, Luxembourg, Netherlands, Sweden.

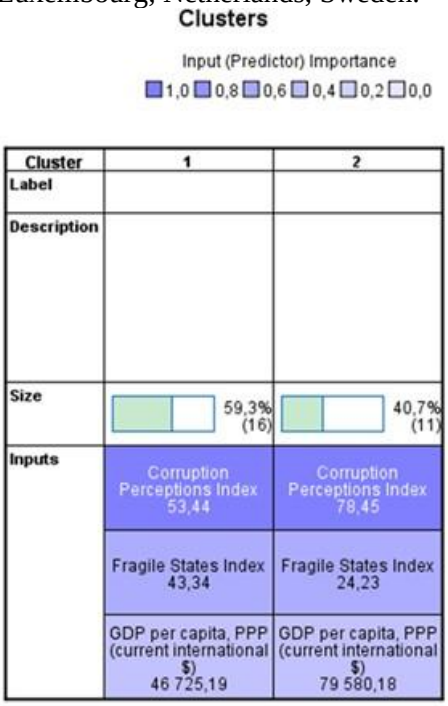


Figure 2. Cluster analysis of the EU countries (by GDP per capita, fragile states and corruption perception), 2022

Source: calculated by the authors using the IBM SPSS software on the basis of the Corruption Perceptions Index (EUROSTAT dabase 2024a), Fragile States Index 2022 (The Fund for Peace 2024b), GDP per capita (EUROSTAT dabase, 2024b).

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Further analysis of the EU countries clustered according to fragile states and corruption perception shows differences in how these factors impact GDP per capita.

Cluster 1 (more fragile countries)
Fragile States Index: an increase in this index by one score causes a decrease in GDP per capita by 254 euros. The regression coefficient between the Fragile States Index and GDP per capita is -0.351 (p-value = 0.000), which indicates a statistically significant negative impact: the higher the Fragile States Index, the lower the GDP per capita (Fig. 3);

Corruption Perceptions Index: an increase in this index by one score (which means a decrease in the corruption perception level) causes an increase in GDP per capita by 388 euros. The regression coefficient is 0.367 (p-value = 0.000), indicating a statistically significant positive impact: the less corrupt a country is, the higher the GDP per capita (Fig. 4).

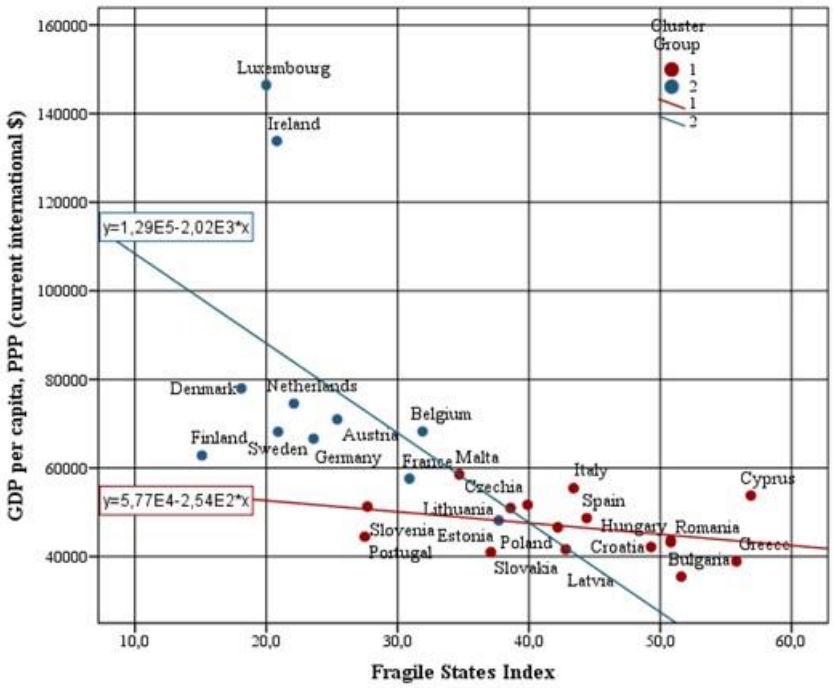


Figure 3. Regression analysis of the EU countries (GDP per capita – dependent variable, Fragile States Index – independent variable), 2022

Source: calculated by the authors using the IBM SPSS software on the basis of Fragile States Index 2022 (The Fund for Peace 2024b), GDP per capita (EUROSTAT dabase, 2024b).

Cluster 2 (less fragile and richer countries)
Fragile States Index: an increase in this index by one score causes a decrease in GDP per capita by 202 euros. The regression coefficient between the Fragile States Index and GDP per capita is -0.437 (p-value = 0.000), indicating an even bigger negative impact compared to the first cluster (Fig. 3);

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-Corruption Perceptions Index: an increase in this index by one score causes a small increase in GDP per capita by 7.69 euros. The regression coefficient is 0.002 (p-value = 0.000), indicating that there is a statistically significant, but very small (close to zero) impact of corruption on GDP per capita within this cluster (Fig. 4).

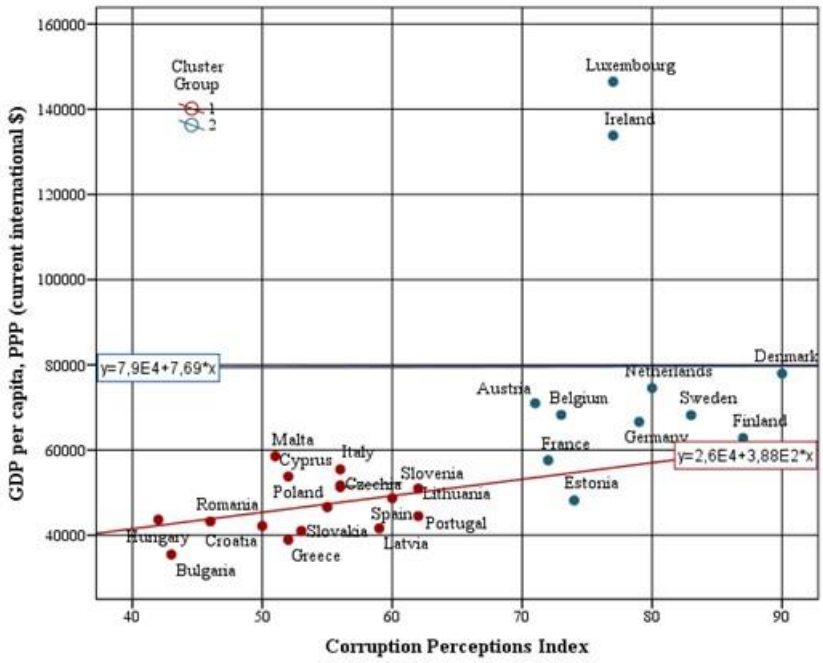


Figure 4. Regression analysis of the EU countries (GDP per capita – dependent variable, Corruption Perceptions Index – independent variable), 2022

Source: calculated by the authors using the IBM SPSS software on the basis of the Corruption Perceptions Index (EUROSTAT dabase 2024a), GDP per capita (EUROSTAT dabase, 2024b).

Thus, the results of data analysis show the following key issues: in countries with higher fragile states and higher corruption perception (Cluster 1), both indices demonstrate a significantly significant negative impact on GDP per capita; in countries with lower fragile states and lower corruption perception (Cluster 2), the impact of corruption perception on GDP per capita is very small (close to 0), but the impact of fragile states is much bigger compared to Cluster 1.

Other authors (Knack & Keefer, 2015; Rodrik, 2016; Dincer & Gunalp, 2018; Charron et al., 2020) also found that corruption significantly influences economic performance, including GDP, in the EU countries with poor governance (low level of quality of public institutions). In countries with strong public institutions, the impact of corruption is less pronounced. Thus, in countries with lower level of quality of public institutions, corruption has a significant negative impact on economic performance, while in more developed countries with strong public institutions, corruption has a lesser impact on economic performance. These studies support the hypothesis that in countries with high corruption and low level of quality of public institutions (the first cluster), corruption has a greater negative impact on economic performance, while in countries with strong public institutions (the second cluster), the impact of corruption is decreasing, but state fragility continues to have a significant impact on economic performance.

These results emphasize the importance of fighting corruption and strengthening state institutions in countries with higher fragile states, as improvements in these areas can lead to a big and statistically significant increase in GDP per capita. Whereas in more resilient and wealthier countries, more attention needs to be paid to prevent fragility of state, as even small changes in this sense can have a big impact on economic performance. As

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information technology is rapidly evolving, corruption schemes have often become global in scope. Therefore, the EU faces the challenge of addressing corruption at three levels: the EU countries, the EU as a whole, and at the global world level with EU involvement.

5. Discussion and conclusions

The study "Institutions' quality and economic performance in the EU: insights from a cluster analysis" investigates the complex interconnection between corruption as measured by the Corruption Perceptions Index, fragile states as measured by the Fragile States Index, and economic performance as measured by GDP per capita in PPP. While the study focuses on the EU countries, its findings can be useful to any country. Regardless of region, corruption and low level of quality of public institutions have a similar impact: they decrease economic performance, erode the quality of public services and prevent investment.

The authors examine how these factors affect the economies of EU countries, dividing them into two clusters: countries with a relatively low GDP per capita, high fragile states and high corruption (countries of Central, Eastern and Southern Europe); countries with a relatively high GDP per capita, low fragile states and low corruption (countries of Western and Northern Europe).

The study shows that GDP per capita decreases with increasing fragile states, demonstrating the negative impact of fragile states and corruption on economic performance. In the first cluster of countries, a decrease in corruption was associated with an increase in GDP per capita, while in the more developed and less corrupt countries of the second cluster the impact of corruption on GDP per capita was much smaller.

The authors conclude that corruption and fragile states are barriers to high economic performance in the EU countries, although they occur differently in the two types (clusters) of countries. In more developed countries, the negative impact of fragile states on economic performance is bigger, while in less developed countries, corruption has a bigger negative impact on economic performance. This finding is a key contribution to the scientific literature on this topic. These aspects make a significant breakthrough in understanding the complex interconnection between corruption, fragile states and economic performance, providing valuable insights for policymakers, economists and researchers concerned with governance, corruption and economic performance and development. The use of up-to-date data for 2022 adds value to the study by making it relevant to the current economic performance of the EU countries and anti-corruption policies. Thus, the findings of our study show that the fight against corruption and the strengthening of public institutions are not just long-term goals, but have real results. More transparent governance helps attract investment, create new jobs and improve citizens' quality of life.

For countries with high corruption, our results show that stronger anti-corruption activities can reduce financial losses and increase economic performance by improving the investment climate and stimulating competition. Countries with high corruption needed to introduce transparent procedures in public procurement, establish independent anti-corruption agencies and digitize public services to reduce the impact of human factor on the governance. Countries with low corruption but low level of quality of public institutions needed to strengthen the judicial system, increase public accountability and develop strategies for better governance.

Countries with low corruption and strong public institutions attract more investment, leading to employment growth, innovation and sustainable economic development. Business and international investors will be interested in results that show how fighting corruption and strengthening public institutions can improve the investment climate in the EU countries. Reducing corruption and increasing transparency make countries more attractive to foreign investment.

Our study underscores the importance of developing differentiated policies for countries with varying levels of corruption and fragile states. For less developed countries, anti-corruption activities should be a priority; for

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more developed countries, strengthening public institutions to sustain economic performance should be a priority.

In countries where corruption remains high and public institutions quality low, continued current trends can lead to further economic lag, lower trust in government and increased social conflicts.

The results of our study apply not only to the EU countries, but also to other regions where corruption and fragile states hamper economic development. The recommendations developed could be adapted to countries with similar economic conditions. Corruption not only undermines economic performance but also increases social inequality, erodes trust in government and increases political instability, which can have serious social and economic consequences in the long run.

Appendix A. Results of cluster analysis in the IBM SPSS software

				Country	GDP per capita, PPP (current international $)	Fragile States Index	Corruption Perceptions Index
Cluster Group	1	1		Bulgaria	35470	51,6	43
		2		Croatia	42171	49,3	50
		3		Cyprus	53786	56,9	52
		4		Czechia	51695	39,9	56
		5		Greece	38923	55,8	52
		6		Hungary	43660	50,8	42
		7		Italy	55442	43,4	56
		8		Latvia	41625	42,8	59
		9		Lithuania	50969	38,6	62
		10		Malta	58547	34,7	51
		11		Poland	46610	42,2	55
		12		Portugal	44484	27,5	62
		13		Romania	43240	50,8	46
		14		Slovakia	41013	37,1	53
		15		Slovenia	51282	27,7	56
		16		Spain	48686	44,4	60
		Total	N	16	16	16	16
	2	1		Austria	70975	25,4	71
		2		Belgium	68253	31,9	73
		3		Denmark	77953	18,1	90
		4		Estonia	48168	37,7	74
		5		Finland	62823	15,1	87
		6		France	57594	30,9	72
		7		Germany	66616	23,6	79
		8		Ireland	133823	20,8	77
		9		Luxembourg	146457	20,0	77
		10		Netherlands	74542	22,1	80
		11		Sweden	68178	20,9	83
		Total	N	11	11	11	11
	Total	N		27	27	27	27

a. Limited to first 100 cases.

Source: calculated by the authors using the IBM SPSS software on the basis of the Corruption Perceptions Index (EUROSTAT dabase 2024a), Fragile States Index 2022 (The Fund for Peace 2024), GDP per capita (EUROSTAT dabase, 2024b).

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DETERMINANTS OF FOREIGN DIRECT INVESTMENT: INSIGHTS FROM SELECTED EU COUNTRIES*

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Abstract. Foreign Direct Investment (FDI) is a key driver of economic growth, innovation, and sustainable development. Understanding its macroeconomic determinants is essential for policymakers aiming to foster favourable investment environments. However, existing literature lacks consensus on which macroeconomic factors significantly influence FDI. This study addresses this gap by exploring the determinants of FDI across selected EU countries. The study aims to analyze the impact of key macroeconomic variables, such as GDP growth, unemployment rate, public debt, trade openness, corporate income tax rate, and inflation, on FDI, and to identify the most significant drivers of investment flows in the EU context. Panel regression analysis was conducted using data from 17 EU countries from 2014–2023. Data were sourced from Eurostat, OECD, the World Bank, and the International Monetary Fund. The random effects model was selected based on the Hausman test, ensuring robust results. GDP growth and unemployment rate positively influenced FDI, while public debt, trade openness, and corporate income tax rates negatively impacted it. Inflation was not statistically significant. These findings underscore the importance of economic growth and fiscal prudence in attracting investments. This study contributes to the literature by identifying critical macroeconomic factors affecting FDI in the EU, providing actionable insights for policymakers to optimize investment climates. The research also offers a foundation for further empirical investigations into FDI determinants.

Keywords: determinants of FDI; public debt; trade openness; corporate income tax; panel regression

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1. Introduction

Investment is a key driver of economic growth, business expansion and job creation. In macroeconomics, investment refers to spending on capital goods—such as machinery, buildings, infrastructure, and technology—that increase the economy's productive capacity. The level of investment in the economy can significantly affect its overall economic performance, affecting both short-term fluctuations and long-term growth trends. Understanding the macroeconomic determinants of investment is essential for policymakers, businesses and economists seeking to promote sustainable economic development. Broad economic factors influence the

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decision-making processes of companies, governments, and other economic entities regarding allocating resources to investment projects. These determinants help explain why investment levels fluctuate over time and why some economies experience strong investment growth while others face stagnation.

Investment decisions are influenced by a complex interplay of factors at the macroeconomic level. Understanding these determinants is critical for policymakers, businesses and investors alike, as they shape the overall investment environment in the economy. Economic stability, sound fiscal and monetary policies, favourable business conditions and technological innovation are vital to support healthy levels of investment that drive economic growth. Macroeconomic determinants of investment refer to general economic factors that influence the level and direction of investment in the economy. These determinants are key to understanding how businesses and governments allocate resources to capital formation, whether for new projects, expansion or infrastructure. One of the main objectives of economic policy is to increase capital accumulation in terms of investment, which is necessary to maintain a sustainable rate of growth in developing and developed countries. (Kalaš et al., 2024) Due to the influence of determinants, the level of investments in the economy tends to fluctuate more than other components of aggregate demand. This is because the underlying determinants also tend to change. (Emako, 2022) Uncovering the true determinants of investment has recently become increasingly important worldwide. (Alalmai, 2024) In general, this topic has been of interest to politicians and economists for a long time, as it is an essential source of financing. Before the process of globalization, it is necessary to attract investments. (Rathnayake et al., 2023) It can increase capital inflows and production, improve infrastructure, create jobs and contribute to higher economic growth.

Investments are important for any economy because they ensure its development and innovation. Understanding investment determinants is key to developing strategies that support economic growth and channel capital toward sustainability and innovative practices. There is no consensus in the literature about the macroeconomic factors influencing investment. Several researchers (e.g., Kalaš et al., 2024; Hysa et al., 2022; Marinescu et al., 2019) focused on analyzing macroeconomic indicators that largely determine investments. Several studies, e.g., Emako (2022), Sajilan et al. (2019), Tayebiniya, Khorasgani (2018), and Aljbory (2016), revealed a strong link between investment and economic growth.

2. Literature review

In essence, investment is a fundamental tool in financial planning that allows individuals and institutions to grow their wealth over time by strategically putting their money to work. Keynesian economics emphasizes that investment is a function of demand, meaning that when consumer spending and demand for products increase, firms are incentivized to invest more to meet this demand. The determinants of investment influence how much businesses and individuals choose to invest in various assets, projects, or financial markets. These determinants are central to understanding investment dynamics, as they explain why investment levels fluctuate and what drives changes in economic activity. Several authors dealt with the topic of investment determinants. According to Endriukaitienė et al. (2022), the determinants of investments can be divided into two groups. One group includes internal factors, e.g., the size of the enterprise, the place of business, and the intensity of research and experiments, while the analysis of these factors helps to answer the question of what encourages the enterprise. (Economou et al., 2017) Another group consists of external factors, i.e., advantages of the country, e.g. market size or labour cost. (Belgibayeva & Plekhanov, 2019) The analysis of external factors answers the question of what attracts investments to the country. Shafigas et al. (2021) state that investments are significant for developing countries' economies because they support economic growth. Investments are an essential part of economic growth and globalization of finance, as they attract foreign capital and advanced technology and improve management skills. (Alfaro, 2017) In their study, Kalaš et al. (2024) tried to cover the most used macroeconomic determinants affecting investments in general. Studies on investment determinants (Sharma & Kautish, 2020) have pointed out that the level of investment depends on the level of development of countries. In many countries, investment plays a vital role in economic growth because it attracts investors who develop the economy and improve the quality of human resources. (Simionescu & Naros, 2019) In summary,

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determinants ranging from economic conditions to investor sentiment help to explain why investment levels vary over time and across different regions and sectors.

Empirical analyses carried out over the years indicate that the most critical determinants of investments are macroeconomic variables such as market size (measured by GDP growth or GDP per capita), inflation, employment level, and interest rates (Kalaš, 2024; Alalmai, 2024; Carvelli; 2023; Okafor et al., 2017) although recent studies also consider other explanatory factors, such as wages, exchange rate, government spending or debt. (Kalaš et al., 2024; Emako, 2022; Endriukaitienė et al., 2022; Lisowski et al., 2021)

Previous research (Emako, 2022; Sajilan et al., 2019; Tayebiniya & Khorasgani, 2018; Aljbory, 2016) concluded that economic activity represents one of the most analyzed determinants of investment and is often measured by gross domestic product. GDP is a measure of the size of the economy and an important indicator reflecting the country's macroeconomic operations. (Wang et al., 2023; Sineviciene, 2015) A higher GDP value is usually associated with higher economic stability and progress and, therefore, can create a favourable environment for investment. (Belgibayeva & Plekhanov, 2019) GDP per capita indicates economic development, and its high value can attract investors. Suyuan and Khurshid (2015) and Ahmad and Zhao (2018) found a positive causality between investment and GDP growth. Romano and Scandurra (2016) and Carvelli (2023) investigated the positive relationship between GDP per capita and investment. On the other hand, Akinlo and Oyeleke (2018) showed a negative impact of GDP per capita on investment in Nigeria, which was like the empirical findings of the study by Ayeni (2020) and Dang et al. (2020), who confirmed that GDP negatively affects investment.

Inflation is another typical macroeconomic indicator affecting investments (Azhgaliyeva et al., 2023), depending on their dynamics. (Todorovic et al., 2016) However, the effects of inflation are contradictory. An increase in inflation can lead to economic uncertainty and make it difficult for investors to make investment decisions. (Ababio et al., 2022) The negative but significant impact of inflation on investments was also confirmed by Akinlo, Oyeleke (2018) and Martins et al. (2020). Ayeni (2020) also stated that inflation significantly and negatively affects investment, but only in the short term. This finding is related to Dang et al. (2020), whose study also confirmed that inflation is not a significant determinant of investment in the long run. Similarly, Omitogun (2018) found different inflationary responses to investment. Rathnayake et al. (2023) report a negative impact of inflation on investment (Alalmai, 2024), while Alshamsi et al. (2015) and Sajilan et al. (2019) demonstrated a significant positive relationship between inflation and investment.

To provide information on human capital, the authors (Martins et al., 2020; Adinda, 2018) used the total labor force as input. Several recent studies have found a positive relationship between human capital and investment (Martins et al., 2020; Rumanko et al., 2021; Jurickova et al., 2020), as firms are more willing to invest in countries where workers have higher levels of education and training. (Pose & Cols, 2017) High unemployment can cause instability in the economy and discourage investors. (Okafor et al., 2017) Regarding the empirical relationship between investment and unemployment, Hoon et al. (2023) and AtilawWoldetensaye et al. (2022) demonstrated their negative relationship. On the contrary, Strat et al. (2015) found no causality between investment and unemployment.

The link between interest rates and investment has proven to be important when it comes to the financial structure of an investment. (Kalaš et al., 2024) On the one hand, if interest rates are low, borrowing costs decrease, i.e., loans become more available and favourable, so investors are advised to invest. (Inessa et al., 2019) On the contrary, high interest rates increase the cost of loans. (Giebel & Kraft, 2018) The negative impact of interest rates on investments was demonstrated by the analysis of Marinescu et al. (2019), while the authors of Kharb et al. (2024) concluded that the relationship between interest rate and investment is negative in the long run but positive in the short run. Krugman and Wells (2015) and Akinlo and Oyeleke (2018) confirmed their negative but significant relationship. The results of the research team Lisowski et al. (2021) are inconclusive as they conclude that there are significant Pearson correlations between investment and interest

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rates. However, these relationships are not confirmed by random correlation, i.e., that financial constraints caused by capital costs positively affect investment. (Sharma et al., 2019)

Government debt is one of the variables that has a negative impact on investment. (Marinescu et al., 2019) In general, it was found that countries with high debt and especially risk for the sustainability of public debt negatively affect the development of investments. (Mirovic et al., 2023). In her research, Sineviciene (2015) came to a similar conclusion as Akinlo and Oyeleke (2018). They used error correction model analysis to examine the effects of government debt as a proxy for investment, with a negative but insignificant impact in the long run. Debt obtained a negative coefficient, not too large although statistically significant, in the analysis carried out by the researchers Marinescu et al. (2018) and Lehmann et al. (2022); therefore, debt does not have a significant impact on investment.

Endriukaitienė et al. (2022) concluded that wages are a statistically insignificant variable in relation to investments. On the other hand, Hoang and Bui (2015) and Mansi et al. (2020) argue the opposite, as higher wages can increase consumer demand. Thus, if wages rise, workers have more disposable income, which leads to higher consumption. (Nguyen, 2024; Emako, 2022) This increased demand for goods and services can encourage businesses to invest more, e.g., to modernize technologies. And so, if higher wages lead to increased demand, companies can respond by investing more to meet it. (Bachmann & Zorn, 2020; Xuan, 2020).

Economou et al. (2017) showed a negative but insignificant relationship between corporate tax and investment. Based on the empirical results of the research of Kalaš et al. (2024), we claim that taxes significantly affect investments in both the short and long term, and according to the authors, tax policy plays an important role in shaping investment decisions. The significant relationship between corporate tax and investment was also confirmed in the studies of Minh Ha et al. (2024) and Đurovic Todorovic et al. (2024), while it was a negative relationship.

Based on the research we studied, we created an overview of the databases (Table 1) from which data were most often taken for analysis. The authors drew primarily from the database of the World Bank, the United Nations Conference on Trade and Development (UNCTAD) and Eurostat.

Table 1. The databases overview

Database	Author
World Bank	Alalmai (2024), Patel et al. (2024), Emako et al. (2022), Endriukaitienė et al. (2022), Martins et al. (2020), Economou et al. (2017)
UNCTAD	Alalmai (2024), Emako et al. (2022), Endriukaitienė et al. (2022), Economou et al. (2017)
Eurostat	Kalaš et al. (2024), Endriukaitienė et al. (2022), Lisowski et al. (2021), Marinescu et al. (2019)
IMF	Hysa et al. (2022), Economou et al. (2017)
OECD	Kalaš et al. (2024)

Source: Authors' elaboration

The following table (Table 2) shows an overview of the research devoted to the determinants of investments. We were particularly interested in those in which the authors analyzed the impact of macroeconomic indicators on investments while applying various statistical methods. Macroeconomic indicators are essential for studying the determinants of investments because they provide a comprehensive view of the economic environment that directly influences investment decisions. Indicators such as GDP, inflation, and unemployment reflect the overall health of the economy and its growth potential, which are critical factors for investors. For instance, higher GDP levels indicate increased economic activity and demand, while low interest rates reduce financing costs and stimulate capital expenditure. Additionally, indicators like trade openness and tax rates affect the profitability and feasibility of investments. By evaluating these factors, investors can identify opportunities, assess risks, and understand the impact of fiscal and monetary policies on the investment climate.

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Table 2. Overview of research on the determinants of investment

Author	Macroeconomics indicator	Research method
Alalmai (2024)	GDP, GDP per capita, inflation, imports, exports, level of corruption, government spending.	Descriptive statistics Multiple linear regression
Kalaš et al. (2024)	Real GDP per capita, government spending, unemployment, inflation, tax revenue, interest rate.	Error correction model
Patel et al. (2024)	GDP, import, export, inflation, infrastructure.	Error correction model ARDL bounds testing approach
Emako et al. (2022)	Population, GDP per capita, labour force, availability of natural resources, import, export exchange rate, inflation, minimum wage.	Driscoll and Kraay standard errors
Endriukaitienė et al. (2022)	Population, average monthly salary, tax burden.	Multiple linear regression
Hysa et al. (2022)	Unemployment, interest rates, economic growth, inflation.	Descriptive statistics Multiple regression analysis
Lisowski et al. (2021)	Production, consumption, interest rate.	Canonical analysis Linear and causality correlation Autocorrelation and cointegration tests
Martins et al. (2020)	GDP, Inflation, Credit, Labor, Trade, Government Stability.	Cross-sectional time-series FGLS Panel ARDL
Marinescu et al. (2019)	Income, output gap, public debt, interest rate, loans, GDP, population, active population.	Descriptive statistics Correlation analysis OLS panel
Economou et al. (2017)	GDP per capita, imports and exports as a percentage of GDP, labour costs, corporate income tax, and inflation.	Descriptive statistics Fixed effects panel model Arellano–Bover/Blundell–Bond Dynamic Panel

Source: Authors' elaboration

3. Methodology and data

This paper formulates *hypothesis H1: Selected macroeconomic indicators significantly impact investments.* This impact will be analyzed through panel regression that investigates the relationship between selected macroeconomic indicators (such as GDP, inflation, unemployment, openness of the economy, etc.) and investments in the studied countries and time periods.

Data on investments are collected at the micro-level and macro-level of selected EU countries. The research will be processed based on the latest statistics from Eurostat and other internationally recognized sources available at the time of analysis (OECD, World Bank, IMF). Wherever possible, international sources will be used to ensure comparability between countries. First, suitable variables were selected, and secondary data were collected. Then, a research sample was sorted and created, forming our research's basis. Comparison methods are used to compare the obtained results, and based on the synthesis method, we will formulate conclusions on the investigated issue. We monitor a time horizon of 10 years between 2014 and 2023. Based on the availability of data, the examined sample includes selected EU countries, which are: Austria (AT), Belgium (BE), Czech Republic (CZ), Denmark (DE), Finland (FI), France (FR), Germany (DE), Greece (GR), Italy (IT), Latvia (LV), Lithuania (LT), Poland (PL), Portugal (PT), Slovakia (SK), Slovenia (SI), Spain (ES) and Sweden (SE).

It is assumed that investors' decision-making process is influenced by a wide range of factors that are considered determinants of investments. However, there is no consensus among economists about which ones are key. Based on the professional articles we studied, we tried to propose and define the determinants that most influence investments and these will be examined in this work. The following table (Table 3) captures the macroeconomic determinants we selected, their units, and the sources from which the data will be drawn.

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Table 3. Selected determinants

Determinants	Abbreviation	Unit	Source
Foreign Direct Investment	INV	Net inflow, percentage of GDP	IMF
Gross domestic product	GDP	Annual percentage growth rate of GDP	World Bank
Inflation	HICP	Harmonized index of consumer prices in percentage	OECD
Public Debt	PD	Percentage of GDP	Eurostat
Trade Openness	TO	Percentage of GDP	IMF
Unemployment Rate	UR	Percentage of the labour force	OECD
Corporate Income Tax Rate	CITR	Tax rate in percentage	OECD
Interest rate	IR	Long-term real in percentage	Eurostat
Gross fixed capital formation	GFCF	Percentage of GDP	Eurostat
Unit labour cost performance	ULC	Percentage change (t/t-1)	Eurostat
Political stability	PS	Political Stability and Absence of Violence/Terrorism Index (ranging from -2.5 to 2.5)	World Bank

Source: Authors' elaboration

We aim to verify the dependence between the explained variable (investments) and the explanatory variables (individual determinants).

The study's methodology focuses on analyzing the determinants of investment, with a key step being the selection of relevant macroeconomic indicators that influence investment decisions. The first step in the analysis was data preparation, which included performing a correlation test and Variance Inflation Factor test. These steps ensured that false regression pitfalls were avoided and that the subsequent regression analysis would be accurate. Descriptive statistics and a correlation matrix were first conducted to provide a thorough summary of the data's primary trends and the relationships between the variables. We also created a series of regression models to estimate the impact of selected indicators on investments. The determinants of investment in EU countries were then analyzed using panel regression. This statistical approach, which combines cross-sectional data (data collected from multiple subjects at a single point in time) and time-series data (data collected from a single subject at multiple time points), allows the analysis of the dependence between explanatory and dependent variables. Panel regression thus accounts for heterogeneity between countries and, over time, provides more robust and precise results.

The general formula for our model is:

$$INV=\beta_0+\beta_1 GDP+\beta_2 HICP+\beta_3 PD+\beta_4 TO+\beta_5 UR+\beta_6 CITR+u_{it} \quad (1)$$

Where u_{it} is the error term for each country *i* and time period *t*.

To verify the significance and validity of the model, various statistical tests will be used. The Hausman test will help decide between the fixed effects and random effects models, determining which model is more suitable in this case. Additionally, tests such as Breusch-Pagan and Pesaran CD will be used to detect heteroskedasticity and spatial dependence, while the Breusch-Godfrey/Wooldridge test will be used to check for potential serial correlation.

Another step in the analysis will be the use of the Generalized Method of Moments (GMM) model, which is appropriate for analyzing panel data, especially in cases where endogeneity or incorrect model specifications exist. The GMM method provides robust estimates even when some variables are endogenous, i.e., correlated with the model's error term. This model is particularly useful if there is suspicion of simultaneity between

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investments and macroeconomic factors, which could lead to inaccurate estimates when using traditional regression methods. The GMM model will serve as a complement to panel regression and provide more precise results in analyzing the determinants of investment. These tests and models will ensure the reliability and accuracy of the analysis results and contribute to a more robust and detailed interpretation of the macroeconomic factors' impact on investment.

The analytical part of the work mainly uses panel regression since we have the data in full panel form. The significance level of all tests is 5%. We will use the econometric software R. (R Core Team, 2018) for processing.

4. Results

The first part of the analysis consists of descriptive statistics (Table 4) of the determinants of investment. The dependent variable is INV and the explanatory variables are GDP, HICP, PD, TO, UR, CITR, IR, GCF, ULC and PS. The average investment is 2.3094, with a value ranging from -7.7 to 12.1, which is approximately a wide range in investment values. Skewness 0.6190 values - a slightly negative value, meaning that they are slightly shifted. Investments in the analyzed countries show high volatility, with the average value of investments being positive. Still, the range shows significant differences between countries, which can be influenced by various factors such as economic conditions and political stability in individual countries. Trade openness varies considerably between countries. A slight right-sided asymmetry indicates that most countries have trade openness around the average, but there are also countries with very high values (Belgium, Slovakia, Czech Republic). Public debt shows that there are large differences in the level of indebtedness in the analyzed countries. Countries have different levels of public debt, with some countries having relatively low debt while others have much higher values. A slight right-sided asymmetry indicates that most countries have a reasonable level of debt, but there are also countries with significant public debt (Greece, Italy, Portugal).

Table 4. Descriptive statistics

Variables	Mean	SD	Median	Min	Max	Range	Skew	Kurtosis	SE
INV	2,3094	2,8899	2,5	-7,7	12,1	19,8	-0,6190	2,5547	0,2216
GDP	1,9293	3,1297	2,2	-11,1673	8,3799	19,5472	-1,3614	3,5659	0,2400
HICP	2,6088	3,5700	1,4	-1,4	18,9	20,3	2,0098	4,2596	0,2738
PD	79,3159	41,1105	69,1	29,3	207	177,7	0,9418	0,2200	3,1530
TO	109,5288	38,6308	101,95	55,3	203,9	148,6	0,5012	-0,9111	2,9628
UR	8,1618	4,5723	7,1	2	26,6	24,6	1,7717	3,6551	0,3507
CITR	22,5716	5,3490	22	15	44,4333	29,4333	0,9022	1,1201	0,4103
IR	1,5377	1,6221	0,9704	-0,51	9,67	10,18	1,8258	4,8928	0,1244
GFCF	3,5912	0,9946	3,6	1,6	6,5	4,9	0,2870	-0,5706	0,0763
ULC	0,5982	2,1509	0,3	-4,1	9,4	13,5	0,6249	1,2250	0,1650
PS	0,6591	0,3051	0,7088	-0,23556	1,2822	1,5178	-0,5542	-0,2368	0,0234

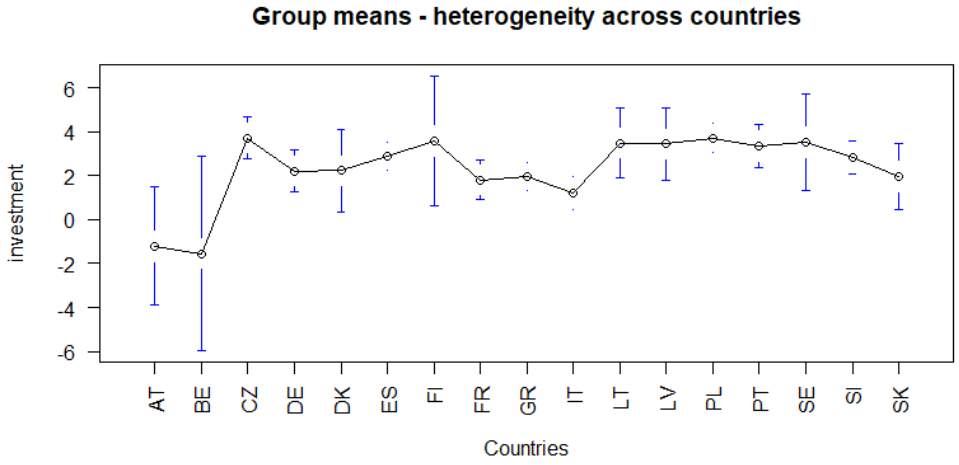
Source: Authors' calculations

Figure 1 shows the differences in investment activity across countries. This chart compares investment trends and performance in selected EU countries, allowing us to identify how investment varies across countries. It shows the variability of investment, highlighting countries that show significantly higher or lower levels of investment compared to others, and also shows which countries experience stable investment growth, which experience large fluctuations and which countries tend to show similar investment behaviour. Overall, the chart provides an insight into the heterogeneity, i.e. the diversity of investment activity. In terms of fluctuations, the most significant changes occur in Belgium (19.8), Finland (11.8) and Austria (11), where sharp increases and decreases are observed in some years, indicating high volatility and sudden changes in their development. On

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the contrary, countries such as Spain (2.2), Poland (3) and Greece (3.1) show a more stable development with smaller fluctuations, showing a more moderate growth or decline without sudden reversals.

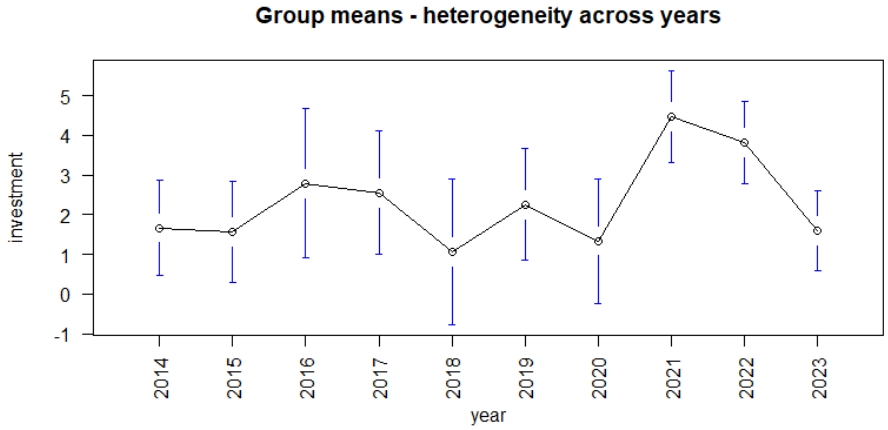
Figure 1. Heterogeneity across countries



Source: Authors' elaboration

Figure 2 captures the heterogeneity of investments over the years. The results of the variance analysis show that the largest fluctuations in investments occurred in 2016, 2017 and 2020. The year 2016 shows the largest range of fluctuations (19.4), which indicates that investments fluctuated within a wide range between the maximum and minimum values in this year. This significant range may result from unpredictable economic events or external factors that cause volatility in the market. The years 2017 and 2020 also show significant fluctuations (14.1 and 13.1), which may be related to global economic events and situations influencing investment decisions. On the other hand, the years 2023, 2022, and 2021 show minor fluctuations (7.3 to 8.2), indicating a more stable market and less investment volatility, which may indicate better economic stability and lower volatility in these years.

Figure 2. Heterogeneity across years. Source: Authors' elaboration



Correlation coefficients, which are key to identifying linear relationships between variables, are captured in Table 5. If their values are lower than 0.8, they indicate a moderate to weak correlation between these variables. Thus, the variables are relatively independent. If the correlations are positive, values between 0.2 and 0.4 signal

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a weak correlation, while values between 0.4 and 0.7 represent a moderately strong relationship. Correlations in this range may indicate that the variables move in the same direction but not in a completely synchronized and strong relationship. A negative correlation between -0.2 and -0.4 indicates a weak inverse relationship, where a change in one variable causes a slight change in the other in the opposite direction. Larger negative correlations in the range of -0.4 to -0.7 show a moderately strong relationship, indicating that the variables often move in opposite directions but not entirely predictable. These correlation values are important in analyzing relationships between variables because they indicate that other factors may be present in addition to the correlation itself, influencing the relationships between variables.

Table 5. Correlation Matrix

	INV	GDP	HICP	PD	TO	UR	CITR	IR	GFCF	ULC	PS
INV	1,0000										
GDP	0,2592	1,0000									
HICP	0,1538	0,1564	1,0000								
PD	-0,1995	-0,1821	-0,1854	1,0000							
TO	-0,0254	0,2083	0,3072	-0,4629	1,0000						
UR	-0,0226	-0,0919	-0,3561	0,6455	-0,4257	1,0000					
CITR	-0,2620	-0,1269	-0,1988	0,5846	-0,3582	0,3911	1,0000				
IR	0,0036	0,0081	0,2510	0,3653	-0,1266	0,4134	0,1085	1,0000			
GCF	0,1953	0,0450	0,1657	-0,4790	0,2056	-0,1949	-0,3266	0,0425	1,0000		
ULC	0,1033	-0,0811	0,3428	-0,4113	0,4038	-0,3281	-0,3875	-0,1241	0,1231	1,0000	
PS	0,1415	0,0960	0,0033	-0,5791	0,2890	-0,5663	-0,3737	-0,3739	0,1433	0,1601	1,0000

Source: Authors' calculations

The results of the VIF test (Table 6) show that most of the variables in the models have VIF values below 5, which means that multicollinearity between the variables is not performed. Most variables have VIF values below 2, meaning there is no significant correlation between them, and their coefficients should be stable and accurate. The variables PD and UR have VIF values higher but still below 5, which means that multicollinearity is moderate and will not have a significant impact on the stability of the model. The average VIF value is 1.8707, which is relatively low and supports the stability of the regression model. These results show that the model will not suffer from problems associated with multicollinearity, and its coefficient is likely reliable for further analysis.

Table 6. VIF test

Variables	VIF	1/VIF
GDP	1,1697	0,8549
HICP	1,7434	0,5736
PD	3,4421	0,2905
TO	1,4967	0,6681
UR	2,6343	0,3796
CITR	1,6485	0,6066
IR	1,6597	0,6025
GFCF	1,4831	0,6743
ULC	1,5919	0,6282
PS	1,8372	0,5443
Mean VIF	1,8707	

Source: Authors' calculations

Before testing the model, the Im, Pesaran and Shin (IPS) unit root test was also performed for individual variables in the panel data, and the results showed that most of the variables are stationary. The exception was interest rates, which failed the stationarity test and showed the presence of a unit root (p-value=0.999). This result indicates that interest rates are not stationary, and their behaviour over time may change, which may affect the stability of the model. Due to this instability, the interest rate was excluded from the variables considered to ensure the reliability and consistency of the resulting model, which focuses on stationary variables.

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The results of a series of regression models aimed at estimating the impact of various independent variables on investments are presented in Table 7. The GDP coefficient is consistently positive across all models, indicating a positive and significant impact of GDP on investments. In other words, an increase in GDP leads to higher levels of investment, potentially linked to greater economic activity and a favourable business environment in economies with growing GDP. Inflation, represented by HICP, is also positive across all models, with its impact becoming significant only after adding additional variables (from model 4 onwards). This positive relationship may suggest that moderate inflation growth can stimulate investment activity in the context of low interest rates. The public debt is predominantly negative, implying that an increase in public debt leads to a reduction in investment inflows. This result suggests that high public debt levels create market uncertainty or divert resources that could be used for productive investments. However, the impact of government debt was not significant in all models. The trade openness, representing the percentage share of the sum of exports and imports in a country's GDP, was significant across all models (from model 4 to model 9). The data showed a negative relationship between trade openness and investment inflows, possibly reflecting more substantial exposure to external shocks or competition in global markets. An increase in the corporate income tax rate (CITR) reduces investment inflows, indicating an inverse and significant relationship across all analyzed models (from model 6 to model 9). Higher taxes likely reduce the net returns on investments, discouraging investors. A positive but insignificant effect was identified among other analyzed variables, such as political stability, gross fixed capital formation (GFCF), unit labour costs (ULC), and political stability. This suggests that while these factors may contribute to a better business environment, their statistical significance was not established within this model.

Table 7. Baseline regression results

	GDP	HICP	PD	TO	UR	CITR	PS	GFCF	ULC	β
1	0,2394*** (0,0688)									1,8476*** (0,2524)
2	0,2226** (0,0694)	0,0940 (0,0608)								1,6348*** (0,2867)
3	0,2020** (0,0697)	0,0754 (0,0612)	-0,0100. (0,0053)							2,5171*** (0,5496)
4	0,2232** (0,0689)	0,1154. (0,0619)	-0,0165** (0,0058)	-0,0170** (0,0063)						4,7563*** (0,9926)
5	0,2101** (0,0686)	0,1532* (0,0640)	-0,0246*** (0,0070*)	-0,0154* (0,0063)	0,1289* (0,0631)					4,0938*** (1,0354)
6	0,2105** (0,0674)	0,1388* (0,0632)	-0,0160* (0,0076)	-0,0170** (0,0063)	0,1247* 0,0622)	-0,1214* (0,0475)				6,3944*** (1,3589)
7	0,2069** (0,0672)	0,1648* (0,0652)	-0,0130 (0,0079)	-0,0171** 0,0063	0,1629* 0,0667	-0,1156* (0,0474)	1,3708 (0,8892)			4,7592** (1,7194)
8	0,2128** (0,0673)	0,1552* (0,0656)	-0,0086 (0,0087)	-0,0167** (0,0475)	0,1503* (0,0674)	-0,1120* (0,0475)	1,4890. (0,8938)	0,2838 (0,2409)		3,3340 (2,100)
9	0,2329** (0,0700)	0,1365* (0,0680)	-0,0061 (0,0090)	-0,0186** 0,0064	0,1473* (0,0675)	-0,1027* (0,0483)	1,5916. (0,8988)	0,3290 (0,2446)	0,1239 (0,1182)	2,8327 (2,1535)

Source: Authors' calculations

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The results of the panel regression of the individual models (Pooling, Fixed Effect, Random Effect, Generalized Method of Moments) are shown in Table 8.

In **Pooling** model, the constant regression term (Intercept) is statistically significant at the 1% level and represents the basic value of the dependent variable when all other variables are equal to zero. The coefficient for GDP is statistically significant at the 5% level, and its increase by 1 unit is associated with an increase in the dependent variable by 0.2105. The coefficients for inflation (HICP) and UR also turned out to be statistically significant at the 10% level, with a positive relationship with the dependent variable. The coefficient for PD and CITR are statistically significant at the 10% level, and in both cases there is a negative relationship with the dependent variable. Trade openness (TO) is statistically significant at the 5% level, with a standard error and a negative relationship with the dependent variable demonstrated. All variables GDP, HICP, PD, TO, UR and CITR show a significant relationship with the dependent variable, with GDP and TO showing the strongest significance.

The results of the **Fixed Effects (FE)** regression model indicate that GDP and HICP have a positive relationship with the dependent variable, but they are not statistically significant. The coefficient of PD is statistically significant at the 5% level, while it is negatively related to the dependent variable. Trade openness and Corporate income tax are statistically significant variables at the 10% level and negatively related to the dependent variable. The unemployment rate showed a positive relationship, which is also statistically significant at the 10% level.

The results from the **Random Effects (RE)** regression model indicate that the intercept is highly significant at the 1% level. This highlights a strong baseline value for the dependent variable when all other variables are zero. The coefficient for GDP is statistically significant at the 5% level, demonstrating a positive and substantial effect on the dependent variable and underscoring the importance of economic growth. In contrast, the coefficient for HICP (Harmonized Index of Consumer Prices) is positive but not statistically significant, suggesting it does not have a meaningful impact on the dependent variable. The coefficients for PD and TO are significant at the 10% level, showing a negative relationship with the dependent variable. Meanwhile, the UR variable exhibits a positive relationship at the 10% significance level. Finally, the CITR variable demonstrates a negative relationship with the dependent variable, also significant at the 10% level. In conclusion, the significant factors in the model include GDP, PD, TO, and CITR. Among these, GDP has the strongest positive impact, while PD shows a notable negative effect. Marginal significance is observed for UR and TO, indicating their weaker but present influence. HICP, however, lacks statistical significance, suggesting a minimal role in explaining variations in the dependent variable. These results emphasize the critical influence of GDP and PD as robust determinants in the model.

Table 8. Summary of Panel regression

	POOLING	**FE**	**RE**	**GMM**
Intercept	6,3934*** (1,3587)		5,8787*** (1,1849)	
lag(INV,1)				0,0828 (0,0982)
GDP	0,2105** (0,0674)	0,1382 (0,1343)	0,1616** (0,0596)	0,2052 (0,1297)
HICP	0,1388* (0,0632)	0,0211 (0,1379)	0,1132 (0,0878)	0,0201 (0,1335)
PD	-0,0160* (0,0076)	-0,0233** (0,0079)	-0,0188* (0,0077)	-0,0228** (0,0075)
TO	-0,0170** (0,0063)	-0,0158* (0,0062)	-0,0143. (0,0074)	-0,0137. (0,0071)
UR	0,1247* (0,0621)	0,1670* (0,0649)	0,1293. (0,0753)	0,1757* (0,0779)
CITR	-0,1213* (0,0475)	-0,1041* (0,0470)	-0,0973* (0,0434)	-0,0917. (0,0482)
Signif. codes: 0,001 '***' 0.01 '**' 0,05 '*' 0,1 '.' 1				

Source: Authors' calculations

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The results from the **GMM** model indicate that the investment lag has a positive effect, but it is not statistically significant, indicating that past investment does not significantly affect the dependent variable. Similarly, GDP and HICP show a positive relationship with the dependent variable, although neither is statistically significant. However, the unemployment rate (UR) variable shows a positive and statistically significant relationship at the 5% level, indicating that higher unemployment is associated with increased investment inflows. On the other hand, the PD variable shows a negative and statistically significant relationship, suggesting that an increase in PD leads to a decrease in investment. Trade openness and Corporate Income Tax Rate show marginally significant negative relationships with the dependent variable, indicating weak evidence of their influence. In short, PD and UR are the most significant variables in this model, while the other factors show weaker or no significant effects.

The results of the tests (Table 9) conducted on the econometric model provide a comprehensive assessment of its assumptions and reliability. The F-test for individual effects reveals a p-value of 0.0068, indicating that individual-specific differences, such as those between countries or firms, significantly influence the dependent variable and should be included in the model, typically through fixed or random effects. Similarly, the F-test for time effects, with a p-value of 0.0457, suggests that temporal changes also play a crucial role, emphasizing the importance of accounting for time-related factors in the analysis. The Breusch-Godfrey/Wooldridge test for serial correlation yields a p-value of 0.8093, showing no evidence of significant autocorrelation in the residuals. This is a positive outcome since time series models assume that errors are independent.

Additionally, the Pesaran CD test for cross-sectional dependence provides a p-value of 0.8367, indicating no significant cross-sectional dependence, meaning the units in the sample behave independently, further enhancing the model's reliability. On the other hand, the Breusch-Pagan test for heteroskedasticity, with a p-value of 0.0115, reveals the presence of significant heteroskedasticity, meaning the variance of residuals is not constant across observations This violates the assumption of homoscedasticity, and we applied robust standard errors to correct this problem. Finally, the Hausman test, with a p-value of 0.1847, suggests that the random effects model is more suitable than the fixed effects model, as there is no evidence of inconsistency in the random effects approach.

Table 9. Summary of Diagnostics

Assumption	Test	P-value	Interpretation
Individual effects	F-test	0,0068	Individual effects are statistically significant.
Time effects	F-test	0,0457	Time effects are statistically significant.
Serial Correlation	Breusch-Godfrey/ Wooldridge test	0,8093	No statistically significant evidence of serial correlation in the idiosyncratic errors.
Cross-sectional dependence	Pesaran CD test	0,8367	No statistically significant cross-sectional dependence.
Heteroskedasticity	studentized Breusch-Pagan test	0,0115	Statistically significant heteroskedasticity.
Model suitability	Hausman	0,1847	The random effects model is suitable for use, as there is no evidence of inconsistency compared to the fixed effects model.

Source: Authors' calculations

5. Discussion

Investment is a cornerstone of economic growth, fostering sustainable development, infrastructure improvement, and innovation. Its fluctuations, driven by internal and external economic factors, make it a dynamic study area. This research examines macroeconomic determinants of foreign direct investment (FDI) across 17 EU countries from 2014 to 2023, using panel regression informed by the Hausman test. GDP growth and the unemployment rate positively and significantly impact FDI, consistent with Alalmai (2024) and Ahmad

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& Zhao (2018), highlighting economic growth's critical role. In contrast, public debt and corporate income tax rates negatively influenced FDI, aligning with findings by Marinescu et al. (2019) and Economou (2017). Surprisingly, trade openness showed a significant negative relationship with FDI, suggesting challenges like competition and regulatory barriers. Inflation, however, was not statistically significant, echoing results from Ayeni (2020) and Dang et al. (2020). These findings underscore the importance of economic growth and fiscal prudence in shaping investment environments while highlighting complexities in trade openness and tax policies. This study contributes to understanding FDI determinants and offers insights for policymakers to foster sustainable investment.

6. Conclusion

The results of this study have significant implications for policymakers seeking to foster investment in the EU. First, the positive role of GDP growth highlights the importance of strategies that stimulate economic expansion. Policies that enhance productivity, support innovation, and improve infrastructure can create a favourable environment for investment. Similarly, addressing unemployment through targeted interventions can have the dual benefit of improving labour market conditions and encouraging investment.

On the other hand, the negative effects of public debt and corporate income tax rates underscore the need for prudent fiscal management. Reducing public debt through effective budgetary policies and maintaining competitive tax rates can alleviate barriers to investment. Policymakers must also address the challenges associated with trade openness by fostering a balanced approach that supports both trade and domestic investment. This could involve reducing regulatory barriers, enhancing the competitiveness of domestic industries, and promoting value-added production.

However, this research is not without limitations. The focus on macroeconomic indicators excludes potential microeconomic or sector-specific factors that may influence investment. Additionally, the sample is limited to 17 EU countries due to data availability, which may limit the generalizability of the findings. Future research could address these limitations by incorporating more variables or examining investment patterns within specific sectors. This would provide a more nuanced understanding of the factors driving investment and help tailor policies to the needs of different industries and regions.

In conclusion, investment remains a cornerstone of economic development, and understanding its determinants is essential for effective policymaking. By identifying the key macroeconomic factors influencing investment, this study offers valuable guidance for governments and businesses seeking to promote sustainable growth and innovation. As the global economy evolves, ongoing research and data analysis will be crucial in adapting strategies to new challenges and opportunities.

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VOLUNTEER MOTIVES AS A CATALYST OF THE SOCIAL ECONOMY*

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Abstract. Volunteering is a catalyst for developing well-being-oriented communities, which are fundamental to the social economy. The transition towards a social economy triggers questions about volunteer roles and the forces which drive them. The paper explores volunteers' motivations, attitudes, and expectations and volunteering as a catalyst for deploying the social economy concept. A survey was conducted among the volunteer community in Bulgaria, and 422 volunteers responded. The study shows that while each person has their motivations for participating in charitable activities, volunteers stand out for their desire to develop new skills, meet new people, belong to a specific community, and change society for the better. The analysis enriches existing views by identifying effective communication as key to attracting and retaining volunteers. Organisations must clearly explain their mission, be transparent about their goals and expectations, and create an environment where volunteers feel valued for their contributions. The obtained insights complement the existing theoretical knowledge in the field of social economy, human resources and motivation. They will also stress the need to develop policies to promote civic and corporate volunteering. The need for more in-depth research in managing voluntary organisations and, more specifically, managing voluntary human resources is emphasised.

Keywords: volunteers; volunteering; motivation; social economy; social responsibility

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1. Introduction

Despite not being a new phenomenon, the social economy has experienced a revival in recent decades. Organisations in this field seek to fill the gaps left by the market and the state, demonstrating innovation, adaptability, and readiness to respond to local needs given the right conditions and support to flourish (OECD, 2008). The term "Social economy" can be interpreted broadly, encompassing market and non-market activities. Examples of non-market activities are services offered by communities and cooperatives, often free to users. For this reason, organisations associated with the social economy can be part of both civil society and the market (Vaillancourt, 2009).

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Like any other economic system, the social economy allows for achieving broader goals, such as increased welfare, sustainability and promoting alternatives to the traditional capitalist model (Sumner et al., 2023). Against this background, volunteers are called upon to perform various tasks, from organising events to fundraising for charities and non-profit organisations. Besides, volunteers act as mentors and trainers, sharing their knowledge and experience to empower others through education and personal development (Pearce et al., 2023). They provide practical assistance, timely disaster support, and support for local shelters and community centres (Volunteero, n.d.). They advocate by raising awareness of social issues and promoting positive change (Zhou & Muscente, 2022; Gunn, 2023). Volunteers also contribute to environmental protection by participating in activities such as tree planting, beach cleaning, and wildlife conservation (Gunn, 2023).

Volunteers form the backbone of civic formations and non-profit associations (Zhou & Muscente, 2022). From consistently supporting all events and activities to helping organise specific programs behind the scenes, volunteers are paramount to realising the mission of non-government organisations (Richards, 2019). This gives reason to Miyamoto and Shiojiri (2023) to define volunteers – the main ones involved in realising these goals – as the *unsung heroes* on the way to achieving the socially significant transformation. Therefore, their efforts should be encouraged, mobilised, and directed to stimulate the social economy and local development in general.

The core of the concept of volunteering is that individuals engage spontaneously in private and freely chosen activities and promote or develop some aspect of the common good. No institution in society imposes these activities, and the behaviour of volunteers is not related to financial gain (Andreasen & Kotler, 2003). Different research shows that optimal motivation is achieved by pursuing multiple motives, and some of them indicate that trust, as a result of these motives, also plays the role of a motivator (Bekkers, 2012; Taniguchi & Marshall, 2014; Gaja et al., 2024).

From responding to emergencies following natural disasters to promoting youth development and protecting the environment, volunteers are indispensable in addressing social, environmental and economic challenges in their communities. Their commitment significantly impacts the economy, helping to increase GDP by an estimated 1.9% in OECD countries (OECD, 2024) and 2.4% of global GDP (Miyamoto & Shiojiri, 2023). Therefore, volunteers are crucial for achieving social transformation in communities of different sizes and achieving significant progress in significant paradigms of our time, including social economy, global sustainability, and green economy (VolunteerMatch, 2023).

Over 860 million people worldwide, or about 15% of the world's population, volunteer each month (OECD, 2024). However, volunteering levels are at an all-time low, with small charities the worst affected. These organisations, which make up 80% of the sector and are more dependent on volunteers, are struggling with declining volunteer numbers. The situation is worsening, with more small organisations reporting problems recruiting volunteers in the last year – 65%, up from 58% the year before (Kitson, 2024).

In Bulgaria, approximately 1.2 million people are members of non-government organisations (NGOs). Thus, practically every fifth adult Bulgarian citizen is a member of some organised form of civil association. Roughly the same share of citizens express trust in NGOs. Simultaneously, data from 2021 show that, on average, an NGO has 5 voluntary collaborators in the country. Compared to the number of NGO members, the number of volunteers seems quite modest – less than 47,000 people (Zahariev, 2018; Zahariev & Yordanov, 2023).

Everything indicates that volunteering, although vital, has been under severe pressure in recent years. Disasters and crises often lead to temporary increases in volunteering, but the COVID-19 pandemic has contributed to a longer-term decline. Despite the challenges of measuring volunteering globally, urgent action is needed to revitalise volunteering and strengthen its role in the development of local communities (OECD, 2024).

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Given the declining levels of volunteerism on the one hand and the societal and individual benefits gained through community engagement on the other, there is no doubt that there is a growing need to encourage volunteerism among people of different generations. But what are the factors that predispose to distrust and weak volunteer initiative? And is it not imperative for non-profit organisations to change their approach and look for new ways to attract like-minded people?

This article aims to identify the motives, expectations and attitudes of volunteers in Bulgaria. The main question being investigated is what motivates individual citizens to volunteer and do socially oriented selfless activities. For the fulfilment of the goal thus set, the following tasks were completed: *1)* A literature review of publications examining the object of research – volunteering; *2)* A study was conducted identifying the attitudes of volunteers in Bulgaria; *3)* Analysis of results; *4)* Formulation of relevant conclusions and recommendations. In accordance with the completed tasks, the structure of this paper was built.

2. Theoretical background

In a broad sense, volunteerism is defined as a noble act that motivates people to give their personal time, skills and energy to help others. In doing so, they make a positive impact in their communities. Volunteering motives are diverse, ranging from personal fulfilment and new experiences to the desire to support a cause close to one's heart (Bekkers, 2012; Taniguchi & Marshall, 2014).

Volunteering can serve multiple functions simultaneously for any individual. However, this basic functionalist notion does not mean that all volunteer motives are equally related to meaningful outcomes. Self-benefit and other-oriented motives have different relationships with volunteer satisfaction and long-term engagement. Most significantly, the value-related function – the motive to participate in volunteering to express one's principles of solidarity and compassion – was more strongly correlated with satisfaction, intention to continue commitment, and volunteer health than functions that focus on self-esteem or personal benefits (Güntert et al., 2022).

In spite in developed countries, for example, the number of volunteers has declined due to changing socioeconomic conditions, an ageing population, and changing values, volunteering continues to tirelessly fight for causes that matter to current and future generations (Richards, 2019; Zhou & Muscente, 2022). A significant part of this added value is generated at the local level, improving social outcomes and creating more robust, social and inclusive communities, which is also embedded in the social economy concept (Pavlov & Ruskova, 2023; Miyamoto & Shiojiri, 2023). Any civil society depends almost entirely on volunteer work. Even in societies where volunteering is sufficiently institutionalised, roughly a quarter of the active population takes part in volunteering initiatives in a given year (Wilson & Son, 2022).

Moreover, in the modern world, there is more and more talk about the disintegration of the family and society and the loss of values (Pearce et al., 2023). Against this background, non-profit organisations and volunteerism appear as a powerful countermeasure because through their activity (UN Volunteer, 2022; Miyamoto & Shiojiri, 2023), they:

- create new connections in society by connecting with other people who share their values and interests;
- stimulate active citizenship by engaging people in solving problems in their community;
- promote social responsibility by learning to think about the needs of others and contribute to the good of society;
- preserve and transmit values such as empathy, mutual aid and solidarity to the next generations.

Volunteers' diverse roles demonstrate their significant impact as they foster a sense of community and create positive change in the world (Gunn, 2023). Along with the wide range of benefits for society, volunteering also positively affects the volunteers themselves, improving their health and well-being. It is associated with increased life expectancy, adoption of an environmentally friendly and healthy lifestyle, reduction of depression and stress (Miyamoto & Shiojiri, 2023), as well as personal growth and development, expanded social networks

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and connections, improved professional skills and experience, increased self-esteem and self-confidence, satisfaction from active participation in positive transformation and the realisation of significant causes (Zhou & Muscente, 2022; VolunteerMatch, 2023).

These different roles stand out most prominently in the non-profit sector. Because non-profit organisations typically have limited resources, they constantly need volunteers to achieve their core goals (Pearce et al., 2023; Wilson & Son, 2022). It is the institutions and organisations that make up the third sector and form the basis of civil society that rely heavily on the unpaid work of volunteers. Many governmental and public sector institutions, such as schools, also look to them for support (Wilson & Son, 2022).

It is clear that volunteering is not only the most widespread but also a vital form of civic proactivity. It has the potential to benefit volunteers' physical and mental health and the community as a whole. However, volunteers become involved in socially meaningful causes for various reasons and motivations (Stukas et al., 2016). Andreasen and Kotler (2003) argue that understanding human psychology is vital to effective volunteer management. Some volunteers are intrinsically motivated and need minimal guidance, while others need more specific direction and incentives. The authors argued that the non-profits that care about their volunteers are more likely to attract the right people, motivate and retain their volunteers, and achieve their social goals. In general, volunteers are most effective when:

- they receive assignments tailored to their skills and interests;
- clear and achievable goals are set for them;
- they receive regular feedback;
- they feel part of the team.

Such relationships can only be built based on mutual trust and transparency in actions. That would ensure compatibility in values and hence sharing in social causes. Therefore, circumstances force NGOs to become experts in attracting financial and additional human resources (Miyamoto & Shiojiri, 2023). The relationship between non-profits and volunteers should be mutually beneficial. Non-profit organisations receive invaluable help from volunteers, which enables them to realise their goals. Volunteers, in turn, get the opportunity to develop, feel useful and contribute to something bigger than themselves (Andreasen & Kotler, 2003).

Furthermore, volunteer recruitment and management strategies must take into account various factors, including changes in the external environment and the individual's internal motivation to undertake one or another action (Pearce et al., 2023; Wilson & Son, 2022). Last but not least, a huge dose of persuasiveness is needed to express the leading maxim of volunteering – the benefits greatly exceed the costs incurred (Miyamoto & Shiojiri, 2023). Akintola (2011) notes that organisations' limited understanding of volunteer motivation, the mismatch between organisational goals and volunteer motivation, and the lack of sufficient funding result in volunteers' basic needs not being met. This can cause dissatisfaction, feelings of resentment and fatigue among volunteers, which in turn reduces the number of socially significant goals achieved.

All this presupposes a better knowledge of volunteering and the motivations for gratuitous engagement by civically active people. A study by Akintola (2011) based on qualitative interviews with 57 volunteers shows their complex motivation behind the decision to engage in volunteer activities. In conformity with functional theory, most of them shared that they had more than one motive for volunteering. Among the 11 motivational categories identified, the most frequently mentioned were those related to altruistic concern for others and the community, professional development or career, and the unemployed's desire to escape from inactivity. Volunteers also see volunteering as an opportunity to develop caring skills, put their abilities into practice, achieve personal development and attract positive experiences into their lives.

Bekkers (2012) found a weak relationship between individuals' willingness to participate in civic engagement and their trust in the respective cause or organisation. As stated by the author, in some countries, trust is not associated with civic engagement at all. Although many studies have found a positive relationship between trust

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and membership in voluntary associations, the relationship is relatively weak. However, the author argues, according to the stability hypothesis, the relationship between trust and civic engagement – albeit weak – results from selection effects: people with high trust are more likely to join and stay involved in voluntary associations than people with low confidence.

Taniguchi and Marshall (2014) share a similar opinion: trust, specifically institutional trust, is more critical in predicting giving than volunteering. Their study revealed a positive and significant correlation between the number of membership organisations and both forms of civic engagement.

In the context of the current research, these statements are critical. NGOs in Bulgaria face more significant difficulties in gaining the trust of various social groups than usual for NGOs worldwide. In addition, the general level of institutional and social trust in Bulgaria is relatively low compared to the level in the world (Zahariev, 2018). The Open Society omnibus research in Bulgaria shows that in 2018, only 22% of respondents fully or somewhat trusted NGOs, 30% distrusted to a lesser or greater extent, and almost half cannot judge or do not answer the question. In 2022, trust dropped to 19.6%, mistrust exceeded 52%, and the share of non-answers and undecideds was 27.2% (Zahariev & Yordanov, 2023).

On the other hand, the share of Bulgarian NGOs that believe they enjoy a low degree of trust from citizens increased from 47.5% in 2017 to 57.2% in 2023. For the same period, the share of NGOs that convey that they don't receive enough real support from local communities and citizens increased from 13% to 17%. NGOs themselves admit to feeling a relatively low degree of public trust, with this feeling rising in 2023 and the share of those sharing very low and relatively low trust in NGOs rising to 58% from 53% in 2017 (Zahariev & Yordanov, 2023).

The presented data confirm, to a certain extent, the connection between the growing mistrust of the NGO sector and the weakening volunteer initiative in Bulgaria. To confirm or reject such a doubt, better understanding the volunteers' motivations and expectations and their reasons for choosing specific NGOs is necessary.

Although volunteering is a long-established practice in many countries, research on its motivation and impact in Bulgaria is relatively new. Recent studies, such as those by Petrova et al. (2018), focus on understanding the role of volunteering in developing students, especially in medical specialities. These studies show that volunteering can contribute to more comprehensive professional development and a deeper understanding of patient needs. Zlatkova (2008) also points out that volunteers are motivated by the desire to contribute to society and meet specific social needs. She emphasises the importance of recognising and valuing this contribution to stimulate the participation of more people in volunteering activities.

In 2017, Ivanova and Nikolova (2018) surveyed students of the Rehabilitation Medicine speciality at the Medical College – Varna, examining the motives and attitudes towards volunteering activities. The study involved 61 students, with more than half of the respondents confirming that they participate in voluntary work in various community activities. Even though the desire to volunteer is present among students, there is a demand for broader participation. The study results highlight the need to create conditions that stimulate volunteering among young people, especially among future medical professionals. Volunteering can prepare students for professional challenges and help them develop the necessary skills to work with patients. Delcheva (2023) identifies multiple motives that drive students to volunteer. In addition to altruistic motives, such as the desire to help others, students also highlight the practical benefits of volunteering, such as developing professional skills and acquiring valuable experience.

The studies by Zlatkova (2008), Ivanova and Nikolova (2018) and Delcheva (2023) are among the few that specifically address and seek the motives of volunteers. Most authors analyse the role and benefits of the prosocial and proactive behaviour of volunteers. But is it enough to know that an action is good enough to

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encourage it among citizens? Isn't the motive and origin of this desire to do good in the name of another's cause more critical?

In 2023, TimeHeroes – one of the largest and most experienced non-profit organisations in Bulgaria, which provides a connection between volunteers and structures with different causes, implemented the fourth national survey on awareness and participation in volunteer initiatives. Although it is mainly aimed at volunteer causes initiated through the organisation's platform, the survey offers valuable insights, both for the current study and future research focused on the motivations of volunteers. In addition to building the volunteer profile, the organisation also analyses aspects such as reasons for *non-participation* in volunteer initiatives. Among the most common answers are: *It was not necessary/I have not come across an initiative; I do not trust the people who organise such initiatives; I do not benefit from participating in such initiatives; I do not believe in the purpose of such initiatives; There is no benefit for people from such initiatives*. The problem of *distrust* among citizens towards the organisations that are the basis of the volunteer initiative is highlighted again. However, there is also distrust of the meaning of volunteering in general.

3. Research objective and methodology

The current study is motivated by revelations about Bulgaria's low volunteer participation and the lack of trust in the structures that most need volunteer energy and support – the NGOs. The theoretical background shows that while there is abundant literature on volunteers' role in bringing about positive change, there is significantly less understanding in Bulgaria of *what motivates volunteers and what drives them to give their energy and talent to specific causes freely*. Based on the literature review and the main objective of the study – *to identify the motives, expectations and attitudes of volunteers in Bulgaria*, the two research questions (RQ) were formulated:

> RQ1: *What are the attitudes, expectations, and motives of the Bulgarian volunteers to offer their skills, time, and energy for free?*
> RQ2: *What strategies can organisations develop to encourage volunteerism and attract more like-minded people to their causes?*

A quantitative methodology was developed for the study. The target group comprises self-determined volunteers without restriction on gender, age, ethnicity, religion, etc. Responses were collected through the online Google Form application and processed in a spreadsheet. The instrument used for the survey is an online questionnaire with a Likert scale for the responses, where 1 means "*Definitely NOT essential*" and 5 – "*Definitely IS essential*".

The research was conducted from March 1st to 31st, 2024. TimeHeroes plays a significant role in the distribution of the survey form. The organisation provides a forum for the interaction of 1,134 civil associations and non-profit organisations and over 96,000 volunteers, who together have participated in the successful implementation of about 3,000 significant social causes (TimeHeroes, 2024). The TimeHeroes team actively assisted the research by distributing the survey form through their communication channels. The association also provided up-to-date information on research conducted on volunteering in Bulgaria, which enriches the discussion of the present study.

The authors developed the questionnaire in accordance with the theoretical background, and the questions were selected and grouped based on similar studies already conducted. The aim is to validate or reject previously formulated generalisations and conclusions regarding the study's object – the motivation of volunteers. This would confirm the volunteer profile to a higher degree through independent research.

Three university professors, two representatives of the Bulgarian NGO sector, and the TimeHeroes team tested the questionnaire. After testing, the number and content of the questions were not changed, as they are believed to be reasonable for identifying motivators for volunteering.

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The questionnaire is anonymous and consists of 4 sections with 5 statements each, to which respondents must answer with an option from 1 to 5. In each section, there is also an opportunity (open question) for respondents to formulate a free answer to a question. The sections provide an answer to RQ1 by examining:

- Section I: the reasons for choosing an organisation in whose activities volunteers voluntarily participate;
- Section II: the attitudes of volunteers;
- Section III: the expectations of volunteers;
- Section IV: the motivation of volunteers to share their skills, time and energy for free.

The insights gained from answering RQ1 will enable the answer to the second RQ2. Figure 1 presents the conceptual framework of the study.

Due to the lack of accurate information on the number of volunteers in Bulgaria – less than 47,000 according to the Open Society Institute (Zahariev & Yordanov, 2023) and over 96,000 (as of March 31st, 2024) according to active volunteer profiles on the volunteering platform TimeHeroes (2024) – the authors of the study assume a general a total of 96,000 volunteers. The minimum recommended sample size is 383, with a 95% confidence level and a 5% margin of error.

Two leading software tools were used to process and analyse the collected data: Microsoft Excel and IBM SPSS Statistics. Excel was used for data entry and initial processing, including creating databases and visualising the data through tables and charts. SPSS was selected for more in-depth statistical analysis, such as calculating descriptive statistics (mean, median, standard deviation), performing correlation analysis, and comparing groups. Using these two software packages allowed for a comprehensive and accurate description of the data and the identification of significant relationships between variables.

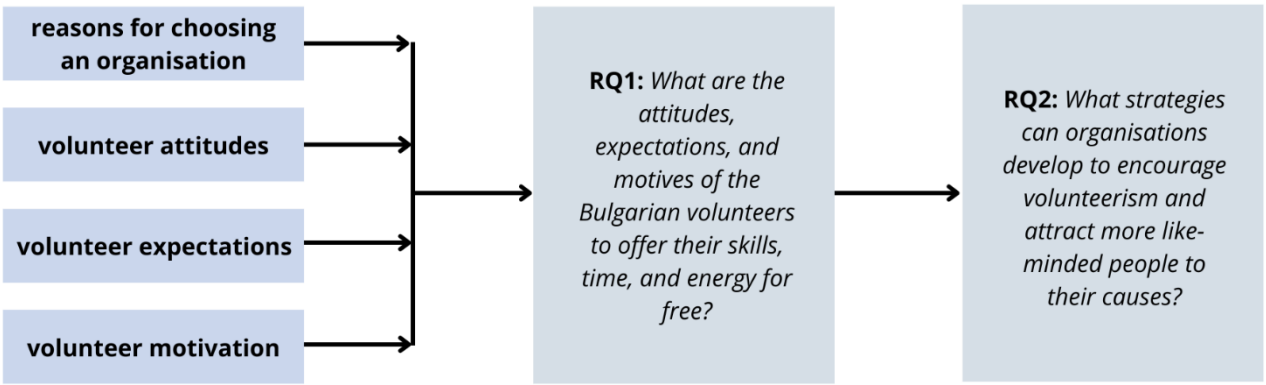


Figure 1. Conceptual framework of the study.

Source: Authors' development

4. Results and discussion

Four hundred twenty-two (N=422) volunteers took part in the study. As the current research seeks general attitudes, expectations, and motivations for voluntary self-initiative, demographic data such as gender and age were not collected by the respondents. None of the respondents wished to leave a free answer to one or more of the open questions in the survey form. Table 1 presents the results of the descriptive statistical analysis performed.

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The reasons for choosing an organisation in whose activities volunteers voluntarily participate

The first section (Table 1: Q1) of the survey focuses on volunteers' motivations when choosing an organisation. Data analysis shows that respondents value several key factors. The mean, median, and mode of responses to the questions in this section are close to 4 on a 5-point scale, which means "Essentially Important." This indicates that for most survey participants, a clear mission statement, team performance, and transparency of the cause are critical when deciding to volunteer.

The standard deviation, which measures the dispersion of the data around the mean, varies slightly across questions in this section. For questions related to mission and cause, the standard deviation is relatively low (.589; .585), indicating a high level of agreement among respondents. This suggests that these factors are universal motivators for volunteering.

Questions related to the organisation's reputation (.967), team (.854) and social networks (1.085) show a more significant standard deviation, suggesting a greater diversity of opinions. Despite these factors are essential for some volunteers, they are not as defining as the mission, the team, and the cause. Figure 2 visualises in detail the results of Question 1. The stated mission of the organisation and the transparently formulated cause why the organisation needs the assistance of volunteers predetermine to varying degrees the choice of the respondents, with 407 (96.5%) marking this answer as true or definitely accurate. A developed social network presence is essential for 302 (71.6%) of the respondents.

Table 1. Descriptive statistics of the results obtained from all questions and their answers, according to the 5-point Likert scale used (1 – "*Definitely NOT essential*" and 5 – "*Definitely IS essential*")

Questions		N		Central tendency			Spread measures
		Valid	Missing	Mean (M)	Median (Mdn)	Mode (MO)	Std. deviation (s)
Q1: When selecting an organisation to volunteer with, it is essential to you that it has…							
	Q1.1: ...a stated mission that defines its existence.	422	0	4.44	4.00	4	.589
	Q1.2: ...introduced his team.	422	0	4.18	4.00	4	.854
	Q1.3: ...a transparently formulated cause, for the realisation of which it needs volunteer support.	422	0	4.41	4.00	4	.585
	Q1.4: ...developed presence in various social networks.	422	0	3.78	4.00	4	1.085
	Q1.5: ...an established reputation in the community to which it belongs.	422	0	3.94	4.00	4	.967
Q2: When applying to be a volunteer, is it important to you…							
	Q2.1: ...to share the cause in the implementation of which you want to get involved.	422	0	4.42	4.00	4	.621
	Q2.2: ...the opinion of your relatives, loved ones, friends, colleagues.	422	0	2.20	2.00	2	.971
	Q2.3: ...to receive training in a field related to the tasks you are expected to perform.	422	0	3.71	4.00	4	.821
	Q2.4: ...the availability of references from previous volunteers.	422	0	3.40	4.00	4	1.003
	Q2.5: ...the transparency of the skills and time that the volunteer is expected to provide for free.	422	0	4.40	4.00	5	.724
Q3: When your participation as a volunteer is over, it is important to you…							
	Q3.1: ...your support remains anonymous.	422	0	2.46	2.00	2	1.242
	Q3.2: ... get public recognition for your grant.	422	0	1.63	1.00	1	.840
	Q3.3: ...to receive an apparent reward for your grant.	422	0	1.47	1.00	1	.681

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	Q3.4: ...to hear/read a non-personalised "Thank you".	422	0	3.45	4.00	4	1.154
	Q3.5: ... to be offered a new cause to join.	422	0	3.37	4.00	4	1.097
Q4: What motivates you to volunteer?							
	Q4.1: The desire to be helpful with your skills and experience.	422	0	4.50	5.00	5	.555
	Q4.2: Possible social and professional contacts.	422	0	3.65	4.00	4	1.200
	Q4.3: The experience you will get by getting involved in different causes.	422	0	3.86	4.00	4	1.078
	Q4.4: The satisfaction of being an hour of meaningful change.	422	0	4.53	5.00	5	.579
	Q4.5: Your acquaintance is a volunteer and motivated you to get involved.	422	0	3.32	4.00	2	1.414

Source: Authors' development

These data resonate positively with the results of a 2023 study by the organisation TimeHeroes (2023) about volunteering activities. Based on the association's analysis, over 83% of respondents (N=244) are interested in various causes and possible participation in them through *social networks*. That implies developing social channels for the respective initiators of social causes and publishing up-to-date information in them. An active presence in social networks is also suggested by the age profile of the volunteer, derived from the TimeHeroes survey: the most significant share – 27% is occupied by the volunteers between the ages of 35-44, followed respectively by the demographic groups of 18-24 years (19.7 %), 25-34 (18.0%), under 18 (15.6%), 45-54 (12.7%), 55-64 (4.1%) and 65+ (2.9%). As can be seen from the data, the most active demographic groups are also the most actively present in the various social networks (Newman, 2023). It makes sense that this would be the preferred channel for gathering information and choosing a cause.

From the answers received, as well as from the applied descriptive statistical metrics (Table 1: Q1.1 – Q1.5), it can be concluded that the most important of the proposed factors for choosing an organisation is its clearly stated mission. Second is the transparently formulated cause, followed by the business card of the organisation's team and the established reputation. The developed social networks of the relevant organisation are positioned last, and this does not mean that this factor should be downplayed – 71.6% of respondents defined it as significant. Instead, it should be kept in mind that communicating the strengths of organisations aiming to achieve a specific cause is imperative to start first with the mission, vision, values, and team.

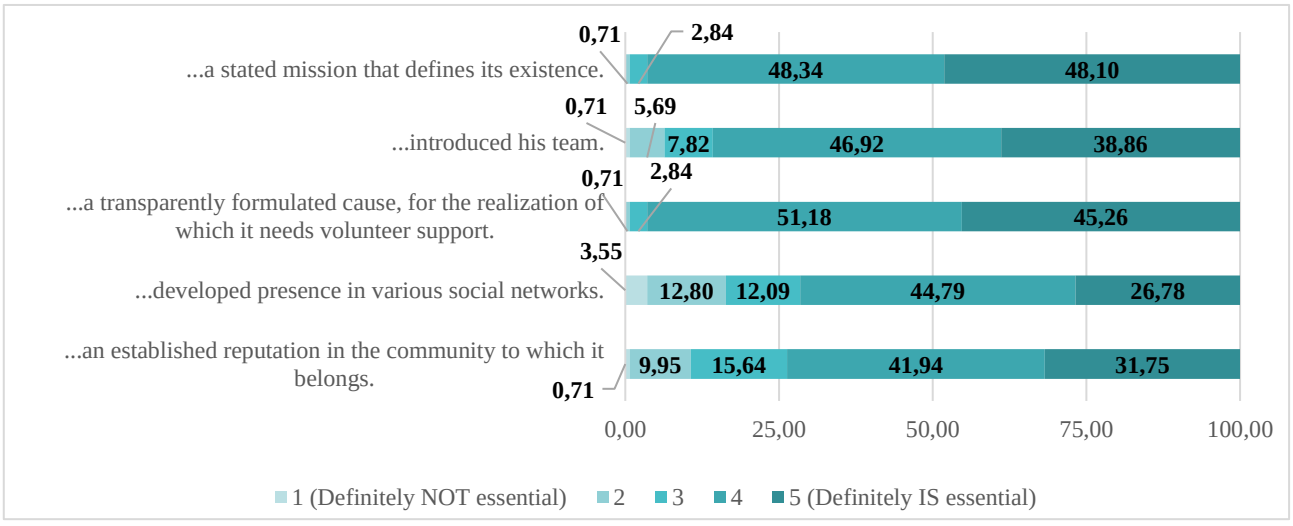


Figure 2. Answers to Question 1. When selecting an organisation to volunteer with, it is essential to you that it has...? (%), N=422.

Source: Authors' development

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Volunteer attitudes

Descriptive statistical analysis regarding the second cluster of questions (Table 1: Q2) shows that for most volunteers, it is imperative to share the cause they are involved in (Q2.1). This suggests that volunteers are looking for organisations with a clear mission and purpose. The opportunity for training (Q2.3) also emerges as an essential factor. Volunteers want to acquire new skills and knowledge.

At the same time, questions Q2.4 and Q2.5 show that volunteers value transparency and clarity regarding expectations. They want to know what is expected of them and what their responsibilities are. The results regarding question Q2.2 are surprising – the opinion of relatives and colleagues is less critical when deciding to volunteer. This categorically points to internal motivation, rather than social influences and examples, as the leading factor in deciding to engage in volunteer initiatives. Although the mean values of most questions are high, the standard deviation varies – from .621 to 1.003. This shows that while some factors are extremely important to most volunteers (e.g., the mission of the organisation), other factors (e.g., the opinion of loved ones) are less critical, and there is a greater diversity of views.

The results of the second group of questions (Q2) are presented in detail in Figure 3. For almost 100% of respondents – 410 (97.2%) to varying degrees, it is essential to share the cause in which they intend to be involved. The opinion of relatives, friends, and acquaintances is not crucial for volunteer participation – 311 (73.7%) considered the statement false or strongly false. Specialised training is expected by just under 72% of the respondents – 42 (10.0%) mark the statement categorically true. The presence of recommendations from previous volunteers was determined to be a significant factor by a total of 245 (58.1%) of the respondents. A considerable number of volunteers – 398 (94.3%) strongly agreed that transparency regarding the skills and time the volunteer is expected to provide is essential when applying to volunteer.

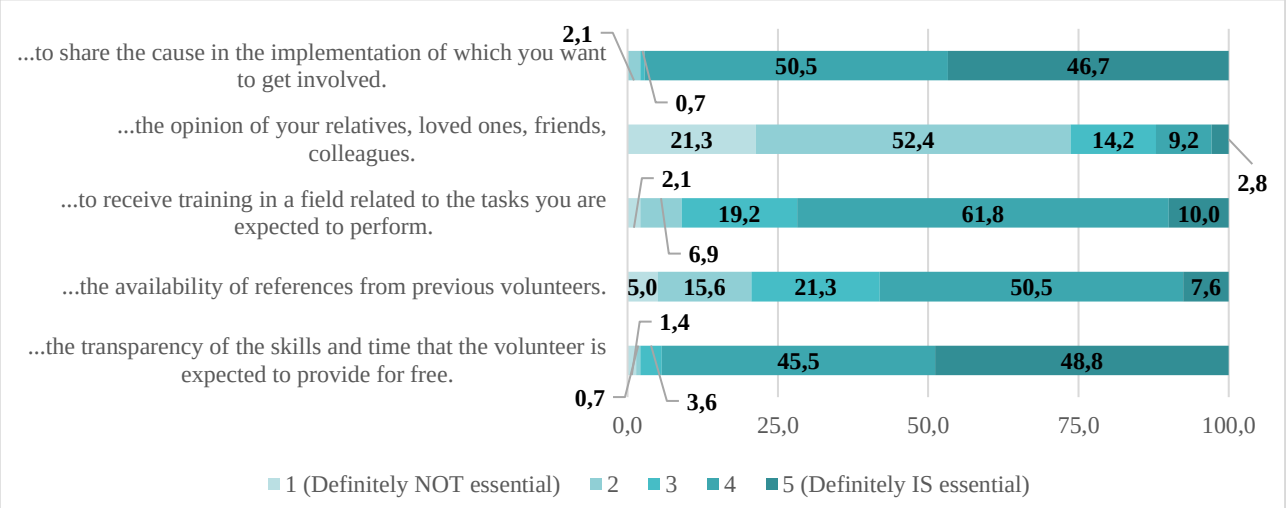


Figure 3. Answers to Question 2: When applying to be a volunteer, is it important to you…? (%), N=422.

Source: Authors' development

The conclusion that can be drawn so far is that volunteers are primarily looking for a shared cause in the realisation in which they wish to participate, as well as transparency regarding what is expected of them and the time they are supposed to dedicate to the cause. Volunteers also assume training and the availability of recommendations, while the opinion of relatives and friends is instead an insignificant factor for volunteer self-initiative.

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Volunteer expectations

The third cluster of statements (Table 1: Q3) examines the expectations of volunteers. Volunteers do not attach much importance to the anonymity (Q3.1). The mean value is below 3 on a 5-point scale, which suggests that most volunteers do not expect anonymity. Volunteer respondents also demonstrate a lack of interest in public recognition and material rewards (Q3.2 and Q3.3). The mean values (M=1.63/1.47) are very low, so it can be concluded that these factors are not the primary motivators for volunteering. At the same time, although volunteers do not seek public recognition, they value gratitude Q3.4 and would like minimal recognition for their contribution. The mean values of question Q3.5 show that volunteers are open to new opportunities for participation. This suggests that they are committed to the causes they support and want to continue contributing.

In the case of the third cluster of questions, the standard deviation maintains significantly high values. The most substantial dispersion of the data around the mean value is observed in question Q3.1. Although the mean is 2.46, the standard deviation is 1.242, which shows that there is a large group of participants who think that anonymity is important. Still, there is another large group that does not think it is crucial. The picture is similar to Q3.4 and Q3.5 – the questions analysing gratitude as a motive and the proposal to join a new cause. In this case, the categoricalness in the answers is dispersed (s=1.154/1.097).

Figure 4 visually presents the trend in the individual answers to Q3 of the respondents according to the Likert scale. The statement that volunteers would like their support to remain anonymous was endorsed as true to varying degrees by just under a quarter of respondents, or 98 (23.2%). That means that a significant proportion of those who give their time and labour for free do not want the emphasis to be on themselves but on the relevant cause. Conversely, 249 (59.0%), to varying degrees, consider the statement to be false. For them, the preservation of anonymity is not a significant factor.

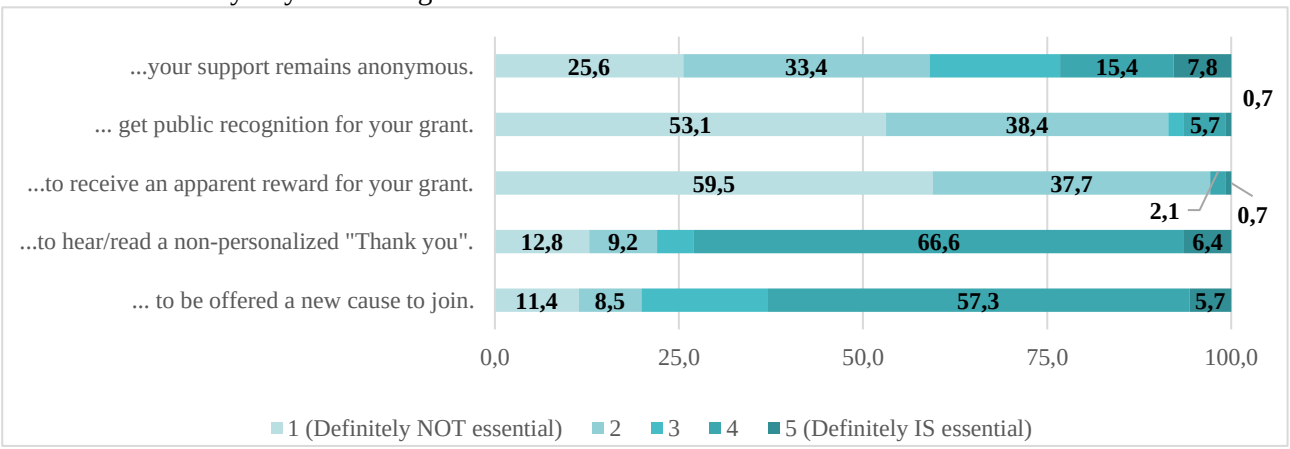


Figure 4. Answers to Question 3. When your participation as a volunteer is over, it is important to you...? (%), N=422.

Source: Authors' development

A total of 27 (6.4%) of the respondents expect to receive public recognition for their contribution, and 386 (91.5%), to varying degrees, define the statement as false. 12 (2.8%) people expect a reward for their help, not one has any hesitation in the statement, and 410 (97.2%) do not wish to be rewarded for their participation as volunteers. On the other hand, a significant number of respondents – 308 (73.0%) would like to hear or read a non-personalised "*Thank you*" for their volunteering.

The last statement in the cluster informs not only how to attract but also how to retain volunteers as such. Quite a few of them – 266 (63.0%) expect to varying degrees to be offered a new cause to join. Another 84 (19.9%)

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mark the statement as false or categorically false. The latter most likely prefer to choose the causes in which they want to get involved rather than being attracted by concrete organisations. It can also be assumed that volunteers do not wish to limit their voluntary activity within a single organisation but would feel more satisfied if they participated in more causes regardless of the association behind them.

Motivation of volunteers to share their skills, time and energy for free

The data for responses from cluster 4 (Table 1: Q4) provide us with information about what motivates people to engage in volunteering. The satisfaction of contributing to change (Q4.4) emerges as the strongest motivator for volunteers. Respondents want to see the results of their work and feel that they are part of something bigger. The desire to be helpful with their skills (Q4.1) is the second strongest motivator for volunteers. The most common response is 5 on the Likert scale, which indicates that most volunteers want to use their skills and experience for a good cause. These are both responses with the smallest standard deviation values, which shows the categorical nature of the respondents' choices.

The opportunity to gain new experience and develop (Q4.3) is also an essential motivation for volunteers. The mean value is 3.86, which indicates that volunteers appreciate the opportunity to participate in different causes and broaden their horizons. The possibility of social and professional contacts (Q4.2) is also a necessary factor, but not as strong as the first one. The average value is 3.65, which indicates that volunteers see opportunities to make new contacts as a bonus. Despite the influence of other people (Q4.25) as a factor also matters, it is not as strong as the others. The average value is 3.32, which indicates that although recommendations from loved ones can influence the decision to volunteer, it is not the primary motivator. These three questions have high standard deviation values (s=1.078/1.200/1.414), which means that most respondents do not agree with a given question or statement. As can be seen from Figure 5 in detail, almost 100% of the respondents – 416 (98.6%) mark the desire to be helpful with their skills as true or categorically accurate. Possible social and professional contacts are evaluated as a significant factor to varying degrees by 290 (68.7%) of the volunteers. The experience gained from participating in various causes was marked as significant by just under 80% of respondents – 117 (27.7%) and 218 (51.7%) rated the statement as definitely accurate or correct, respectively. Almost 100% or 416 (98.6%) of the respondents marked as definitely accurate or true the option that their primary motive was the satisfaction of being part of a meaningful change. The last statement to the question finds the most minor support – a familiar volunteer as a motivator for involvement in a social cause. Of the respondents, 224 (53.1%) chose this option as accurate.

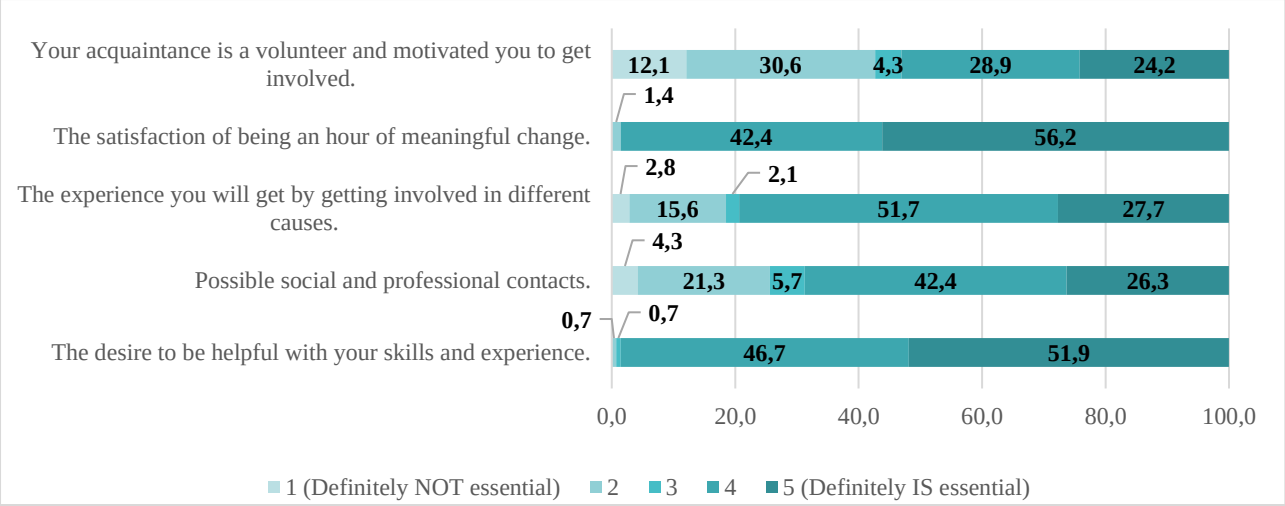


Figure 5. Answers to Question 4: What motivates you to volunteer? (%), N=422.

Source: Authors' development

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The answers to this last option (*Your acquaintance is a volunteer and motivated you to get involved*.), together with the marked answers to the second statement of the second question cluster (*When applying to volunteer, is it essential for you [...the opinion of your relatives, loved ones, friends, colleagues.*]) demonstrate independence in making a decision to be involved in volunteer initiatives. The opinions, support and experiences of relatives and friends have the most minor influence on the attitudes and motives of volunteers. Such a decision is instead the result of internal motives and attitudes, and this predetermines the power and energy that volunteers can exert on the social transformation of any society. Respondents in the current study noted the most potent motivator for their actions as having the desire to be helpful and, on the other hand, the satisfaction of being part of a meaningful change.

Of the four clusters of questions, the first (Q1) directly expresses the volunteers' intention to join a specific cause by choosing a suitable NGO. In fact, the questions in this group directly relate to the expression of trust (through the direct choice of organisation) by volunteers and their unpaid participation through the donation of labour and time. Therefore, the correlations between this and the other clusters are of interest. By calculating the Spearman coefficient between the different questions with the Likert scale, one can understand whether there is a relationship between the various motivations of the volunteers.

Correlations between the different variables determining volunteering

The data in Table 2 examine the correlations between clusters 1 and 2. It is evident that in all cases, the relationship is significant. Still, the highest positive coefficient (.978) and closest to +1 is observed in the correlation between Q1.1 (...*a stated mission that defines its existence*) and Q2.5 (...*the transparency of the skills and time that the volunteer is expected to provide for free*). Volunteers who value a clear mission will likely seek out opportunities for meaningful involvement and want to know how their skills and time will be used. Transparency about expectations helps them to be confident that their participation will be effective and contribute to the overall goal. These two factors, in addition to being significantly correlated with each other, were also identified as the leading motivators for volunteers.

Table 2. Spearman's correlation coefficient between the results of questions from Q1 cluster & Q2 cluster

		Q1.1	Q1.2	Q1.3	Q1.4	Q1.5
Q2.1	Correlation Coefficient	.971**	.846**	.971**	.756**	.785**
	Sig. (2-tailed)	<.001	<.001	<.001	<.001	<.001
	N	422	422	422	422	422
Q2.2	Correlation Coefficient	.709**	.819**	.718**	.946**	.904**
	Sig. (2-tailed)	<.001	<.001	<.001	<.001	<.001
	N	422	422	422	422	422
Q2.3	Correlation Coefficient	.670**	.729**	.655**	.874**	.840**
	Sig. (2-tailed)	<.001	<.001	<.001	<.001	<.001
	N	422	422	422	422	422
Q2.4	Correlation Coefficient	.807**	.793**	.777**	.844**	.835**
	Sig. (2-tailed)	<.001	<.001	<.001	<.001	<.001
	N	422	422	422	422	422
Q2.5	Correlation Coefficient	.978**	.842**	.929**	.770**	.794**
	Sig. (2-tailed)	<.001	<.001	<.001	<.001	<.001
	N	422	422	422	422	422

*** Correlation is significant at the 0.01 level (2-tailed).*

Source: Authors' development

Strong correlations (.971) are observed between Q2.1 (...*to share the cause in the implementation of which you want to get involved*), on the one hand, and Q1.1 (...*a stated mission that defines its existence*) and Q1.3 (...*a transparently formulated cause, for the realisation of which it needs volunteer support*), on the other. Volunteers

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who want to share the cause (Q2.1) tend to choose organisations with a clear mission (Q1.1) and a transparently formulated cause (Q1.3). This shows that these three aspects are closely related and mutually supportive.

The results clearly indicate that it is essential for volunteers to understand and share the mission of the organisation they work for. They want to know that their contribution matters and that they are contributing to something bigger than themselves. In addition, volunteers seek opportunities for meaningful participation where they can use their skills and knowledge for a given cause. A clear mission and transparency of the organisation create a sense of purpose and direction, which is vital for the motivation of volunteers.

The weakest, although significant, relationship (.655) is between variables Q2.3 (*...to receive training in a field related to the tasks you are expected to perform*) and Q1.3 *(...a transparently formulated cause for the realisation of which it needs volunteer support*). Therefore, volunteers can be motivated by different factors, such as the desire for personal development (training) and the desire to contribute to a specific cause. In spite of the fact that these two motivations can coexist, they are not necessarily strongly related.

Table 3 presents the correlations between clusters 1 and 3. The most significant and positive (.937) is the relationship between Q1.5 (*...an established reputation in the community to which it belongs)* and Q3.1 (*...your support remains anonymous*). At first glance, it seems counterintuitive that volunteers who value the established reputation of the organisation would prefer their support to remain anonymous. Wouldn't volunteers want to contribute to the reputation of the respective volunteer organisation through their visible actions? Many scenarios are possible, given that these correlations do not allow for the discovery of a causal relationship.

For example, volunteers who choose organisations with an established reputation may be likely to have greater trust in institutions in general. This trust may make them comfortable even if their support remains anonymous. They believe that the organisation will use their contribution appropriately, regardless of whether they know their name or not. At the same time, a direct focus on the cause rather than on personal recognition is not excluded – for these volunteers, the cause itself is more important than personal recognition. They may engage in volunteering to contribute to something greater than themselves and not seek individual recognition, i.e. they do not mind remaining anonymous in their actions. In other cases, volunteers who choose organisations with an established reputation may fear social pressure or being associated with particular groups or ideas. Anonymity may provide them with a sense of security and allow them to engage in volunteering without fear of negative consequences. Therefore, it is essential to note that this relationship may also be influenced by a number of other factors not included in the survey. For example, cultural differences, personal values, and previous volunteering experiences may influence volunteers' preferences.

Table 3. Spearman's correlation coefficient between the results of questions from Q1 cluster & Q3cluster

		Q1.1	**Q1.2**	**Q1.3**	**Q1.4**	**Q1.5**
Q3.1	Correlation Coefficient	.832**	.900**	.851**	.929**	.937**
	Sig. (2-tailed)	<.001	<.001	<.001	<.001	<.001
	N	422	422	422	422	422
Q3.2	Correlation Coefficient	.931**	.823**	.928**	.757**	.778**
	Sig. (2-tailed)	<.001	<.001	<.001	<.001	<.001
	N	422	422	422	422	422
Q3.3	Correlation Coefficient	.835**	.894**	.882**	.747**	.793**
	Sig. (2-tailed)	<.001	<.001	<.001	<.001	<.001
	N	422	422	422	422	422
Q3.4	Correlation Coefficient	.638**	.716**	.619**	.844**	.830**
	Sig. (2-tailed)	<.001	<.001	<.001	<.001	<.001
	N	422	422	422	422	422
Q3.5	Correlation Coefficient	.745**	.764**	.717**	.838**	.824**
	Sig. (2-tailed)	<.001	<.001	<.001	<.001	<.001
	N	422	422	422	422	422

*** Correlation is significant at the 0.01 level (2-tailed).*

Source: Authors' development

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The weakest but still significant relationship (.619) is between Q1.3 (*...a transparently formulated cause, for the realisation of which it needs volunteer support*) and Q3.4 (*...to hear/read a non-personalised "Thank you"*). This means that although there is a relationship between the two, it is not very strong. Volunteers who value a precise formulation of the cause also value at least minimal recognition for their participation. The strength of the relationship may vary depending on the specific organisation and type of volunteering. For example, in organisations where volunteers have greater autonomy, they may attach greater importance to a clearly formulated cause than to formal recognition.

In addition, the weaker relationship between Q1.3 and Q3.4 indicates that despite the fact that volunteers value a precise formulation of the cause, they do not always expect formal recognition for their contribution. This means that organisations can use different strategies to motivate volunteers, such as providing development opportunities, creating a sense of community, and emphasising the impact of volunteering on society.

When comparing the last cluster (Table 4), the most significant correlation (.979) is found between Q1.4 (*...developed presence in various social networks*) and Q4.2 (*Possible social and professional contacts*). The finding of a strong positive correlation between them is interesting. This means that volunteers who believe that it is essential for the organisation to have active participation in social media are more likely to be motivated by the opportunity to create new social and professional contacts.

Social networks allow people to develop and maintain connections with other people who share their interests. Volunteers who are active on social media may be more likely to facilitate opportunities to create new contacts and expand their professional network. The results show that social media plays a vital role in attracting and engaging volunteers, although this response was found to be inconsistent (Table 1: Q1.4) with a standard deviation of 1.085. The organisation should invest in building a strong social media following and use these platforms to communicate with potential and current volunteers.

Significant, although with the lowest value (.732) in this group, is the correlation between Q1.1 (*...a stated mission that defines its existence*) and Q4.3 (*The experience you will get by getting involved in different causes*). The correlation between these two questions suggests that there is some connection between volunteers' desire to participate in organisations with a clear mission and their desire to gain experience through volunteering. Last but not least, some volunteers may prefer to focus on specific causes without necessarily seeking opportunities for personal development.

Table 4. Spearman's correlation coefficient between the results of questions from Q1 cluster & Q4 cluster

		Q1.1	**Q1.2**	**Q1.3**	**Q1.4**	**Q1.5**
Q4.1	Correlation Coefficient	.923**	.787**	.876**	.746**	.764**
	Sig. (2-tailed)	<.001	<.001	<.001	<.001	<.001
	N	422	422	422	422	422
Q4.2	Correlation Coefficient	.774**	.832**	.774**	.979**	.938**
	Sig. (2-tailed)	<.001	<.001	<.001	<.001	<.001
	N	422	422	422	422	422
Q4.3	Correlation Coefficient	.732**	.850**	.744**	.952**	.924**
	Sig. (2-tailed)	<.001	<.001	<.001	<.001	<.001
	N	422	422	422	422	422
Q4.4	Correlation Coefficient	.855**	.752**	.811**	.752**	.760**
	Sig. (2-tailed)	<.001	<.001	<.001	<.001	<.001
	N	422	422	422	422	422
Q4.5	Correlation Coefficient	.867**	.874**	.849**	.905**	.892**
	Sig. (2-tailed)	<.001	<.001	<.001	<.001	<.001
	N	422	422	422	422	422

*** Correlation is significant at the 0.01 level (2-tailed).*

Source: Authors' development

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Discussion

The findings in the present research regarding volunteer motivation are significantly supported by the above-cited research conducted by TimeHeroes (2023), which founds that:

- almost 80% of respondents indicated the desire to be beneficial to society as their primary motivation. The same option in the current research was supported by nearly 100% of the respondents;
- over 41% chose the opportunity to develop new skills and gain practical experience – an option supported by over 79% of respondents to the current survey;
- almost 37% mark the creation of valuable contacts and friendships, and in the current study, this option was supported to varying degrees by nearly 69% of respondents;
- slightly less than 13% indicated receiving recognition as their motivator. In the current research, this option also finds support – almost 7% of the volunteers involved in the study shared that they expect some public recognition for their participation in a particular cause.

The research gives a satisfactory answer to the first research question – *What are the attitudes, expectations, and motives of the Bulgarian volunteers to offer their skills, time, and energy for free?* The data from the survey conducted among the Bulgarian volunteer community determine the stated organisational mission and the clearly formulated need for help as the essential factors for choosing an NGO. Over 96% of volunteers marked both statements as significant. Concurrently, just over 97% of volunteers expect transparency regarding the skill and time they are expected to give for free, and over 94% primarily choose causes they share. In terms of recognition for their voluntary work, the survey shows that almost a quarter of respondents would prefer their participation to remain anonymous.

In spite of attesting to the altruistic motives of the respondents, the preservation of anonymity is also a potential obstacle to attracting new volunteers. Volunteerism and charity initiatives where good examples are visible are more contagious and effective, respectively. If such examples remain anonymous, the happening of good causes will be limited. Simultaneously, the research makes an interesting correlation – although an expectedly high proportion (97%) of volunteers do not want a material reward for their volunteering, 73% would like to receive feedback for their efforts in the form of a non-personalised thank you. In terms of motives, just under 99% of the respondents indicated their desire to be helpful with their skills and experience as the leading motive for volunteering. The same proportion of respondents chose the potential satisfaction of being part of meaningful change as a reason for involvement.

Answer to the second research question – *What strategies can organisations develop to encourage volunteerism and attract more like-minded people to their causes?* Albeit indirectly, it can also be found in the volunteers' responses. First, organisations whose activities require volunteering should know the volunteers' motives. They also need to be aware of the reasons for choosing an organisation and a cause. Meanwhile, the non-governmental organisations in Bulgaria often underestimate transparency in terms of elements such as vision, mission, and values. In parallel, the survey shows that they are vital to the volunteers. Therefore, a successful volunteer recruitment strategy can be defined as clearly articulating the why, what and how from the perspective of the non-profit organisation.

The closeness of the results of the two independent surveys – the current one and the one conducted by the TimeHeroes organisation in 2023 – clarifies and confirms the volunteers' main motives, attitudes, and expectations. That will significantly improve work with volunteers. Knowing the main drivers of voluntary giving of time, labour, and energy would help to develop and enhance specific measures to encourage and support volunteering among citizens and companies.

Such measures, according to TimeHeroes report (2023), could be planned additional paid leave for volunteers participating in actions during crises; the provision of conditions for familiarising pupils and students with the

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activities of organisations that organise volunteer activities; the possibility of recognise a period of volunteering for social security experience; tax breaks for employers that enable workers to take additional paid leave for volunteering; preferential conditions for insurance of volunteers, etc. The significance of the proposed measures is the choice of the volunteer respondents themselves in the study, which emphasises their importance for such a socially engaged citizen group of our society. That also emphasises the need to develop an effective policy to promote civic and corporate volunteering if our country is really aiming for social and sustainable transformation.

As it became clear, a share of volunteers preferred to keep their participation in various volunteer initiatives in anonymity. In this sense, civil organisations should invest resources and study the motives for such behaviour since anonymity prevents the dissemination of good examples and, hence, the scale of the consequences of voluntary actions. Only knowing the motivations of volunteers, both in terms of their involvement in causes and in relation to their desire to remain anonymous, would allow the formulation and construction of clear strategies for attracting and retaining volunteers.

The problem of trust, covered in the literature review, is a significant reason for actively introducing volunteering storytelling or sharing volunteers' experiences in NGO practices. The 2023 data shows that NGOs are clearly aware that between 2017 and 2023, distrust and lack of support for the civil sector by citizens and their communities, fueled by an adverse media environment, is growing, albeit slightly. This fact indicates the need for NGOs to communicate more actively and effectively with citizens and the media. In general, civil organisations share that they enjoy a relatively low degree of trust from various public institutions and communities, except European institutions (Zahariev & Yordanov, 2023). Some organisations tend to attribute the generated distrust towards their activities to deliberate efforts to discredit them, as their causes affect policies and personal interests that have influence (Zahariev & Yordanov, 2023). This distrust is reflected in weak support and difficulty, bordering on impossibility, in attracting volunteers for various causes.

In summary, the present study demonstrates that volunteers need to be understood and motivated in a way they would want to continue giving their energy. The summaries of the current research outline essential aspects of voluntary self-initiative, such as a clearly formulated mission and cause, transparency regarding donated time and labour, training, etc. The data presented fully confirm Peter Drucker's statement, cited by Philip Kotler (Andreasen & Kotler, 2003), that volunteers require three things: *a clear mission of the organisation, training* and *personal responsibility*. An important finding is that despite their gratuitous actions, volunteers expect at least a thank you as feedback. That suggests they wish to receive a sign that their efforts have been appreciated. It is a vital motivator for their involvement in future causes.

The conducted study fully confirms the understanding that organisations' limited knowledge about the motivation of volunteers and the discrepancy between their goals and the motivation of volunteers leads to misunderstandings between these two critical subjects of the social economy. There is no doubt that volunteers are primarily motivated by the desire to contribute to society and satisfy specific social needs. The current analysis contributes with the understanding that the decision for volunteer proactivity is due to at least two factors: first, this prosociality has primarily an *internal locus* and is little influenced by the opinions of loved ones, relatives, and friends, and second – it is directly influenced by *transparency* as a phenomenon: transparency in actions, the stated mission and cause, transparency in results and expectations on the part of those employed in volunteer organisations, transparency as a way of communication. Therefore, the essence of the problem of distrust and low volunteer activity is not necessarily a problem of missing volunteer motivation. Perhaps the problem with trust in organisations from the NGO sector in Bulgaria is due to their underestimated or neglected transparency towards people who altruistically give their time and energy to a given cause.

Therefore, the problem with low levels of volunteering is not necessarily to be found only in the motivation of the volunteers themselves but in the attitude of volunteer organisations towards them. Are they not treated and controlled as ordinary employees due to a lack of knowledge in the field of *volunteer human resources*

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management? Are volunteer organisations not crossing the line of volunteer labour and energy by unintentionally or intentionally categorising volunteers as their employees and demanding from them a complete dedication to an organisational cause, but without considering their values and motives? Such assumptions should not be taken as an accusation against volunteer organisations. The latter are most likely doing their best given the available knowledge, resources and the environment around them. However, it is a fact that they fail to fully attract the trust of both the general public and the volunteers. In this sense, the new questions formulated here signal that the volunteering process is at least two-sided – a volunteer body and a volunteer. When looking for the reason for the low volunteer activity, it should be sought in each of the directly interested parties.

Limitations and Future Research

The research was conducted among a limited (geographical) sample of volunteers from Bulgaria. Results may not be representative of the wider volunteer population. The research method used (surveys) may be limited in its ability to capture the nuances of volunteer motivation. Therefore, factors that have not been taken into account and that actually predetermine the attitudes and motivation of the volunteers, such as personal values, social norms, and cultural contexts, may exist. The authors aim to conduct more in-depth research on volunteer motivation using different methods, such as interviews and focus groups. Subsequent studies will attempt to identify and include the mentioned limiting factors since their recognition may prove to be key to the attraction and retention of volunteers and the achievement of a more socially responsible society.

In addition, the authors of this study identify a new gap in the existing knowledge – management of voluntary organisations (NGOs, civil associations, etc.) and volunteer human resources, which are undoubtedly different from traditional ones. Suppose society as a whole wants the social economy to surpass theoretical paradigms and become a real, socially responsible, sustainable present. In that case, more detailed attention should be paid to each of its aspects, including the management of the voluntary organisations and volunteers. Future studies by the authors may focus on these aspects.

Theoretical and practical implications

The results of the study can be used to improve the theory of volunteer motivation as well as social economics and related educational disciplines. Newly acquired knowledge can be applied in theory and practice to develop more effective and transparent strategies for recruiting and retaining volunteers, including marketing strategies to communicate the values and goals of the respective organisation, attract the right audiences and help achieve the socially oriented cause. In this sense, the study enriches motivational theory and social economy theory.
Furthermore, the results of the research will be made available to non-governmental and other organisations that work with volunteers. That would allow them to develop more effective programs and activities, and the strategies for motivating volunteers identified based on the results can be applied in different contexts. In this sense, it is essential to note that volunteer motivation is complex and influenced by various factors, and organisations that work with volunteers must adapt to the individual needs and motivations of their volunteers. The current research sets the direction in which successful collaboration can happen in practice.

Conclusions

The current research outlines the phenomenon of volunteering from the point of view of the attitudes, expectations and motives of those directly employed in this sector – the volunteers themselves. The analysis of the answers shows that the most significant factor in choosing an organisation is the clearly formulated mission. It is followed by the transparently defined cause, team and reputation of the organisation. Developed social networks are positioned last, but this does not mean they are unimportant. That gives reason to conclude that organisations that focus on clearly articulating their values, goals and team will have a better chance of attracting volunteer support.

Seeking an answer to the question, *"What are the attitudes, expectations, and motives of Bulgarian volunteers to offer their skills, time, and energy for free?"* the study reveals that Bulgarian volunteers are strongly motivated by the desire to contribute to meaningful causes and to use their skills for society. A clear mission of the organisation and transparency in communication are key factors influencing volunteers' decision to get involved in a given initiative. Despite the fact that volunteers value recognition for their work, they are more motivated by internal factors, such as the desire for personal development and a sense of belonging to the community. This finding has important implications for organisations that work with volunteers. In addition, it allows for the formulation of insights regarding the second research question – *What strategies can organisations develop to encourage volunteerism and attract more like-minded people to their causes?* The conducted descriptive statistical analysis, as well as the identified statistically significant correlations between various variables, show that to attract and retain volunteers, organisations must focus on creating a clear and inspiring mission, ensure transparent communication, and create an environment where volunteers feel valued and appreciated.

Moreover, the analysis of the results shows that the most critical factors for volunteers are: *1) Shared cause:* volunteers are motivated by the desire to contribute to something they believe in; respectively, they look for organisations whose values and goals correspond to their own; *2) Transparency:* volunteers appreciate organisations that are transparent about their mission and cause and want to know what is expected of them as tasks, time and resources required for volunteering; *3) Training:* volunteers want to feel confident and competent in their tasks and often choose organisations that offer training and support.

The study shows that volunteer motivation is strongly linked to their desire to contribute to a specific cause and to receive clear information about that cause. Unlike previous studies focusing on extrinsic motivators, such as social recognition, our study emphasises the importance of intrinsic motivation related to the meaning and purpose of volunteering. Furthermore, we found that the lack of a relationship between volunteers' motivation and the opinions of their loved ones indicates that volunteering is a highly individual decision that is not significantly influenced by social pressure.

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GOVERNANCE FOR WELL-BEING: FOSTERING MEANINGFUL AND MINDFUL LIVING IN POLITICAL PHILOSOPHY

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Abstract. This research investigates philosophical and mindful visions of political governance, sustainable development, and well-being. It explores how nations and their policies can enhance individual and community well-being while remaining sociologically, environmentally, and economically sustainable. Using case studies of Bhutan's Gross National Happiness (GNH) and Scandinavian welfare states, the paper demonstrates governance models prioritising social justice, environmental protection, and economic goals. The study integrates the philosophical ideas of Amartya Sen, who emphasises the expansion of individual capabilities; John Rawls, who advocates for justice as fairness; and Michel Foucault, who critiques power structures that shape societal norms. The research builds on existing frameworks linking sustainable development and governance, offering recommendations for orienting governance toward equity, justice, and ethical responsibility.

Keywords: political philosophy; mindful living; meaningful life; governance models; social justice; welfare state

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1. Introduction

Meaningful and mindful life has been an idea that has intrigued various scholars, not only in philosophy but in psychology and political science as well. Searching for meaning in life is generally considered a private issue; however, its political aspects are vital and relatively unexplored. The politics, including the forms of government, the prevalent culture, and the state's agenda, provide the basis for individuals and society to articulate what it takes to have a meaningful and mindful life. In this case, we propose a study on the nexus between meaning and mindfulness with politics to reveal the relationship between an individual's well-being and the political ideologies and practices that facilitate or inhibit it.

In the past few decades, research interest in well-being has grown due to the emergence of justice theories, public policy improvements, and the sociopolitical critique of neoliberalism. For instance, Amartya Sen capability approach recognises the importance of governance in widening peoples' options to achieve desirable outcomes in life (Sen, 1999). Similarly, John Rawls' theory of justice focuses on fairness and equality in establishing conditions necessary for societies where people can flourish (Rawls, 1971). The sad thing is that these frameworks primarily concern the adequacy of material resources and social justice and so do not attend sufficiently to other centres of human agency, such as mindfulness and meaning. This research brings existential

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philosophy, political theory and the analysis of the current policy into a coherent set to determine how political systems can create proper conditions for a mindful and meaningful life.

A qualitative analysis is done on whether governance models such as capitalism have a different effect on one being politically active and if surveillance capitalism limits the person from thinking deeply. This is then matched with how 'meaning' is defined concerning politics and ethics and what the structures of political institutions can do to limit this integration of ethics and the sense of self. As a result, mindful living and its necessity are defined with respect to a self-analysis of society. The study emphasises the works of Hannah Arendt, who explored the human condition and the nature of public life; Thich Nhat Hanh, who advocates for mindfulness and engaged ethics rooted in Buddhist philosophy; and Michel Foucault, who critiques how power and surveillance shape societal norms and individual autonomy. Multi-disciplinary perspectives are blended with a broad understanding of what living a meaning-filled life encompasses, which is the overall aim of the research. This study allows for thoroughly exploring the topic's theory and practice.

Considering global challenges resulting from climate change, economic inequality or political polarisation, it becomes crucial to study the interplay between practices for meaningful living and the nature of political systems. Its significance comes from filling in an existing gap in the literature. In particular, mindfulness and meaning from a psychological and philosophical point of view have attracted significant attention, but their political aspects are still underdeveloped. This study, therefore, adds to the increasing body of work on governance and well-being by offering a comprehensive approach that seeks to elevate the individual within the context of political action aimed at changing society for the better.

The life that has meaning, as well as the life that is lived with intention, is one in which the focus is on the people and acknowledges ethical responsibility in the broad sense of self-actualisation. There is quite some time that sounds of existentialist philosophers like Søren Kierkegaard and Albert Camus have stressed the human search towards meaning in a perplexing and uncertain surrounding (Camus, 1942/1991). Similarly, the recent forms of mindfulness practices based on Buddhist philosophy advocate such practices as being fully present, aware, and loving-kind as a means to a good life (Hanh, 1987). Yet, such views do not account for the political environments in which people express this meaning and engage with mindfulness. This is the gap in political sociology this research seeks to fill by showing that political structures, rather than being neutral settings, are active in either facilitating or stifling the attempts to pursue a meaningful and mindful life.

The political aspect of living with purpose and living with an intention is particularly important in the understanding of neoliberalism which has been critiqued for placing too much emphasis on individualism and market goals and not enough on society as a whole (Brown, 2015), for example Sheila Zuboff (2019) analysis of surveillance capitalism explains the commodification of personal experiences through the utilisation of various technologies that tend to objectify individuals. Furthermore, David Harvey (2005) and Wiley Brown (2015) believe that neoliberalism as a system of governance puts a greater focus on economic efficiency and consumerism at the expense of alienation through decreased individualism and lack of integration. Considering the critiques mentioned above, this research examines the nexus between the economy and politics and how each system alters the ability of people to search for meaning and be present in their existence.

Apart from its theoretical contributions, this research has policy and governance implications. There are three interrelated areas: the potential of political institutions to facilitate holistic and purposeful living through social justice, governance participation, and ecosystem sustainability. This includes the form of well-being policies, which include mental well-being, community, and environmental policies. A clear example is Bhutan, which, with others, has created the Gross National Happiness Index to measure social policies and related factors, and it demonstrates that it is possible to rethink economic growth orientation in the context of more innovative' models' aimed at promoting happiness and well-being-oriented policies (OPHI, n.d). Quite in the same manner, reading the Scandinavian welfare states through the same lenses of equality and balance between social assistance, work and living excites the mind to rethink the place of governance in our lives.

As this research locates the quest for meaning and mindfulness at the local or political level, it adds to understanding the relationship between individual life and global well-being phenomena. The analysis gives

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insights to policymakers, educators, and even activists on conducting fairer and kinder societies. More importantly, the research demonstrates the necessity of developing governance frameworks that combine economic necessities with ethical responsibilities and aid in creating contexts so that people live, deliberate, and make meaning in life.

To sum up, the quest for a meaningful life full of thoughts and actions is not an individual goal but one intended to challenge the system of politics. The following study seeks to highlight the various aspects of political structures, ideology, and policies that determine the environments that enhance the possibilities for success individually and collectively. Integrating Political Philosophy, Mindfulness Research and Policy Understanding, this study introduced an interesting model for analysing the political aspects of well-being within the US. This study does so in the last section of this document by augmenting the attempts to make societies fairer, more just and more kind. With polymorphic intersecting contemporary issues, tackling the challenges that target society is of utmost importance, making seeking purpose and focus vital in modern political science.

2. Methodology

This investigative work uses a case study approach to qualitatively analyse the complex dynamics of governance and well-being. The study aims to disentangle the intricacies of living an intentional life in its three core settings of culture, politics and society and integrate advanced hermeneutic analysis. Critical discourse analysis of media focus in relation to the subject of the study brings a complex political dimension through a qualitative lens by focusing on the broader implications of the relations as social and cultural phenomena. Ultimately, the research combines a delicate interplay of theoretical and practical aspects on such a multidimensional topic.

A key philosophy in this research that enables the analysis of specific philosophical and political texts concerned with meaningful and mindful living is hermeneutics. As Gadamer (1975) noted, hermeneutics is heavily influenced by the works of Paul Ricoeur and Hans-Georg Gadamer, who stress the need to comprehend the intention and context in which a text was written. This is an essential approach in working with primary texts, John Rawls' A Theory of Justice (1971), Amartya Sen's Development as Freedom (1999), and the writings of Thich Nhat Hanh on mindfulness (1987), for example. The research scrupulously seeks an understanding of one of the key concepts and rationale for policies that promote holistic well-being through these texts. Furthermore, the hermeneutic approach enables an examination of how these forms of mindfulness and meaning in governance are influenced and understood within their historical and cultural situational contexts.

The case study approach is utilised to interpret the instances where governance frameworks have successfully applied principles of mindfulness and meaning. Case studies allow a thorough understanding of context and time during complex state changes (Yin, 2018). This research looks at two such employment cases. Bhutan's Gross National Happiness (GNH) Index and the Scandinavian welfare models are also used. These three cases were chosen because they exemplify policies that promote social welfare over economic development. The GNH involved analysis that looked at psychological well-being and cultural and environmental factors, while Scandinavian models considered social, ecological, and economic factors in their policies and strategies. The research makes suggestions and assessments that allow one to extrapolate the nature and conditions needed to move towards governance, which encourages mindfulness and meaning in assisted living.

Critical discourse analysis (CDA) is another methodological aspect that assists in tackling language use, power relations, and ideology within policies and modes of governance. CDA, in particular, drawn from scholars such as Norman Fairclough and Teun A. van Dijk, explores the interplay between discursive practices and the construction of social power relations (van Dijk, 1993; Fairclough, 1995). This method is used to examine policy documents, political events, speeches, and communications within the scope of the case studies. For instance, GNH surveys in Bhutan or Scandinavian policy statements are taken to see what these systems say officially about well-being and the use of mind. CDA also facilitates counter-discourse against particular governance models, such as neoliberal or authoritarian. The study seeks to fill this gap by focusing on intersectionality and gendered roles central to governance practices.

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The nature of the research questions leads to the justification of qualitative methodology, which aims to explore conceptual abstractions and their application in the real world. Quantitative approaches also have their strengths, for instance, in measuring GDP or happiness indices. Still, they fail to address life's more extensive cultural and philosophical aspects meaningfully and appropriately. Qualitative techniques assist in understanding how a political system and policies impact people and enable us to consider multiple realities simultaneously.

This cross-sectional research also makes a case for the dominance of qualitative methods. It uses political philosophy, sociology, and mindfulness studies and crosses disciplinary boundaries to address a complex problem. For example, the hermeneutic approach to analysing literature papers complements the empirical data retrieved through the case studies, and vice versa; critical discourse analysis aids in placing the concepts in the theoretical part of the study and the practical governance outcomes. Such integrative strategies ensure the research encompasses the study's unreal and concrete aspects.

To compile the case studies, the research relies on policy papers, scholarly work, and trusted organisations' reports in addition to the case studies as primary and secondary materials. Case studies for GNH Index in Bhutan utilised framework analysis of Ura et al. (2012) and the Centre for Bhutan Studies and GNH Research reports. Policy publications, World Happiness Reports, and comparative studies provide the data in support of the analysis of Scandinavian welfare models (Helliwell et al., 2022). Interrelationships between several elements concerning these processes are established to ensure the triangulation of findings, enhancing the validity and reliability of the claims made by these studies.

In this case, the qualitative approach and methodology rely on an iterative and reflexive process where repetitive data analysis is required to derive the requisite themes and patterns through coding. Different governance frameworks pluralised the meaning of concepts like justice, equity, mindfulness, and meaning through a hermeneutic approach to analyse the implementation and outcomes of said frameworks. Policy discourses framing well-being in linguistics and ideologies were used in critical discourses illustrating the politics and values within those frameworks.

Apart from the respect owed to cultural aspects in representing one's historical context, ethical considerations are part of the research design in the view of many scholars. For instance, Buddhism and the GNH of Bhutan can be analysed from a Buddhist-centered perspective and evaluated for their use in other cultures. Similarly, the Scandinavian welfare systems have been scrutinised in the context of the socio-political environment that gave them their rise. Such critiques, including anti-typical examples like neoliberal and authoritarian rule, enable a more comprehensive approach to the discussed topics.

Overall, the political articulations that pertain to the very concept of meaningful and mindful existence can be explained using qualitative methodology. Many methods are used, including hermeneutics, case study methodology, and critical discourse, as part of the discussion concept, all of which are equally essential. These methods are all-encompassing and, therefore, applicable for practitioners and theorists as they intersect with policy, governing, and human factors, thus ensuring the messiness within the context is understood.

3. Literature Review and Theoretical Framework

The politics of life is a growing body of literature that expands through explanations in several areas, such as philosophy, psychology, sociology, and political science. Political systems and ideologies construct the principles that aid individuals and societies to lead meaningful and mindful lives. This chapter provides a comprehensive overview of the relevant literature. It provides a model that seeks to bring together political philosophy, the politics of mindfulness and the politics of contemporary government.

Existential life, meaning, purpose, and even absurdism have been central to existentialism—Soren Kierkegaard and Albert Camus, for example, have emphasised the idea of searching for life's meaning and also crafting, creating and sculpting existence and finding one's unique purposes and actions (Camus, 1942/1991; Kierkegaard, 1843/1989). Kierkegaard focuses on individual decision-making and accountability for shaping a meaningful life. At the same time, Camus maintains that searching for meaning can only be possible if one first

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deals with the sense of absurdity that humankind faces. Therefore, both thinkers considered the search for meaning primarily independent but still emphasised the role of social setting. In the same way, Frankl asserts that political oppression or regimes of terror are a way of external conditioning—so his research of logotherapy presents that meaning is the product of the individual's reactions to those conditions (Frankl, 1959). Such existential views enable us to appreciate this essential human trait of searching for meaning. Still, life pursuits, most importantly, lack insight into the structural dynamics that put boundaries on or promote such activities.

Within political philosophy, the framework established by John Rawls in his Theory of Justice presents an intricate understanding of how political orders construct solutions for a life worth living. According to Rawls (1971), an actual society guarantees a fair opportunity to be provided with the primary goods everyone needs to fulfil their vision of a good life. While persistent on distributive justice, Rawls' focus on equal chances does differ regarding what he wanted to achieve, which was the development of conditions that would allow people and societies to thrive. Parallel to these ideas, Amartya Sen built on them with what is referred to as the capability approach, fundamentally shifting the governance/policy focus to players' freedoms to achieve desirable ends (Sen, 1999). Examples that fall under Sen's perspective encompass the crucial personal and political life pillars, exposing the political relevance of better lives and living consciously.

Recently, however, the interest in mindfulness, both as an idea and a practice, has surged, particularly in psychology and health science. It originated from Buddhist appropriation and includes fostering presence, awareness and compassion (Hanh, 1987). When looking at the work of Thich Nhat Hanh in engaged Buddhism, which advocates for political and social action in mindfulness, one can see that there is a strong basis for concepts such as social equity and social balance (Hanh, 1987). Nowadays, mindfulness is often implemented as part of "treatment" in secular settings, where the main goal is to improve an individual's mental state or even their productivity. On the other hand, David Forbes (2019) criticises the same trend, noting how neoliberal culture managers could use mindfulness for commercial purposes within their systems. In this sense, it matters much more to place mindfulness in any social and political context so it treats systemic injustice and fosters actual well-being.

The connection between governance and mindfulness is pushing the boundaries of critical theories, with Herbert Marcuse's criticism of developed industrial society exposing the existence of consumerism and technological conquest that tends to blunt a person's critical consciousness and distance him from an active life (Marcuse, 1964). Likewise, Wendy Brown (2015) contends that the neoliberal focus on market value systems disintegrates democratic participation and merely turns people into consumers, thereby limiting their exercise of mindfulness and meaning. Such critiques reinforce the realisation that it is essential to think about how political beliefs and economic structures interact with and restrict the abilities of individuals to practice mindfulness and find meaning in their lives.

According to Shoshana Zuboff (2019), surveillance capitalism is a relatively recent approach in which people do not live meaningfully and mindfully. Zuboff maintains that personal data, now translated into products by digital platforms, kills autonomy and authenticity, which are fundamental and essential to meaningful existence. As such, surveillance technologies constitute not only boundaries on privacy and trespasses but also influence and control people's actions for profit-oriented goals. These are the aspects of Foucault's study on disciplinary power, which deals with the intersection of surveillance-associated activity and control of individuals' ideas and thoughts (Foucault, 1977). Biopolitics put forward by Foucault emphasises how else political power functions-the regulation of life itself and, therefore, beautiful questions emerge about political systems of governance and their ethics with respect to mindfulness and meaningful living.

Political movements related to climate change, social justice and participatory democracy, in particular, show how necessary and worthwhile democracy can be for humanity and the world. Their critiques suggest that present-day governance structures bear specific challenges, but at the same time, they provide room to increase possibilities for transformative action. Advocacy for a well-being economy, through the grassroots movements in defence of people and the planet, as Klein (2014) subscribes to, is also a paradigm shift from the neoliberal one. Naess (1989), for example, argues that ecological mindfulness, informed by deep ecological and other indigenous knowledge systems, captures the meaning of the convergence of the individual, social and

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environmental aspects of well-being. There are impulses underlying these ideas which assert that the problem cannot and should not be solved by everyone on their own, but, in addition, requires a profound change in the politics and economics of the society.

The research model incorporates existential philosophy, political theory, studies on mindfulness and critical theory. It starts with the assumption that a meaningful and mindful life is an individual and a sociocultural project, which is an outcome of the individual's will and structural conditions. It is stated that life makes sense when a person implements his/her plans and becomes responsible for his/her actions. Such engagement in the world is meaning creative. The framework further incorporates political science and economics engaged with wellness concepts, including distributional justice provided by Rawls and monetary concepts on the capabilities approach advanced by Sen.

Mindfulness is conceptualised as a social and political ethic, not just as an individual engagement. Thich Nhat Hanh's engaged Buddhism offers a paradigm for understanding governance and collective action through mindfulness. This paradigm is also informed by critical perspectives that question the social structures inhibiting a purposeful and thoughtful existence, such as neoliberalism, consumerism and surveillance capitalism. Such structural factors constrain what would be considered eco-ethical or praxis eco-mindfulness, which respects the need for practices that will unify individual and collective interests and care for the environment.

In methodological terms, the framework combines the hermeneutic analysis of philosophical texts with the critical discourse analysis of policy frameworks. This makes it possible to delve deeper into the theoretical and practical aspects of the issue. For instance, engaging with the primary texts of Rawls, Sen, and Foucault helps understand the central tenets of a meaningful and mindful life, whereas looking at the case studies of Bhutan's Gross National Happiness Index and Scandinavian welfare models illustrates practical solutions.

The literature review and the theoretical framework discuss the promotion of a just, caring and rational lifestyle in a political context and from an ethical stance. For example, the ethic of autonomy, equity and justice can pose complex challenges, especially concerning the empowerment of marginalised groups. In practical terms, they relate to the formulation and execution of evidence-based policies that are protective of human mental health, socially cohesive, and environmentally friendly. The general objective of integrating these components is to provide a framework for understanding the political aspects of meaningful and mindful living practice at theoretical and operational levels.

To conclude, the existing body of work on meaningful and mindful living accentuates the profound relationship between choosing an individual and the structures in which one is situated. Elements of existential philosophy, political theory, mindfulness, critical theory, and other disciplines bring various dimensions to the subject. To that end, the theoretical framework elaborated in this research aims to give ideas on how political aspects of rational living can be operationalised, and such an understanding can be used to map how types of governance and policy priorities relate to each other. This perspective not only deepens but also provides pragmatic routes towards building more flourishing and blossoming societies.

4. Political Ideologies and their Influence on Meaningful Living

Political doctrines or ideologies are central structures with which societies are configured, resource allocation occurs, and values are expressed. This means that they not only govern relations between a population and the ruling authority but also determine the nature of any endeavour that is fulfilment worthy of societies and individuals. Among other ideologies, Liberalism, Socialism, and Anarchism are the three key political doctrines with varied answers to the question that focuses on a fulfilling life. Each of these would portray a graphic of a life that emphasises the goal of self-governance, social solidarity and the state's defined role in enabling and limiting these objectives. Besides, postmodern questioning of fiction of total or universal histories makes possible only one of the critiques of the homogeneity of all these ideologies, challenging the pluralities of meaning and the consequences of collective intelligence in the first order.

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Liberalism encourages people to be personally accountable and, as a result, believe in individual freedoms and the protection of rights. These ideals stem from Immanuel Kant, John Stuart and John Locke, who, in a way, helped build a framework for Liberalism that explains how life can have meaning through choices made by individuals (Locke, 1689/1988; Kant, 1785/1997; Mill, 1859/1975) It focuses on creating a legal system that is fair and can able to offer its citizens protection of their life, ownership, liberty, and everything else. Everyone within society is allowed to strive for whatever they see as success. On the other hand, Liberalism has been criticised due to its structural inequalities and causing collectivism to be challenging to achieve. Rawls suggests in his Theory that Liberalism needs to be more encompassing and understand that society comprises people with differing limitations and starting points which restrict their freedom (Rawls, 1971). As a similar point, alongside other scholars, Brown states that neoliberalism damages the strong community feeling people yearn for and replaces it with isolation in the name of greater market independence.

Instead of focusing on the well-being of society, Socialism focuses on the redistribution of resources. Karl Marx and Friedrich Engels appreciated Liberalism; however, they acknowledged that there is a fundamental flaw: true freedom and significance can only be realised by critiquing the social framework in terms of social and economic equity, i.e., true freedom can only be within a collective society (Marx & Engels, 1848/1978). The socialist regime imagines a society wherein resources are pooled to cater to individuals' needs, and they can form lasting integral bonds and perform significant labour. Such an ideology understands how essential living is always a matter of interdependence, inter-embeddedness, and mutual aid. For instance, the idea of alienation in Marxism illustrates how, in capitalist production, people are detached from their work, society, and even their sense of self from everything (Marx, 1867/1990). Socialism, with its focus on the group, is consistent with a concern for the environment and anti-consumerism, as it seeks to promote sustainable development and fairness in the distribution of resources. Nonetheless, there have been concerns raised that socialist regimes tend to limit individual freedom and encourage standardisation, which leads to the dilemma of personal liberty versus a sense of collective purpose (Berlin, 1969).

Anarchism is not only a criticism of the state but also a critique of Socialism and Liberalism, as it promotes the construction of self-managed egalitarian communities while abolishing hierarchical structures. It has been pointed out by Kropotkin (1902/1995), Goldman (1917/1969), and Bookchin (1982) that the potential for us to live meaningfully emerges from cooperative decentralised social structures. The Marxist ideology defines the state as an apparatus of coercion and further argues that such institutions are detrimental to self-expression and self-autonomy. Instead, it advocates for societies built on volunteerism, mutual aid, and direct democracy. When framed from an Anarchist perspective, meaningful living integrates the system of oppression and the dismantling of spaces with genuine human creativity. Anarchism can also be popularly defined through the lens of autonomy, which resonates with the notions of democracy, compassion, and community; however, through the socialist and Marxist lens, it is different. Many critics, for instance, Graeber (2004), have stated that Anarchism is inefficient and cannot resolve modern complexities as it lacks an authoritative structure that can provide order.

Postmodern critiques of grand narratives weaken these ideological structures, as they refute their universality claims and their objective stance on truth. As Jean-Francois Lyotard and Michel Foucault presented, Postmodernism rejects the claim that a single ideology encompasses all human meaning and social order (Lyotard, 1979/1984; Foucault, 1977). Instead, it conveys the multiplicity of interpretations and the contextual nature of meanings. Lyotard's formulation of the 'incredulity toward metanarratives' emphasises the importance of valuing various narratives and meeting the control of broader narratives (Lyotard, 1979/1984). Foucault's work on power complements this position by discussing how major discourses govern social knowledge and subjectivity and considers how viable social orders are - who and for what purpose orders people's lives (Foucault, 1977). These critiques resonate with mindfulness practice that calls for non-attachment to definitive identities and impermanence.

Postmodernism has a considerable impact on the practice of collective mindfulness and awareness. Postmodernism fails to provide a coherent centre in its worldview precisely because it is anti-liberalism, anti-socialism, and even anti-anarchism. Asserting the need for aspiring for a more considerate and pluralistic notion of voluntary meaning-making, Postmodernism holds this perspective to coincide with the present ideals of

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intersectionality, decolonisation and ecological justice. For instance, knowledge held by Indigenous groups contributes to understanding what it means to live a good life in terms of interconnectedness, reciprocity, and balance with nature (Smith, 1999). Such constructs counter those held by dominant paradigms and beliefs, which tend towards a human-centred and self-centred view of reality and life, illustrating an example of how life and governance could be better understood.

However, as some might say, Postmodernism also denies universal human values, allowing the problem of collective mindfulness to cohere. All this postmodern affirmative action leads to a breakdown and, by extension, a loss of purpose in communities it was supposed to strengthen. There are at least two positions on the matter, and for instance, postmodernists' detractors, Jürgen Habermas, have lamented that such an attitude precludes meaningful conversation and joint action (Habermas, 1981/1984). In these terms, however, the aim of ensuring such a balance between being mindful of giving recognition to difference and being conscious of promoting oneness is essential.

Liberalism– social democracy, and Anarchism offer ways in which an individual can live meaningfully; each approaches the concept of self and others in society differently, as well as the capacity of government. Postmodern critiques target these by valuing the multiplicity of meaning and the contextuality of truth, thus prompting us to consider what this entails for the collective consciousness. This is why, by incorporating these viewpoints, this study also attempts to elucidate the political aspects of meaningful and conscious living and the necessity for non-exclusionary and reconstructive governance and well-being policies.

5. Results: Policy Frameworks and Case Studies on Collective Well-being and Mindfulness

Bringing the concepts of mindfulness and meaning to political systems is both old and not purely theoretical. Past and modern policy examples show how countries and communities can foster the welfare of the people. This part studies one such system, namely the Gross National Happiness Index of Bhutan and Scandinavian welfare systems, to analyse how they implemented these concepts within their governing systems. These case studies help to demonstrate the benefits of prioritising policy goals to achieve such important goals as well-being.

The Gross National Happiness (GNH) Index, which is unique to Bhutan, seeks to, as a GNH advocate would eloquently put it, Buccaneers the paradigm of prioritising high economic growth as its most amoral pursuit rather than emphasising the civilisational milestones such as prosperity. Informed by the Buddhist Philosophy, King Jigme Singye Wangchuck discerned a necessity in the 1970s to deviate from the Gross Domestic Product (GDP), which accounts solely for economic output neglecting the social, cultural, environmental well-being among others (Ura et al., 2012). GNH incorporates nine chapters: psychological well-being, health, education, time use, cultural diversity, good governance, community vitality, ecological diversity and living standards. These domains promote a holistic conception of development that goes beyond the material to spiritual and social development. The principles are operationalised through policy frameworks like regular surveys incorporating GNH, which aim to measure citizens' happiness and guide a policy course (Ura et al., 2012).

The purpose of King Jigme Singye Wangchuk GNH governance is to further insight into how Bhutan has achieved significant positive structural transformation in governance and policy-making and the ability to institutionalise mindfulness and meaning within the governance structures. For instance, the education policies of Bhutan stress values-oriented education where ethical learning and mindful practices are infused into the curriculum of schools (Thinley, 2007). Likewise, the government's environmental policies support ecological mindfulness by ensuring a minimum of 60% of the land will be vegetated by trees and encouraging ecotourism to limit environmental damage (Rinzin et al., 2007). These policies show how the principles of GNH are operationalised in practice, such as promoting environmental protection, cultural protection and social integration.

On the other hand, the GNH framework in Bhutan also has challenges. One of the contentions would be that overemphasis on the cultural dimension sometimes discriminates against minority sections of the country, which creates issues around equity and inclusivity (Pellegrini & Tasciotti, 2014). Moreover, the heavy dependence on

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hydropower exports as the country's major economic activity also negatively impacts its long-term economic viability. Nevertheless, GNH is still well known worldwide as the 'Buddhist way of governance', combining mindfulness and meaning for all governance, and it is replicated in other countries as well.

Scandinavian welfare states offer another compelling example of governance systems that embed mindfulness and meaning. Blocks such as Denmark, Norway and Sweden are ranked among the happiest countries in the world because they place importance on social justice, the welfare of society and a balance between work and family (Helliwell et al., 2012). Some indicators of Scandinavian welfare society include social consumption, which covers education, healthcare, social security, and parental leave, among other things. These measures illustrate how people can participate in society as they have the means to live a fulfilling and purposeful life.

One of the characteristics of Scandinavian welfare models, as highlighted by particular local features and outstanding society participation, is eclecticism. Many policies are subject to consultative processes in which everyone, including citizens or ordinary people, trade unions, and civil social organisations, are invited to participate (Esping-Andersen, 1990). Such an approach builds an environment where the effectiveness of governance increases since social trust is built in public institutions, which is very important for a meaningful and mindful life. An example would be Denmark's flexible security or flexicurity approach, which adds social protection to labour market flexibility, allowing employees to change jobs without being worried (Andersen & Svarer, 2007). It strengthens the economy and, as a result, decreases stress related to uncertainty, which helps enhance people's understanding and improve their mental health.

In Scandinavian nations, policies are made with sustainability in mind. Sweden, for example, plans to go carbon neutral and is making efforts to use renewable energy. Åkerman et al. (2022) echo its ambition through their research. Energy sustainability is perceived as a critical need not just for economic growth but for societal and environmental developments as well. Norway's Sovereign Wealth Fund manages oil-based revenues with a socially sound investment approach, producing competitive, socially responsible returns. The Norwegian Ministry of Finance notes that 2021 is used as a reference. These policies showcase how Scandinavian welfare states promote economic growth while preserving the environment by incorporating mindful principles.

Nonetheless, it is incorrect to claim that Scandinavian welfare models do not have flaws; they do. Critics argue that high taxation and extensive involvement from the government can threaten economics and grant limited freedom (Berggren & Trägårdh, 2012). In addition, these models can become unstable due to demographic trends, which pressure the availability of social services, such as in an ageing society. Even so, the Scandinavian perspective provides beneficial recommendations on how to use mindfulness and meaning in governance and to what degree freedom can be sacrificed for the sake of society.

A glance through the post compares the Scandinavian and Bhutan welfare models focusing on sound government policies with respect to mindfulness and good living. The case studies demonstrate that tackling policy challenges such as material deprivation or psychological distress alongside social injustices often requires careful formulation of priorities. The case studies offer valuable insight as they emphasise the role of participatory governance, social inclusion, and community cohesion in modern societies. In particular, the case studies reveal how the cultural and historical context defines the sense of meaning and the context within which mindfulness can be embedded.

The amalgamation of these case studies suggests that there is much to learn and to be implemented in terms of global governance structures. They argue that the consideration of meaning and mindfulness for incorporation into the policy frameworks at the societal level would not be difficult to achieve. Overcoming such problematic areas would advance the achievement of the necessary policies that would not only shift the nature of global governance but achieve holistic and actionable goals. Such requirements reinforce the significance of responsive governance approaches needed to transform a society without compromising its well-being.

The GNH Index of Bhutan and Scandinavian welfare models exemplifies how political systems can be infused with mindfulness and meaning. These tools also underscore the importance of integrating collective well-being into policy formulation, which many figures worldwide can learn from. Engaging with the models' challenges

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and opportunities means that this study sheds some light on the political aspects of Mindful and Meaningful living and extends the discourse on governance to be more inclusive and sustainable.

Governance across the globe has seen a disintegration of policies which place value on importance and mindfulness; these policies tend to fail in society, as seen in the case of Bhutan and Scandinavian countries. Furthermore, policies that ignore the community's well-being lead to adverse effects on society, such as inequality, alienation, and even the devastation of the environment. This section will delve into such negative impacts and examine the consequences of neoliberalism, environmental degradation and authoritarianism. Highlight potential challenges and risks in governance structures that lack meaning and mindfulness tend to operate.

Promoting and ensuring the well-being of society and its citizens is one of the primary duties of the government. However, a surge in the adoption of neoliberal policies by some Western democracies in the late 20th century is one of the most explicit instances where a failure on the part of governance to ensure the collective well-being of the citizens was witnessed. Harvey (2005) criticised such policies as deregulation, privatisation, and enhancing market efficiency as detrimental to social efficiency and social equity. A case, for example, would be the United States, where tax cuts for the elite and wealthy have led to significant inequalities in education, healthcare, and housing as there is a rise in spending cuts for social welfare (Stiglitz, 2012). The effects of these inequalities, especially on the lower social classes, is the increasing amount of stress and anxiety, which is ultimately harmful to the singular and collective welfare. Social welfare is significantly reduced as basic needs tend to be prioritised through economic growth and medication. This is the very reason why policies of neoliberal governance can be harmful to not only society but the citizens as well.

Another illustration of governance detrimental to collective physical and psychological well-being is the British austerity policies enacted in the aftermath of the 2008 global financial crisis. Austerity policies, such as the slashing of social welfare and health systems, inflicted damage on the already economically disadvantaged, aggravating mass poverty and social exclusion (Taylor-Gooby, 2013). According to Barr et al. (2015), these policies had negative consequences for mental health, with increasing economic insecurity and social isolation being associated with higher rates of depression, anxiety and even suicide. A lack of mindfulness and meaning in crafting policy is revealed by the governance resulting from a policing mentality where the obsession with austerity is shown to have human costs.

Regimes of this nature fall under the category that stifles autonomy and prevents individuals from developing or acting purposefully. In their case, the social, political, and economic suppression leads to hostility, oppression and a feeling of solitude within most of the populace. Take, for example, North Korea; it is a prime example of a state where the freedom of speech is curtailed, the monitoring of populations through various means is the norm and personal freedoms are all but zero, which creates a vacuum for any meaningful and intentional existence (Kim, 2014). The state mechanism aids in pacifying the people by providing discipline and rigid rules, suppressing the self, creativity and a functional society as a whole. Such an authoritarian model of rule is, on the other hand, of the spectrum when compared to the other more flexible styles of governance that believe in creativity and the collective goodness of the people, thereby highlighting the negative aspects of oppression on humans and society.

Similarly, in the case of India, institutions placing more billing on industrialisation and resource utilisation at the cost of environmental and public health policies are also discouraged. India has also faced backlash with economic growth measures paired with zero respect for environmental protection, sparking severe air and water pollution, especially in metropolitan cities (Chaudhary & Lahiri-Dutt, 2017). It has been noted that these would be the consequences of the abandonment of emphasis on health rather than the nation's sole focus on industrialisation, as the indigenous population was made homeless, ecosystems were disrupted, and health infrastructure was all lost (Gupta, 2014). Such measures endanger sound physical status, damage individuals' psychological and cultural wellness, and sever one's ties to society and nature.

Brazil's approach to the Amazon rainforest under former President Jair Bolsonaro offers another case of governance failure in promoting ecological mindfulness. Bolsonaro later took it a step further by putting

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immigration policies in place that would ensure Brazil couldn't recover from the Eco crisis (Ferrante & Fearnside, 2020). Well, this comes as no surprise given that he, in the past, has encouraged deforestation for agriculture and mining. Such a viewpoint has affected not only the economy but also the livelihood of native tribes (Ferrante & Fearnside, 2020). Furthermore, he has also implemented policies that have wrecked the previously established biodiversity and the climate. Let us not forget that everything was completed with the help of Brazil's development, which focused solely on short-term goals.

These policies and actions also further diminish the Englishman's three-pillar concept regarding citizenship. Other nations use these policies as examples of what to avoid to get the most effective governing strategy. The Chinese government enforced such a policy in which the state-controlled and monitored the privacy and autonomy of its citizens. The Chinese system aimed at creating social order has weakened trust, dignity, and confidentiality (Hoffman, 2017).

The effects of disregard for mindfulness and meaning in policy formulation are not limited to individual hardships but also entail global issues. Strategic plans that emphasise generating economic returns at the expense of social and environmental considerations tend to worsen climate change, deplete resources, and cause social discontent. A case in point is that the Purchase of fossil fuels worldwide devised through the promotion of oil and natural gas production policies, has worsened climate conditions along with related issues such as food scarcity and migration from affected areas (IPCC, 2021). Such developments highlight the necessity of governance frameworks that focus on the overall well-being of people in the future rather than emphasising economic success in the short run.

To conclude, negative cases and incorrect planning are examples of the consequences governance systems experience due to neglecting the aspects of mindfulness and meaning. Neoliberalism's view of the market's efficiency, authoritarianism's control over political freedoms, neglect of the environment and governance based on a surveillance apparatus are all some of the shortcomings of viewing the humanitarian welfare of people as secondary to political or economic gain. These cases, however, provide vital insights for policymakers aiming to advance the status of governance to an actively humanitarian one. Hence, policymakers seeking to promote social justice, gender equality, and environmental sustainability across nations would find these cases insightful.

Governance Models and Their Impact on Mindful and Meaningful Living

The results of this study provide a detailed assessment of how governance structures influence well-being across dimensions of psychological health, participatory governance, social equity, ecological sustainability, and economic resilience. These findings are supported by Tables 1, 2, 3, and 4 and statistical analyses to provide a clear and logical presentation.

Psychological Well-being

The Governance framework plays an essential role in how individuals perceive themselves in relation to others. In the case of Bhutan, GNH places mental health as a primary focus, together with cultural activity engagement, thus resulting in a higher happiness score of 8.5 and a higher cultural participation of 93%. Mindfulness education is also part of Bhutan's mental health policies, which helps 70% of the population access the required services.

The Scandinavian welfare states have also done a commendable job with regard to mental health, where 75% of the population is covered, and a rating of 8.1 is scored. In strong contrast to this, the rise of neoliberal regimes exemplified by the UK has shown detrimental effects on public health, particularly the psychological systems, through neglect of investment with only a score of 5.6 while experiencing a rise in mental health disorders by 15%. Countries with authoritarian systems get the lowest score, with the overall access to mental health being at around 20 per cent combined with an overall score of 4.1 out of 10. (OECD/European Observatory on Health Systems and Policies, 2023, Wang et al., 2022, Wahlbeck et al., 2011).

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Table 1. Psychological Well-being Across Governance Models

Country/Region	Happiness Score (10)	Mental Health Support (% Access)	Cultural Engagement (% Population)
Bhutan (GNH)	8.5	70%	93%
Scandinavia (Average)	8.1	75%	85%
Neoliberal Economies (UK)	5.6	45%	55%
Authoritarian Regimes	4.1	20%	15%

Source: Made by the authors

Participatory Governance

Bhutan's GNH framework emphasises community vitality and active citizen participation. The 2022 GNH Index reveals that 9.5% of the population is very happy, 38.6% extensively happy, 45.5% narrowly happy, and 6.4% unhappy, indicating a significant portion of the population experiencing high levels of well-being. Scandinavian welfare systems exhibit even higher civic participation, with 82% voter turnout and 70% involvement in voluntary associations. Trust in government is a significant factor, with 84% of Scandinavian citizens expressing satisfaction with public institutions.

By contrast, neoliberal regimes display declining participation, with voter turnout averaging 58%, while authoritarian regimes fall below 1%, reflecting minimal citizen engagement and suppressed freedoms (Table 2). (Nordic Council of Ministers, 2022, Oxford Poverty and Human Development Initiative, 2023, Nordic Statistics, 2024, The Times, 2024).

Table 2. Participatory Governance Metrics Across Governance Models

Country/Region	Voter Turnout (%)	Civic Participation (% Population)	Trust in government (%)
Bhutan (GNH)	66%	High (Emphasis on community vitality)	High (Indicators from GNH Index)
Scandinavia (Average)	80%	60% (Engagement in voluntary associations)	65-84% (OECD)
Neoliberal Economies (UK)	60-70%	Declining	Low (14%, UK as an example)
Authoritarian Regimes	<1% varies, of unreliable	<1%, limited	Low (Suppressed freedoms)

Source: Made by the authors

Social Equity and Inclusion

Social equity, measured through Gini indices and minority representation, shows stark contrasts across governance models. Scandinavian welfare states achieve near-perfect equality with a Gini index of 0.26 and 47% female parliamentary representation. Bhutan follows closely with a Gini index of 0.35 and high citizen satisfaction (70%) regarding resource distribution. However, challenges in Bhutan's inclusivity persist, with 18% of minority groups reporting unequal access to services. Neoliberal economies reveal growing inequality, with a Gini index 0.48 and top earners controlling 40% of wealth. Authoritarian regimes fare worst, scoring 0.65 on the Gini index and exhibiting severe underrepresentation of marginalised groups. (Kwon 2018, Statista, 2023).

Table 3. Social Equity Indicators Across Governance Models

Country/Region	Gini Index (0=Perfect Equality)	Gender Representation (% Women in Parliament)	Minority Satisfaction with Services (%)
Bhutan (GNH)	0.35	35%	70%
Scandinavia (Average)	0.26	47%	85%
Neoliberal Economies (US)	0.48	23%	55%
Authoritarian Regimes	0.65	10%	30%

Source: Made by the authors

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Ecological Sustainability

Bhutan excels in ecological sustainability, maintaining 70% forest cover and achieving carbon neutrality (World Bank, 2024). Sustainable tourism and strict environmental regulations support the nation's ecological score of 9.3/10. Scandinavian countries have also made substantial progress, achieving 75% renewable energy usage and a 22% reduction in CO2 emissions over the past decade. Negative cases highlight governance failures. Brazil's deforestation rate increased by 34%, resulting in significant biodiversity loss and environmental degradation. Neoliberal regimes contribute to low sustainability scores due to the prioritisation of industrial growth over environmental preservation. (Statista, 2024).

Table 4. Ecological Sustainability Metrics Across Governance Models

Country/Region	Forest Cover (%)	Renewable Energy Use (%)	CO2 Reduction (10-Year %)	Ecological Score (10)
Bhutan (GNH)	70%	45%	10%	9.3
Scandinavia (Average)	60%	75%	38%	9.5
Neoliberal Economies (US)	30%	20%	5%	3.5
Authoritarian Regimes	20%	10%	-2%	2.8

Source: Made by the authors

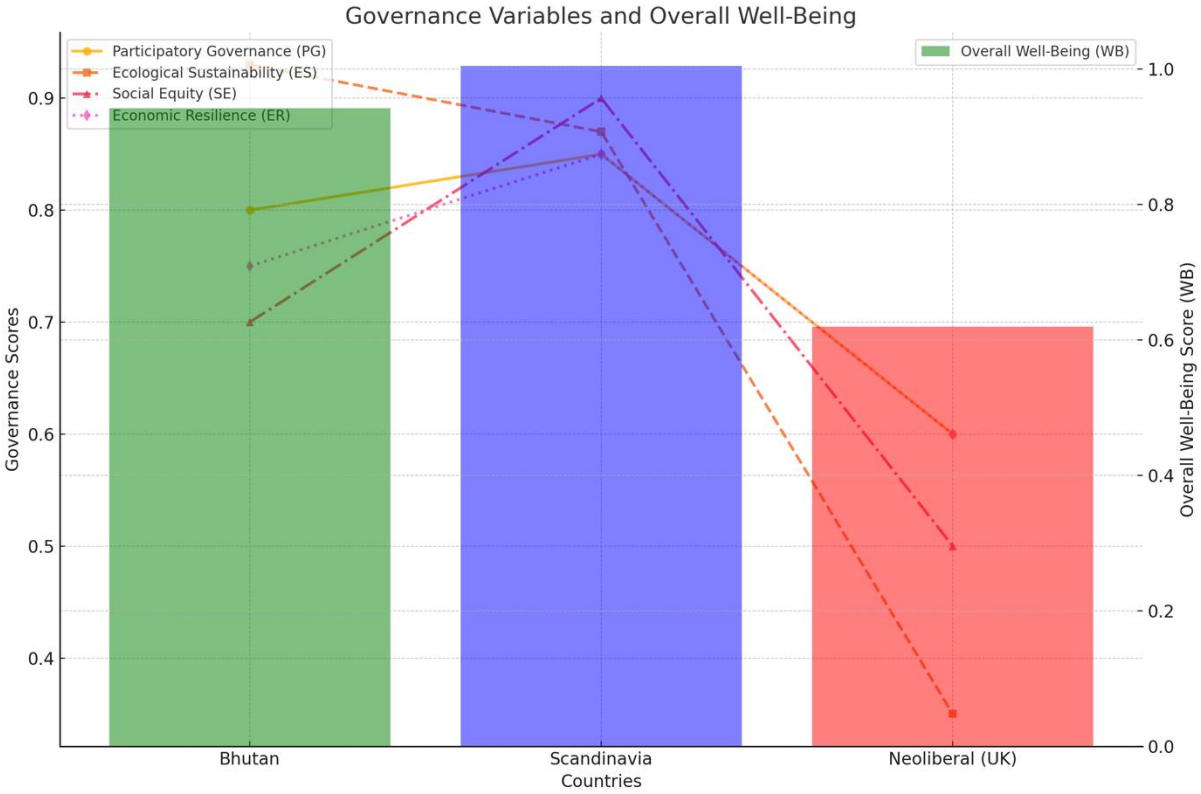


Figure 1. Governance variables and overall well-being
Source: Made by the authors

Figure 1 above illustrates the interplay between governance variables—Participatory Governance, Ecological Sustainability, Social Equity, and Economic Resilience—and their collective impact on Overall Well-being (WB). Bhutan and Scandinavia lead with high well-being scores (WB of 0.92 and 0.96, respectively), driven by strong participatory frameworks, sustainability efforts, and social equity. Bhutan excels in ecological sustainability, while Scandinavia demonstrates balanced governance across all dimensions. In contrast, Neoliberal regimes score significantly lower (WB=0.60), reflecting weaknesses in sustainability and equity, which undermine well-being. The alignment between high governance variable scores and overall well-being highlights the importance of an integrated, balanced approach to fostering mindful and meaningful living, offering actionable insights for underperforming systems to prioritise reforms in sustainability and inclusivity.

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These findings emphasise that governance models profoundly influence mindful and meaningful living, with Bhutan and Scandinavian systems as benchmarks for integrating well-being into public policy. In contrast, neoliberal and authoritarian regimes demonstrate the consequences of neglecting these priorities, offering valuable lessons for global governance reform.

Discussion

The search for a meaningful and mindful life remains the key issue in today's governance. This discussion addresses such concerns as the Gross National Happiness (GNH) Index of Bhutan, the welfare model of Scandinavian countries, the neoliberal regimes and the authoritarian governments, as applied to contemporary well-being, mental disorders and social justice.

The Bhutan's GNH Index measures the country's progress in nine domains: psychological well-being, health, education and ecological diversity. According to the 2022 GNH Survey, 93.6% of Bhutan's population is reported to be happy, a significant increase in happiness levels since 2015 (Centre for Bhutan and GNH Studies, 2023). This has been fundamental in formulating policies that promote protecting the environment and the cultural heritage. However, there are many problems, such as how to modernise without losing its roots and how to bridge the economic gap.

Scandinavian Welfare Model: Countries such as Denmark, Norway, and Sweden are exemplary in providing Social protection services, which encompasses health services, education, and welfare. They are also among the happiest people in the world due to high levels of equality and good social support within the community. Social spending by Denmark and Sweden as a percentage of their GDP is 28% and 26%, respectively, while the average of the OECD countries stands at 20% (Public Finance Focus, 2019). Recent investigations point to these welfare models evolving to respond to contemporary needs such as population ageing and economic downturn by instituting reforms which promote participation in the labour markets while sustaining social infrastructures (Greve, 2016).

Neoliberal Regimes: Social inequality coupled with mental health problems has time and again been linked to neoliberal policies, which are unduly characterised by deregulation, privatisation and less spending by the state. In the UK, harsh economic policies have put a strain on community mental health centres and other services, leading to a lack of access and greater distress to at-risk people (Transforming society, 2022). Mental healthcare in a neoliberal regime has historically been focused towards a more biomedically inclined practice, losing sight of the social factors surrounding patients suffering inequalities (Zeira, 2022).

Authoritarianism Regimes: Authoritarian governments use extensive surveillance and censorship, which compromises individual freedom and dramatically impacts their psychological state. (Feldstein, 2019) Defining the standards of digital authoritarianism, the Social Credit System in China is a method of AI and big data-centric subordination that embarks upon the regulation and management of citizens' behaviour whilst ignoring the matter of privacy and individual autonomy. On the other hand, the Russian model of SORM - the System for Operative Investigative Activities has initiated mass surveillance through endless communication monitoring, which curbs dissent and looses trust in society (Morgus, 2019). It also leads to self-censorship, social fragmentation, and anxiety among citizens.

The Scandinavian welfare system can be closely related to Bhutan's GNH index as both help embed well-being into governance. On the one hand, Bhutan's happiness as a central policy goal has allowed the local culture to preserve itself and promote active environmental conservation. The equitable generation of income and welfare for the population has been the pith of the Scandinavian model, which guarantees trust and a satisfactory life experience. In contrast to those, the neoliberal regimes are pretty active in their pursuit of economic growth with no regard for social welfare, and this has its toll on the manner of social fabric /strains that affect mental well-being rather than the opposite. Considering that the degree of surveillance and control exhibited in authoritarian regimes suppresses personal autonomy and social trust, which further contributes to the negative cycle of wellness.

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Today's Situation: The COVID-19 pandemic has necessitated existing governance models targeting well-being. The strong health and social systems of Scandinavian countries served to properly tackle the crisis-centred situation and limited further negative consequences on the economy and mental health (Nordic Health and Welfare Statistics, 2023). In contrast, neoliberal regimes with diluted public health systems struggled with the pandemic, and these countries saw the implications of low investment in social services. Under democratic and authoritarian regimes, the COVID-19 pandemic further fostered the digital surveillance culture, raising ethical questions about privacy and its abuse (Oxford Global Society, 2022).

These governance models show that focusing on people's well-being, social justice and freedom results in better, more cognizant societies. The GNH Index of Bhutan and the welfare model of citizens in Scandinavia are good examples of merging happiness and citizen welfare with governance. As for the other end of the spectrum- the neoliberal and authoritarian regimes- their remnants illustrate the consequences of neglecting social welfare and individual rights. In the future of governance, the concept of quality of life for all citizens should come before economic development.

Conclusions and Recommendations

The emphasis on the value of politics to sociocultural well-being provides a robust counter to the deterministic ideational focus of the culture in which politics is based. We can integrate political and cultural analyses, highlighting political un/democratisation and sociocultural development cycles. After explaining how Bhutan has successfully exported its Gross National Happiness movement, which allows measuring socio-economic development along with the GNH Index, it defines Denmark's social and economic roles by utilising the GNH in contrast to neoliberalism and totalitarianism. The metaphor employed then is spiritual and life-affirming, which urges us to look back to see a well-rounded picture illustrated by strategic governance models.

According to the parable, governance in its own right has to be treated in the same way, as the gardener is expected to encourage various and even extraordinary forms and not impose sameness. For example, Bhutan's GNH framework illustrates this metaphor well – it fosters psychological health, culture and ecology (Ura et al., 2012). Even this gardener, however, must be trained to adapt and hear the sound of every seed, such as inclusiveness, which appreciates the multiplicity of experiences that humanity has. While GNH promotes a revolutionary perspective of a person's well-being on the other side, it has a con in that it may not be able to accommodate the minority groups as a reminder the act of cultivation must not agree with the garden (Pellegrini & Tasciotti, 2014).

Likewise, Scandinavian welfare models operate like a strong and stable bridge between the person and the society. Their agenda of social justice, democracy, and ecological conscience is the power and integrity of a bridge that permits everyone to move toward a purposeful life to the fullest (Esping-Andersen, 1990). However, like any bridge, frequent maintenance and repairs are required. In this case, the maintenance must focus on averting the erosion of sustainability caused by demographic change or global economic circumstances (Berggren & Trägårdh, 2012). Men need an evolving governance structure capable of adjusting to new situations without deviating from the core goal of society.

On the other hand, polemic policies maintain a grim prospect reminiscent of a tree decayed by neglect. The emphasis on control by authoritarian regimes and the constant pursuit of efficiency by the market in neoliberalism serves as reason enough for concern. Such realities underline that the health of a tree is defined by more than its hulk; it consists of the depth of its roots and the integrity of its ecology. Economistic policies that compromise on social issues in favour of growth and authoritarian regimes that promote uniformity under the guise of peace demonstrate the sensitivity of trees in unfriendly environments (Harvey, 2005; Hoffman, 2017). To inhibit further disintegration from occurring, governance should cultivate and protect its guarantees: equity, justice, and trust, in turn without leaving any fragment of the tree unfixed.

Light and shadow are more than just simple metaphors; they define the nature of the tree and serve as a common centralisation for a plethora of implications concerning governance, which has its bounds, both sane and insane.

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Policies such as the ones that were observed in Scandinavia and Bhutan serve to facilitate a better way and better meaning to life. In contrast, others, such as the neoliberal and authoritarian ones, conceal what one could have been. However, with such power comes responsibility, as governance can and will evolve to be dynamic, meaning that balance, reflection and even renewal may be needed for further progression.

This study presents important insights to help policymakers and societies promote enriched and thoughtful living. In light of that, governance needs to make room for the well-established principle of interdependence, which states that the individual's health cannot be separated from society's well-being or ecological health. As Thich Nhat Hanh (1987) eloquently states, this principle for policies that promote individual, community and environmental well-being is informed by Buddhist philosophy and ecological well-being. Governments must factor in the varying cultural contexts by embracing inclusivity with holistic approaches such as General Well-being or Gross National Happiness of Bhutan.

For policies that foster thoughtfulness and being present to oneself to forge a new way of living, governance needs to be participatory from the grassroots up. Governance needs to establish frameworks that build on Scandinavian welfare models where inclusivity, transparency and collaboration are core principles to enable citizens to create policies that impact their day-to-day lives (Esping-Andersen, 1990). All people require the ability to participate in decision-making, which can be achieved through participatory budgeting, citizen assemblies and other community-driven approaches to build collective trust, agency and a sense of belonging.

Third, education should be reconceived as a garden in which seeds of mindfulness and meaning are implanted early. Policies that fuse values-centred education, ethics of learning, and mindful approaches into the school system can create citizens of the next generation who can deal with a myriad of complexities of life with care and fortitude. While Bhutan's experience is an example of value-oriented education, contextualisation must be relevant to international society's philosophical outlooks and cultural practices (Ura et al., 2012).

Fourth, governance must help deal with underpinning discrimination in society, which constrains one from seeking a life of purpose and awareness. Policies should address economic inequality, make education and medical care available to all people, and establish adequate social security measures. In this way, governments can reduce these structural constraints so that people can discover their potential without the burden of insecurity and poverty (Stiglitz, 2012).

In the end, governance must also be consistent with the idea of being an ethical trustee and consider itself not as the owner of the planet and its people but as its guardian. This long-term thinking puts ecological concerns, equity between generations, and protecting culture and nature first. Such policies should promote savings, invest in sustainable technologies, and aid in conservation efforts, achieving economic progress whilst remaining ecologically conscious (Åkerman et al., 2022).

This study, in turn, can demonstrate the fusion of governance and effort to live a fulfilling and thoughtful life. Governance would rediscover the concept of integration, where disparate instruments unite to form a song by implementing policies that respect the rich tapestry of humanity while ensuring harmony. In this way, societies will head towards a civilisation where governance can help people flourish instead of restraining them if they can learn from Bhutan's GNH, the Scandinavian welfare models, the neoliberal set-up and authoritarian regimes.

Governance is undoubtedly an art, and just like life, it requires a careful metaphorical use of gardens, bridges, trees, and pieces of light and shadow. It's about wisdom, humility, and courage to perform the needed tasks, unite tradition and progress, and listen to and consult with many in case of making such moves. Looking at today's global context, such as climate change, social disunity, and so many more, governance of a conscious and constructive kind is something we need dearly today. In this ache for the complete well-being of human society, there lies the possibility of shaping a world where every living being can prosper in all its rich diversity.

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DEVELOPMENT TRENDS IN THE FINANCIAL PERFORMANCE OF CONSTRUCTION COMPANIES IN THE CZECH REPUBLIC AND ABROAD

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Abstract. The construction industry plays a significant role in the economic growth of many developed countries, helping to keep the economy steady and growing. In places like the Czech Republic, the construction sector builds essential things like roads and buildings, creates many jobs, and helps other industries grow. This article examines how construction companies are doing financially, with a focus on the Czech Republic and how it compares to nearby countries. By looking at data from the past eight years, this study provides a complete picture of the construction industry's performance, using a special method called the Winsorized mean to ensure fair comparisons. The study shows economic changes, new regulations, and demand affect construction companies' performance. In recent years, challenges such as increasing costs of materials, a shortage of skilled workers, and stricter rules have affected their performance. However, the sector continues to be vital. This article also examines factors that could influence the construction industry's future. These factors include using environmentally friendly building methods, improving technology like automation, and managing resources more efficiently. By dealing with today's problems and taking advantage of future chances, the construction industry can continue to be a key driver of economic growth in the Czech Republic and other countries.

Keywords: financial performance; construction industry; the Winsorized mean; analyze; Visegrad group; EU

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1. Introduction

The construction industry is a key driver of global economic growth, helping to build new infrastructure, create jobs, and support the development of cities (Pheng & Hou, 2019). In many countries, such as the Czech Republic, this sector is vital for the overall value of goods and services made (GDP). It is closely linked to other industries, affecting economic growth and the speed of national development. As nations and regions put money into sustainable and strong infrastructure, knowing how well construction companies are financially is vital for researchers, government officials, and business leaders (Liu et al., 2020; Asad et al. 2024). In the Czech Republic, the construction industry employs a large part of the workforce, including many foreign workers who take on important jobs due to lacking local workers (Kocourkova et al., 2023). Using a varied group of workers highlights the flexibility of the manufacturing industry and its part in offering jobs to people with different abilities (Dhanasekar et al., 2023).

Many authors investigated factors of economic cycles and confirmed that local economic situations strongly affect business cycles (Gavurová et al. 2016; Tkacova et al. 2018; Tkacova & Gavurova, 2023; Gelfer, 2024).

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Different areas are affected differently by changes in money, government rules, and market conditions (Sinicakova & Gavurova, 2017; Sinicakova et al. 2017). This means that construction companies need to be very quick to adapt to changes in what the market wants and the financial situation, as these directly impact their success (Kinnunen et al., 2022).

The success of construction companies, whether in their own country or abroad, depends on the company's size, location, and how well it runs its operations (Al-Hashimy, 2025). Financial analysis is crucial because it helps make good decisions, use resources wisely, and increase profits. By analysing financial indicators, construction companies can identify areas of strength and weakness, forecast future performance, and assess their competitive standing within the industry. Moreover, strong financial stability allows businesses to endure economic changes and exploit new growth opportunities (Struckell et al., 2022). Analysing the financial growth of construction firms helps to understand the more prominent economic factors that influence the industry. This research is especially important for construction companies in the Czech Republic, as local economic conditions significantly affect their success (Vitkova et al., 2024). In cities, businesses often have better access to resources and money, while in less developed areas, companies may face challenges such as poor infrastructure and low consumer demand (Kookana et al., 2020). According to Sudirjo (2023), grasping these distinctions is crucial for creating specific plans to improve performance and boost competitiveness.

Construction companies' financial success depends on many things, like market situations, local economic issues, and how well the companies manage their operations (Giménez et al., 2019). Since the construction industry is essential for economic growth in the Czech Republic and worldwide, it is important to look at and understand the money-related parts that help it do well. By focusing on critical financial signs, construction businesses can handle economic shifts better and find growth opportunities. Looking at Czech companies and comparing them to those in nearby countries helps us see where they stand in competition and what they can do better (Vitkova & Kocourkova, 2021). As Rame et al. 2024) continue to evolve, it is essential for stakeholders to consistently assess key sustainability metrics to ensure that development remains aligned with long-term sustainability goals and can adapt to the dynamic economic and environmental challenges ahead.

2. Literature Review

This chapter is divided into two parts. The first part describes the situation in the construction industry in the Czech Republic, and the second part discusses the situation in the construction industry within the EU.

2.1 Situation of the construction industry in the Czech Republic

According to the Ministry of Industry and Trade, the construction industry offers numerous opportunities for analysis and improvement. Despite some fluctuations, the construction industry is a necessary and nonnegligible factor in the national economy (Alaloul et al., 2022). However, there are still considerable reserves within the construction industry to improve construction technologies and processes and to achieve better performance for construction companies (Ibrahim et al., 2024). Given the fundamental labour shortage in the sector, the potential scope for innovation could be exploited by the industry to manage the resources used by the construction industry more efficiently or respond more flexibly to unforeseen situations (Loosemore, 2015). Innovation would contribute to significant technological change and thus to building a higher value-added economy (Upadhyay et al., 2023). Reducing energy use and lowering the carbon impact are essential for construction companies.

As per the analysis titled 'Construction is expected to decline by 2% in 2023' by BusinessInfo.cz (2023), many things have influenced the construction industry, like unpredictable situations that affect overall business performance. Unexpected events, such as the 2020 SARS-CoV-2 pandemic, greatly affected business outcomes, with the construction industry seeing a drop in production (Alsharef et al., 2021). According to Gajdosikova et al. (2022), the general development of the construction industry in recent years has not only been affected by this epidemic but also by rising prices, the war in Ukraine, the inflation rate, and many other aspects. The impact of these events was evident in the 2023 economic outcomes, with a mid-2023 forecast showing a 3% drop in construction because of adverse effects (Izzeldin et al., 2023). Due to lower sales, high inflation, and increasing

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costs, the profit from contracts will go down. The Czech Statistical Office (CZSO) reports that construction fell by 2.6% in 2023 compared to the previous year, with matching forecasts and leaders of construction firms expecting another 2.7% decline in 2024. This results from the Q4/2023 Quarterly Analysis of the Czech Construction Industry prepared by the analytical company CEEC Research. The reason for this is the still unfavourable economic conditions, including expensive loans or high prices of building supplies (Musarat et al., 2020). However, construction materials and energy costs are reduced, which will help the industry grow further.

The bigger persistent problem for construction companies overall is the lack of skilled labour on the market. Almost 90 per cent of construction companies in the Czech Republic lack graduates in civil engineering (Vitkova et al., 2022). According to the CEEC Research's analysis and the words of Education Minister Mikuláš Bek (STAN political party), 95 per cent of 139 small, medium, and large companies surveyed did not record any recruitment of civil engineering graduates to their staff (Talaat & Gadallah, 2024). According to the analysis, most students nowadays prefer more modern fields with higher social status, such as IT, marketing, or finance. In addition, the considerable reluctance of companies to invest in their capacities in times of economic instability is also a problem (Ozili, 2018). On average, the capacity of construction companies is 93% utilised. However, the construction sector, in particular, has faced a high degree of uncertainty in the past period (Fashina et al., 2021). The war in Ukraine has hurt the prices and availability of construction materials and workers (Pereira et al., 2022). Rising inflation or sharp increases in energy and other input prices have not yielded good results. These unexpected events had a significant impact on the construction industry.

The data from the Czech Statistical Office (CZSO) shows that construction in the Czech Republic in 2023 was a bit lower than the Eurozone average, with a similar drop in nearby Germany and Slovakia (Bílková, 2023), which we will also examine in our study. The year 2024 should, therefore, be marked by stagnation, with the Czech construction sector already weaker than the Eurozone average (see Figure 1).

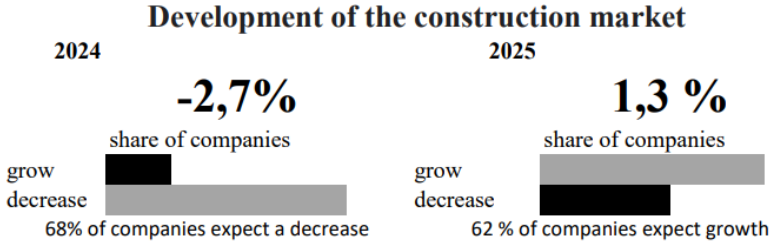


Figure 1. Development of the construction market

Source: Own processing according to Stavebniserver.com, 2023

An aspect influencing the construction industry is the rise in prices, with construction works up 10.3% and materials 12.7% year-on-year in Q1 2023 (Kalinin et al., 2024). A key question for civil engineering is government investment in construction, which depends on factors like the war in Ukraine, energy and material prices, and the impact of public finance consolidation on spending (Grieveson et al., 2024). Minister for Regional Development Ivan Bartoš views the 2024 Construction Act as an opportunity to boost and stabilise the construction industry. Public procurement is crucial for the construction sector, and while its volume hasn't grown year-on-year, the record SFDI budget may boost companies (Dita et al., 2020). This is a prerequisite for production in the transport infrastructure segment. Most construction companies agree that Czech transport infrastructure is insufficient and hindered by funding shortages and complex legislation. Compared to neighbouring countries, road and motorway construction in the Czech Republic has been slow in recent years and, despite record infrastructure construction in 2022, insufficient (Dvořáková et al., 2024). Construction companies believe that adjusting legislation and reducing the administrative burden would improve the poor situation on roads and motorways, with new city bypasses reducing traffic and enhancing safety (Ignatov, 2024).

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2.2 Situation of the construction industry in the EU

Not only the Czech Republic but all European countries were negatively affected by the coronavirus pandemic in 2020 (To & Lee, 2024). Due to supply shortages of certain materials, construction in the European Union has generally slowed; alas, it was revived in May 2020 (Matiiuk et al., 2023). Currently, construction in the European Union grew by 0.4% year-on-year in Q1 2023 and by 0.3% in the Eurozone (CZSO, 2023) (Jašová, 2023). However, none of the major European economies showed growth. In Germany, for example, the construction sector declined by 1.3%. Civil engineering increased by 0.8% in the EU, while in the Eurozone it decreased by 0.3% (Gornig & Pagenhardt, 2024). The domestic construction sector within the EU countries performed below average. Even from the point of view of global companies, the biggest barriers to growth in the construction industry remain the lack of employees and materials or equipment (Omopariola et al., 2022).

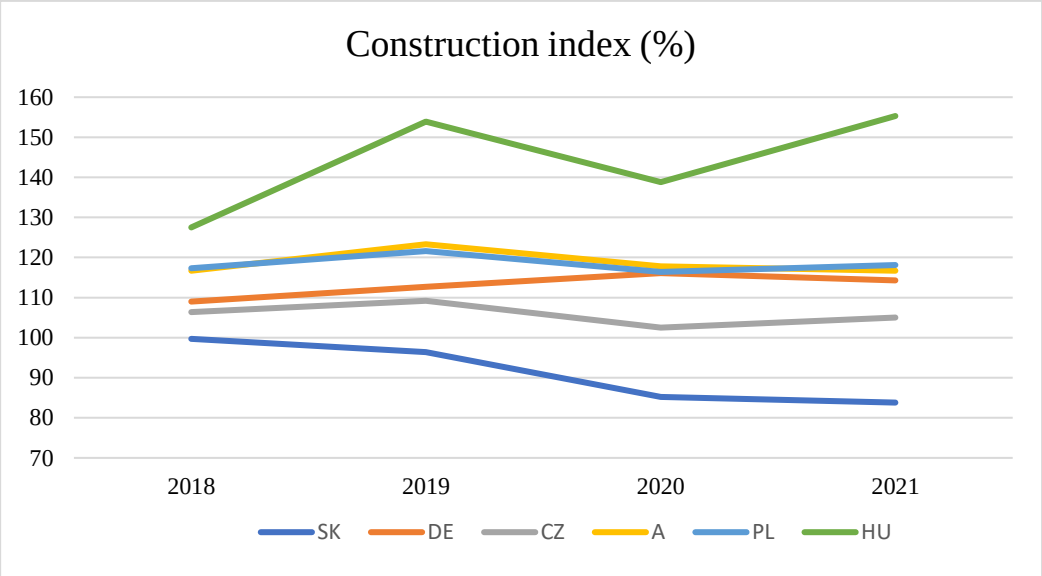


Figure 2. Construction index

Source: Own processing according to Eurostat, 2022

The selected EU countries should be analysed in the context of the construction industry, with Figure 2 above showing the construction index, using 2015 (100%) as the base year (Lederer et al., 2024). Figure 2 indicates that the Slovak and Czech Republic are at the bottom of the graph. The Slovak Republic even saw a decrease in construction in those years compared to 2015. The Czech Republic is slightly above the 100% mark. Germany, as mentioned above, also saw a slight decline in construction. Surprisingly, Hungary recorded the highest increase in construction each year. This perspective can help to understand the evolution of the financial indicators selected below. Eurostat's 2022 GDP per capita distribution shows that all V4 countries are in the lower middle-income group, while Austria and Germany are in the high-income group (Boršič & Podgoršek, 2024). This offers an interesting perspective on the selected countries.

The Budindex report, published by Budimex S.A., Poland's largest general contractor, at the start of 2022, also compares the construction sector situation in individual countries. The report shows the Czech Republic invests 6% of its GDP in construction, ranking 17th in the European top 27, while Poland is second, followed by Austria. European construction projects show that even an influential investor like Germany faces numerous difficulties implementing large projects (Akinsulire et al., 2024). However, Poland led the EU in large construction projects during these years, while the Czech Republic invested the least in construction among the V4 countries. In conclusion, the Czech construction sector is growing only at an average rate within the European Union (Cyrek et al., 2024). Experts attribute the slow Czech construction sector to poor building regulations, unlike Hungary and Poland, which experienced a construction boom. Czech Fund analyst Lukáš Kovanda cites capacity

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constraints and a labour shortage as key factors. In contrast, Hungary has shown strong growth in civil engineering and infrastructure, leveraging European funds to build at an impressive pace.

3. Methodology

This article aims to analyse the development of the financial performance of construction companies in the Czech Republic and neighbouring countries over the last eight years. The article uses the secondary research method based on the literature study and data from the ORBIS database. Over 82 million active enterprises have been identified in this database. Furthermore, under the criteria of being located in one of the selected six countries, being active in the construction sector, having a size corresponding to small, medium, and large enterprises according to the European Commission classification, and having a period of the last ten years, the final 20,553 enterprises met the requirements chosen for this article. These enterprises were subjected to an analysis of their financial performance in three selected indicators and a subsequent comparison between the countries. For this paper, the following financial indicators were selected:

3.1 Return on Sales (ROS)

Return on Sales (ROS) is a profitability ratio that measures how much profit a company makes for every revenue unit. It shows the efficiency of a company in generating profit from its sales.

$$\text{Return on Sales} = \frac{\text{Operating Profit}}{\text{Revenue}} \quad (1)$$

3.2 Added Value on Sales

Added Value on Sales shows how much value a company adds to its products or services relative to its total sales. "Value Added" typically refers to the difference between sales revenue and the cost of raw materials or services purchased. This ratio indicates how efficiently a company creates additional value from its sales activities.

$$\text{Added Value on Sales} = \frac{\text{Added Value}}{\text{Sales Revenue}} \quad (2)$$

3.3. Added Value on Employees (EUR)

Added Value on Employees measures the added value generated by each employee, expressed in thousands of EUR. It provides insight into the productivity and efficiency of employees in generating value for the company.

$$\text{Added on Employees} = \frac{\text{Added Value}}{\text{No. of Employees}} \quad (3)$$

The results are processed using the aforementioned Winsorized mean.

4. Results and Discussion

To determine the appropriate companies to analyse performance, the criteria of annual turnover and asset value were chosen so that the companies fall into the category of small to large enterprises (classification below, see Table 1). Micro enterprises are, therefore, not used for monitoring. Enterprises meeting this classification were included in the survey, with their headquarters in one of the six selected countries, and classifications 41 - Construction of buildings, 42 - Civil engineering, and 43 - Specialised construction activities. The period of observation is 2013-2022.

Table 1. Categorisation of the enterprises

Category of entities	Number of employees	Annual total of net turnover	Assets in total
Micro	<10 employees	<2 mil. EUR	<2mil. EUR
Small	<50 employees	<10 mil. EUR	<10 mil. EUR
Medium	<250 employees	<50 mil. EUR	<43 mil. EUR

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Large	>250 employees	>50 mil. EUR	>43 mil. EUR

Source: Own processing according to European Commission

The following graphs present the development of selected financial indicators for the chosen period within all selected states to easily compare the situation. Data for the period 2013-2022 were analysed. However, only 2015-2022 were included in the resulting graphs due to fluctuations within the first two years. For example, in 2013, there was a large construction boom in Austria, which led to a fluctuation in the value added to sales indicators and, at the same time, distorted the situation of the other years. Therefore, for better validity, only eight years of results have been plotted in the graphs. The research also examined the evolution of average sales per country. No particular variations, fluctuations, or changes were found from one year to the next. Therefore, the research compared the following three indicators that further differentiate the sales.

4.1. Return on Sales (ROS)

The profitability of sales compares the development of the construction industry over the last eight years in the six selected countries. The development is shown in Figure 3 below, and the data used is presented in Table 2. The return on sales indicator is given as a percentage.

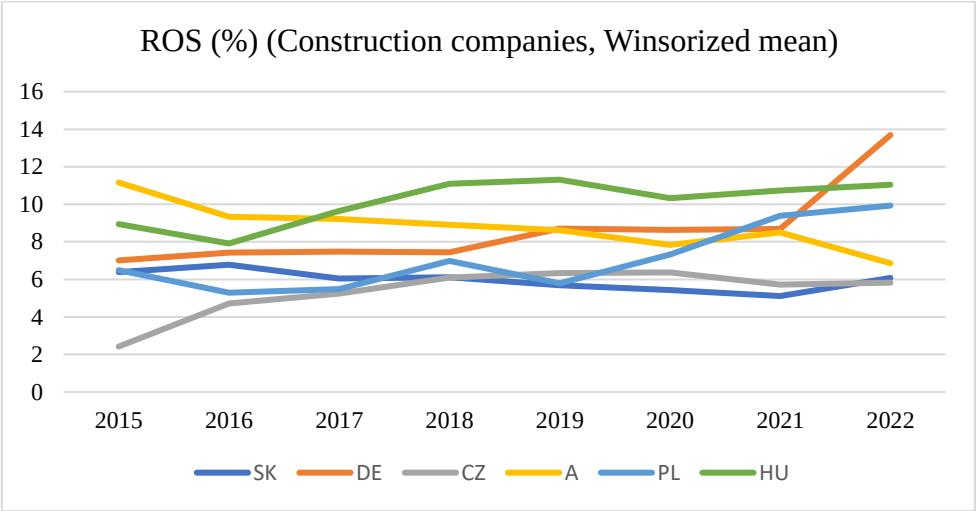


Figure 3. Return on Sales (construction companies)

Source: Own processing

Table 1. Return on Sales

ROS (%)	2015	2016	2017	2018	2019	2020	2021	2022
SK	6,38	6,78	6,04	6,12	5,69	5,43	5,11	6,08
DE	7,01	7,42	7,48	7,44	8,71	8,64	8,69	13,69
CZ	2,42	4,72	5,25	6,09	6,33	6,37	5,72	5,82
A	11,16	9,34	9,21	8,91	8,62	7,83	8,5	6,86
PL	6,48	5,29	5,48	6,98	5,78	7,32	9,38	9,93
HU	8,95	7,91	9,64	11,09	11,31	10,33	10,74	11,05

Source: Own processing according to ORBIS

Regarding return on sales, there are no significant differences when comparing countries. The results for the period under review are in the same range, with no significant fluctuations. In terms of this indicator, the Hungarian construction sector, in particular, is substantial. Germany has also seen an improvement in the last two years. The situation is the worst in the Czech and Slovak Republics.

4.2. Added Value on Sales

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The value-added indicator in the construction sector is also compared over the last eight years in the six countries selected. The trend is shown in Figure 4 below, and the data used are also presented in Table 3. The value added on the sales indicator is shown as a percentage.

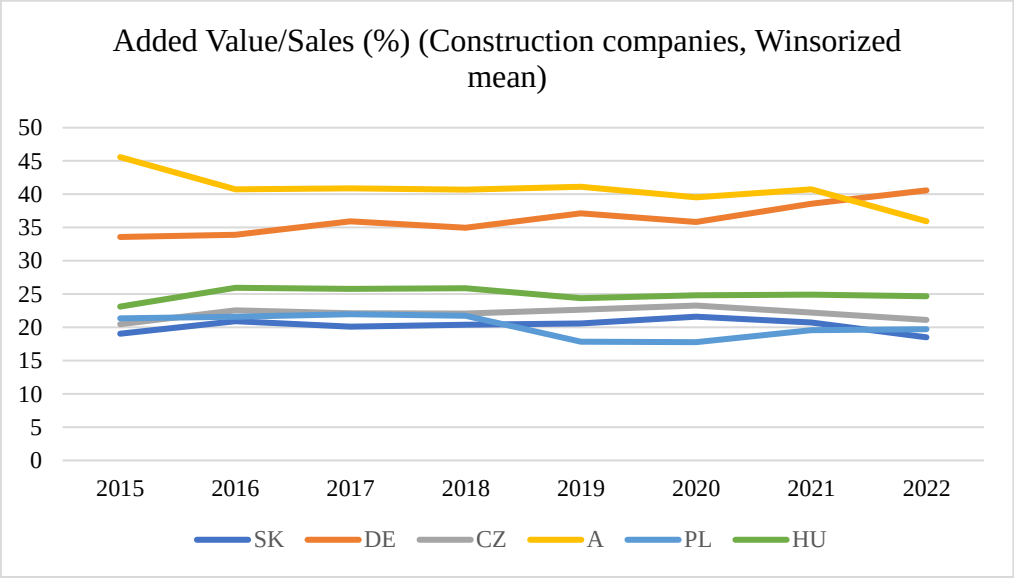


Figure. 4. Added Value on Sales (construction companies)

Source: Own processing

Table 2. Added Value on Sales

AV/S (%)	2015	2016	2017	2018	2019	2020	2021	2022
SK	19,05	20,9	20,12	20,4	20,6	21,6	20,71	18,5
DE	33,58	33,9	35,94	34,96	37,13	35,83	38,55	40,58
CZ	20,47	22,55	22,12	22,08	22,67	23,27	22,2	21,1
A	45,58	40,76	40,9	40,7	41,1	39,53	40,76	35,94
PL	21,35	21,6	21,97	21,72	17,84	17,77	19,57	19,73
HU	23,12	25,94	25,8	25,89	24,39	24,82	24,92	24,69

Source: Own processing according to ORBIS

The chart shows that construction companies operating in the Visegrad Group countries achieve similar values for the Added Value on Sales indicator, including those operating in Hungary. As can be seen, construction companies operating in Austria and Germany have different values, where in some years, this indicator is double that of construction companies in the V4 countries. Their Added Value on Sales indicator reaches the level of 40%. This shows that the construction industries in Germany and Austria have higher automation.

4.3. Added Value on Employees

The last indicator presents the evolution of labour productivity in the construction sector over eight years in the six selected countries. The evolution is shown in Figure 5 below, and the data used are presented in Table 4. The value added per employee indicator is given in thousands of Euros.

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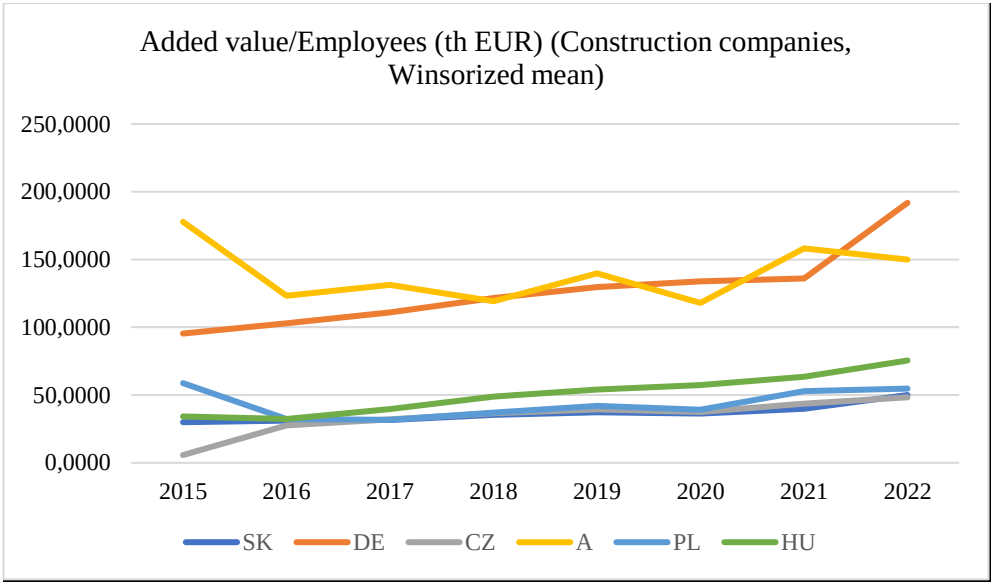


Figure 5. Added Value on Employees (construction companies)

Source: Own processing

Table 3. Added Value on Employees

AV/EMP (in EUR)	2015	2016	2017	2018	2019	2020	2021	2022
SK	29,9726	31,2161	31,7111	35,4821	37,2649	36,3387	39,8526	50,0144
DE	95,3676	102,9839	111,0045	121,7084	129,5719	133,9768	136,0767	191,8173
CZ	5,7786	27,5269	32,2000	36,5429	39,4714	37,5693	43,7285	48,3311
A	177,785	123,354	131,188	119,260	139,804	117,977	158,244	149,846
PL	58,7959	32,3670	31,7368	37,1328	41,9157	39,1097	53,0022	54,6598
HU	34,1974	32,3556	39,7267	48,9735	53,9825	57,4859	63,5678	75,4954

Source: Own processing according to ORBIS

Like the Added Value on Sales indicator, the Added Value on Employees indicator also shows that the construction industry in Germany and Austria is more advanced and performs better than construction companies in the V4 countries, including the Czech Republic. Labour productivity is also almost double in Austria and Germany, which means more automation in these two countries. As of 2018, construction companies in Austria and Germany are alternately in the first position. Construction companies in the Czech Republic are more on the lower end of the V4 countries.

Conclusions

As mentioned, the construction sector is one of the main sectors of national economies. However, the fact remains that the Czech Republic, as a member of the Visegrad Four, is below or below the Eurozone average in the construction sector. This is also reflected in the results of the above indicators. At the same time, it was found that this statement is not a direct consequence of the pandemic at the turn of 2019 and 2020 or other unforeseen events that have occurred in recent years. This trend is evident throughout the period under review, with construction companies in the Czech Republic underperforming their neighbouring countries on all selected indicators. At the same time, the Czech Republic has invested the least in construction in recent years compared to the V4 countries. Construction companies operating in the V4 countries generally show similar financial performance. The analyses show that Hungary stands out in the construction sector due to its strong growth potential in infrastructure. This reason has caused the best performance of construction companies in Hungary, as measured by the return on sales indicator. In the Czech Republic, for example, transport infrastructure is still insufficient.

The analyses clearly show a better position of construction companies in Austria and Germany as more advanced companies with a higher degree of automation, confirmed in the Added Value on Sales and Added Value on Employees indicators. A general problem in the construction industry is the lack of skilled labour, which is also true for companies in the Czech Republic. This shortage could be partly solved by using more modern technologies, and at the same time, it would cause an increase in the values of the Added Value on Employees indicator. As can be seen, this has been achieved by the construction companies in Austria and Germany.

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THE IMPACT OF WORKFORCE DIVERSITY ON JOB PERFORMANCE IN PUBLIC SECTOR ORGANISATIONS

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Abstract. The primary objective of this study is to examine the impact of workforce diversity on job performance on workload - the ability to effectively and efficiently manage, execute, and complete assigned tasks or responsibilities within an agreed timeframe and quality standard, contributing to the achievement of organisational goals. The study used the following performance indicators related to job performance and workload, i.e., timing of work assignments, quality of work, efficiency in work and ability to give feedback on work activities. Data were sourced via primary and secondary sources. The primary source used a standardised questionnaire designed to align with the study's objectives and research hypothesis using the Likert scale method. Two thousand respondents were purposively selected across the public sector organisations such as ministries, departments and public agencies (MDAs) in a select market – Nigeria. The collected data was analysed using the SPSS statistical analysis software, and the hypothesis about the impact of workforce diversity on performance was tested. The results confirm that workforce diversity significantly impacts job performance and workload as it fosters timeliness, ensures quality control in tasks completed, and promotes feedback among employees in an organisation.

Keywords: workforce; diversity; employee; performance; public sector; organisation

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JEL Classifications: D73, J45, J60, J68, J81

1. Introduction

The contemporary global landscape might metaphorically be referred to as the "global village" – a term initially coined quite a time ago in light of media globalisation (McLuhan, 1964) but later extended to describe a broader phenomenon of globalisation phenomenon wherein the unrestricted flow of persons and services across borders has fostered interconnectivity among nations. This interconnectivity has, in turn, led to the diversification of the workforce in organisations as individuals seek opportunities for improved livelihood through labour mobility. This mobility of labour consequently gives rise to different people with different backgrounds, cultures, religions, and skills (Wang et al., 2024) finding themselves together in the same workplace and environment, creating diversity in the workplace.

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Workforce diversity encompasses the differences among personnel within an organisation, particularly regarding their demographic characteristics, backgrounds, experiences, and perspectives. Shijimol (2024) defines diversity as the amalgamation of employees' distinctiveness and similarities, encompassing individual traits, values, beliefs, experiences, backgrounds, preferences, and behaviours. The diversity of the workforce at the organisation suggests that the workplace is varied in terms of gender, education, race, and ethnicity and that each employee has exceptional characteristics that set them apart. Also, there are persons from dissimilar socio-cultural (Kipane et al., 2023) origins coexisting in the office. Values and beliefs are fundamental when a cultural fit of individuals and organisations is considered – the degree of alignment between an individual's values, beliefs, and behaviours and those of the organisation. A higher fit facilitates higher job satisfaction, organisational commitment, and performance (Kristof-Brown et al., 2005). Lately, novel methods of assessing individual values and linking them with skills, learning ability and performance have been developed, such as Motival social technology (Kaže et al., 2022), thus suggesting the high topicality of such a research area. Moreover, in a broader sense, globalisation has redefined the cultural fit of individuals with more extensive social entities beyond productivity at an organisational level to impact value added to industries or even economies (Kaže et al., 2011), becoming even more impactful.

According to Amar (2023), workforce diversity refers to variations in employee characteristics such as age, cultural background, physical abilities and disabilities, race, religion, and gender. Kundu and Turan (1999) define workforce diversity as the coexistence of individuals from diverse socio-cultural backgrounds within an industry. Diversity encompasses representing individuals from various demographic backgrounds, regardless of their hierarchical positions within the industry, in a single organisational entity with shared objectives and collaborative mechanisms, e.g., institution, function, or department.

Diversity in an organisation promotes creative problem-solving and innovative ideas, as different viewpoints identify potential blind spots and generate a broader range of solutions to challenges. Diversity also brings about adaptability, as a diverse workforce is better equipped to adapt to changes and technological advancements (Malatji, 2024). Employees from diverse backgrounds may bring unique insights that help the organisation function more effectively, measured by their productivity indicators, such as job performance on workload.

The purpose of the study is to examine the impact of workforce diversity on employee job performance.

2. Conceptual and Empirical Review

Job performance on workload is a commonly used term in the human resource (HR) management industry and by HR professionals in organisations. However, the scientific literature does not provide a single origin for it. Unlike formal theories (e.g., Maslow’s hierarchy of needs or Herzberg's two-factor theory), this term has been coined for practical use through HR and organisational management decisions, strategies, and employee appraisal procedures rather than academic use. Its evolution in business is mainly related to the extent of employees meeting expectations related to assigned responsibilities, where job performance usually refers to the desired outcomes or outputs of an employee’s work efforts measured by time, quality and compliance, but workload refers to the quantity or volume of tasks and responsibilities assigned to an individual.

The authors of this study define job performance on workload as the ability to effectively and efficiently manage, execute, and complete assigned tasks or responsibilities within an agreed-upon timeframe and quality standard, contributing to achieving organisational goals.

This pertains to an employee's proficiency in accomplishing duties or projects assigned to them. It entails achieving anticipated results, producing high-quality work, and adhering to deadlines, contingent upon the quality of the employee's performance (Cho & Sultana, 2024). The timely execution of a task or responsibility assigned to an employee per the established guidelines is a critical component of job performance (Etalong & Chikeleze, 2022).

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This implies how employees effectively manage and fulfil their tasks or responsibilities within their workload, measured through these key facets that might all be influenced by workforce diversity (see Figure 1).

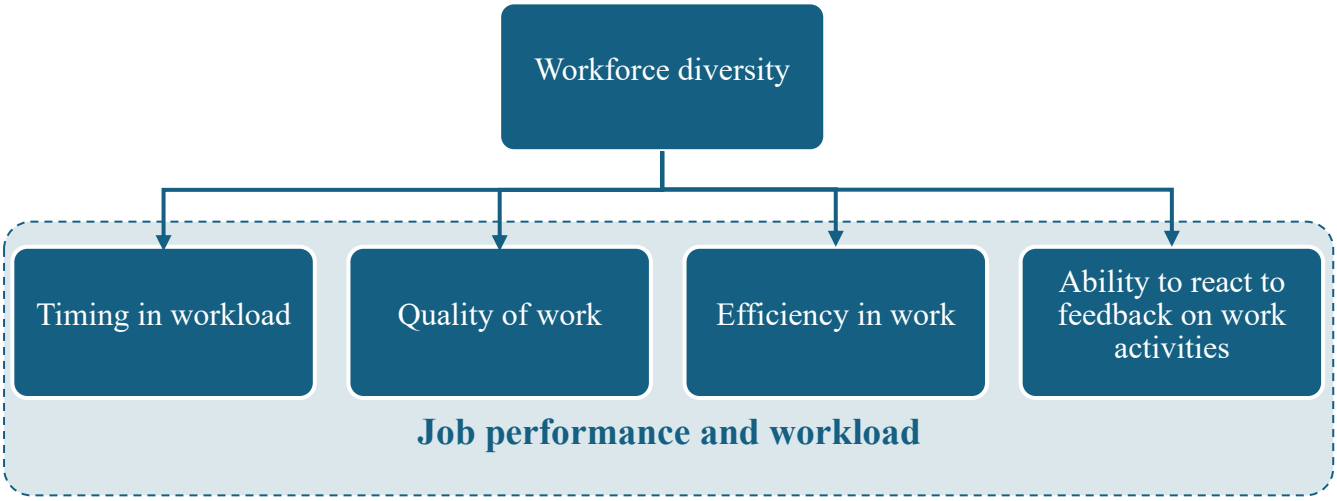


Figure 1. "Workforce Diversity – Performance on Workload" Conceptual Framework
Source: Authors' conceptualisation

Workplace diversity might involve factors such as age and ethnicity that can significantly impact employee performance and innovative efficiency. Studies conducted by Andoh et al. (2019) and Anum-Addo et al. (2024) discovered that age and educational diversity had a notable effect on employee performance; however, gender and ethnicity diversity had no discernible effect.

Mayer (2016) highlighted that workforce diversity positively influences organisational innovation by fostering a pro-diversity culture and promoting better treatment of employees, which enhances innovative efficiency. However, Kerga (2018) argued that only ethnicity significantly impacted employee performance, suggesting that the influence of diversity on performance may vary depending on the specific context. Maqsoom Ali Musarat, Mubbasit, Salah, Ashraf, Babar, and Shaheen (2023) observed that age plays a significant role in the performance of employees in a study covering construction workers where the distant location of the construction site negatively impacted older workers. A separate study by Pandey and Risal (2023) lamented that age diversity might cause conflict in the organisation as youngsters are less dedicated to their work schedule than older and experienced employees who are more devoted to their work, thereby bringing about efficiency and effectiveness in the workplace. On the other hand, young people have a more modern understanding of such sensitive topics as data security in the work process (Jurgelāne-Kaldava et al., 2024), foreign investment (Kastratović et al., 2024), conducting public procurement (Krivins, 2014; Krivins, 2019), fighting corruption (Krivins et al., 2023), cashless policy (Kaže et al., 2007), banking sector (Obeid, 2024a), impact on economic indicators (Obeid, 2024b), etc.

Schlick, Frieling, and Wegge (2013) suggest that the detrimental impact of age diversity on employee performance may be attributed to the belief that older employees may be less effective and productive due to physical decline associated with ageing. Mary, Malhotra, Goswami, Kumar, and Priya (2023) argue that organisations with a diverse workforce generally exhibit more significant levels of organisational performance, as indicated by productivity, innovation, and employee satisfaction. Similarly, Ahmed, Khan, Zaman, Ahmed, and Nabeel ul Haq (2023) support this claim by highlighting team cohesion (Sachdeva & Upadhyay, 2024). leads to enhanced efficiency and effectiveness through the interaction among team members in pursuit of organisational objectives. Rahman (2017) thoroughly examines the correlation between workforce diversity and employee performance, emphasising the influence of diversity in gender (Monteiro et al., 2024), age, ethnicity, and educational background. According to the study, ethnic diversity had the most significant influence on employee performance compared to other dimensions of workforce diversity. In their research, Haleem and

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Khalil Ur Rahman (2023) found that a diverse workforce, which includes individuals of different ages, genders, and educational backgrounds, substantially influences creativity.

The study by Racolța-Paina and Mădularu (2022) aimed to identify the perception of workforce diversity among managers (Ahiawodzi & Kumah, 2024) and team members, specifically with age diversity. The study found that older individuals contribute a wealth of experience, while younger individuals bring fresh ideas to drive the organisation's progress. Ahmad and Rahman (2019) expressed concern over the detrimental impact of age, gender, and ethnicity diversity on employees' performance. Thapa (2023) argues that workforce diversity, encompassing factors such as gender, education, and ethnicity, has a beneficial impact on organisational performance. This is because perceiving a sense of diversity inside the organisation leads to an improvement in organisational performance. A study by Larasatie et al. (2024) explores the correlation between economic and employment diversity and local/regional economic performance, mainly focusing on the collaborative efforts of ethnically diverse groups.

Mahat's (2024) study found that ethnicity moderates the relationship between age and performance. While both age and ethnicity alone positively impact performance, the interaction between ethnicity as a moderating component and age has a negative effect. A study on diversity management conducted by Ashikali and Groeneveld (2014) noted that diversity fosters group cohesion within an organisation, consequently enhancing employee performance through engagement and dedication among employees in public sector organisations. Rengers and Warner (2024) demonstrated that diversity fosters inclusion since employees from various ethnic backgrounds collaborate towards the organisation's shared objectives. Many organisations strive to effectively manage and attract a more diverse staff (Talajić et al., 2024). The workplace is evolving in tandem with the global landscape. In modern times, employees are geographically scattered throughout several cities, countries, and continents. Employees frequently engage with an expanding range of persons from many cultural backgrounds, ethnicities, religions, and sexual orientations.

Liu, Zhu, and Wang (2023) argue that the workforce has been increasingly diversified compared to the past. While organisations actively leverage workforce diversity to improve team innovation and organisational performance, it has been observed that workforce diversity also carries significant hazards, with interpersonal conflict being the most prominent. Chico et al. (2023) argue that diversity improves employees' positive attitudes towards work, and organisations also utilise diversity to promote equal treatment and behaviour among employees.

3. Research Methodology

The study employs a survey design based on a quantitative approach. It uses a structured questionnaire to collect primary data. The study deploys purposive sampling, a non-probability sampling technique, to select 2,000 purposively chosen respondents representing the public administration of a select country - respondents who are directly involved in or impacted by workforce diversity in the area, acknowledging the limitations for generalisability to the broader population. The population of the study was drawn from the following ministries, departments and agencies in the Southeast, Nigeria: Ministry of Justice, Ministry of Education, Ministry of Finance, Office of the Head of Service and Civil Service Commission. The responders were chosen based on their degree of expertise and the crucial role that the Ministries, Departments, and Agencies (MDAs) play in relation to the topic of the study.

The questionnaire measures diversity's impact on key performance indicators, including timeliness, quality of work, efficiency, and feedback related to the respective public sector area only.

Data were analysed using descriptive and inferential statistics, including regression analysis, to evaluate the relationship between workforce diversity and employee performance. Statistical tests were conducted using SPSS version 20 software to ensure the validity and reliability of the findings.

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Such a research design aids the researcher in answering the research questions using empirical data. Research design is a strategy for answering your research questions using empirical data. A well-structured design helps ensure that your methods match your research objectives and that the right method is used for data analysis. This study adopted a survey research design as it allows the researcher to collect data about opinions, behaviours, experiences, and characteristics by interacting directly with the respondents and focusing on the applied nature of the research – public sector employees and their performance on workload.

4. Data presentation and Analysis

Table 1 provides the answer to the question, "To what extent does workforce diversity impact employee workload in the following areas (Timeliness in work assignments)?"

Table 1. Timeliness in work assignments

Options		**Frequency**	**Percent**
Valid	Very High	998	49.9
	High	1,000	50
	Don't know	0	0
	Low	0	0
	Very Low	2	0.1
	Total	2,000	100.0

Source: Field survey 2024

Table 1 shows that 49.9% of the respondents noted that workforce diversity has a very high effect on employee timing of workload as employees crossbreed different ideas to handle the tasks assigned to them. A diverse workforce brings different perspectives and ideas, which can lead to more creative solutions and efficient problem-solving. This can improve processes and reduce the time required to complete tasks. 50% of the respondents also noted that diverse teams often have a wider range of skills and experiences, allowing them to tackle assignments more effectively and efficiently. This can lead to quicker turnaround times. While 1% of the responses show that the effect of diversity on employee timing on workload is very low, as organisations under review are yet to come to terms with the benefits associated with diversity and how to harness it for the betterment of the organisation.

Table 2. Quality of work

Options		**Frequency**	**Per cent**
Valid	Very High	1,028	51.4
	High	900	45
	Don't know	20	1
	Low	25	1.25
	Very Low	27	1.35
	Total	2,000	100.0

Source: Field survey 2024

Table 2 shows that 51.4% of the responses show that workforce diversity positively affects the quality of work. A diverse workforce with different skill sets in the organisation cooperates to ensure that the services rendered to the public are of standard and beneficial to the public.

45% noted that a diverse workforce includes individuals with various skills and expertise, which can improve the team's overall capability. 1.25 and 1.35% observed that the impact of workforce diversity on the quality of work is low and very low, respectively, due to the conflict that may arise in the organisation. Diverse teams might experience more conflicts due to differing perspectives and values, which requires effective conflict resolution strategies.

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Table 3. Efficiency of work

Options		Frequency	Per cent
Valid	Very High	1,000	50
	High	829	41.45
	Don't know	16	0.8
	Low	104	5.2
	Very Low	51	2.55
	Total	2,000	100.0

Source: Field survey 2024

Table 3 shows that 50% of the respondents noted that workforce diversity brings about work efficiency. In the aspect of workload management, appropriate workload distribution and management can prevent burnout and ensure employees have the resources needed to work efficiently.

41.45% observed that a diverse workforce ensures collaboration, streamlining processes and reducing unnecessary tasks, leading to increased efficiency. 0.8% opted that they don't know if workforce diversity affects employee work efficiency. 5.2 and 2.55% observed that efficiency helps in task prioritisation, whereby employees pay attention to essential tasks and set realistic deadlines to complete the tasks assigned to them.

Table 4. Effectiveness in required quality of work

Options		Frequency	Per cent
Valid	Very High	1,008	50.4
	High	817	40.85
	Don't know	19	0.95
	Low	107	5.35
	Very Low	49	2.45
	Total	2,000	100.0

Source: Field survey 2024

Table 4 shows that 50.4% noted that workforce diversity ensures effectiveness in the required quality of work. Employees are given autonomy and empowered to make decisions and take ownership of their work, which leads to effectiveness and productivity in the organisation and a quality output on the job done. 40.85% responded that effectiveness in quality of work is highly affected as it relates to the extent to which an employee completes tasks and responsibilities associated with their role, measured by both quality of work over time. 0.95% lamented that they don't know. In comparison, 5.35% and 2.45% noted that the effect of workforce diversity on employee effectiveness in required quality of work is low and very low, respectively 60.4% of the respondents are of the view that workforce diversity creates room for feedback on work done and continues to seek improvement where there are lapses. 37% also noted that employees use constructive criticism to enhance their skills and contribute to the organisation's overall success, as feedback makes this possible (see Tables 5 and 6).

Table 5. Ability to give feedback on work activities

Options		Frequency	Per cent
Valid	Very High	1,208	60.4
	High	756	37.8
	Don't know	6	0.3
	Low	10	0.5
	Very Low	20	1
	Total	2,000	100.0

Source: Field survey 2024

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Table 6. Number of tasks completed per unit of time

Options		Frequency	Per cent
Valid	Very High	1,225	61.25
	High	705	35.25
	Don't know	0	0
	Low	21	1.05
	Very Low	49	2.45
	Total	2,000	100.0

Source: Field survey 2024

61.25% of the responses show that workforce diversity results in improved processes and methodologies, increasing productivity and the number of tasks completed, as diverse organisations bring a wide range of perspectives and experiences, which can lead to more innovative solutions and efficient problem-solving. 35.25% also noted that a diverse workforce with employees of varied skills and expertise enables the team to handle a wider array of tasks more efficiently

Test of hypothesis

H_0: Workforce diversity has no significant effect on employee Responsiveness (see Tables 7 and 8).

Table 7. Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.32 (a)	.112	.806	.64515

a Predictors: (Constant), Workforce diversity

Source: created by authors, 2024

Table 8. ANOVA

Model		Sum of Squares	Df	Mean Square	F	Sig.
1	Regression	602.253	1	602.253	16.556	.000(a)
	Residual	144.845	348	.416		
	Total	747.097	349			

a. Predictors: (Constant), Workforce diversity
b. Dependent Variable: Employee responsiveness

Source: created by authors, 2024

The hypothesis that stated that "Workforce diversity has no significant effect on employee Responsiveness" where responsiveness ("Ability to act on feedback for work activities" of the framework, see Figure 1) was rejected for the following reasons:

i. at R=0.32, R^2=0.11, F (1, 349) =16.556; p<.05. The null hypothesis is therefore rejected. This implies a positive impact of Workforce diversity on employee responsiveness;
ii. based on the premise that workforce diversity substantially impacts employee responsiveness.
iii. By implementing effective techniques, organisations can utilise diversity to enhance their overall adaptability and effectiveness. The discovery aligns with the research conducted by Sanyang & Othman (2019), Andoh et al. (2019), Khan et al. (2019), and Larasatie et al. (2024), which all concluded that having a diverse workforce improves productivity and provides a competitive

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advantage. Additionally, it empowers employees to take responsibility for job satisfaction and strive for optimal performance.

5. Conclusions and Discussion

The results show that workforce diversity affects job performance. Workforce diversity significantly improves job performance through enhanced creativity, better decision-making, and greater employee engagement. This is made possible with a strong inclusive policy on the ground, which is lacking in the organisations under review. Therefore, there is an urgent need for inclusive leadership; leaders should be committed to diversity and inclusion, setting the tone from the top and modelling inclusive behaviours to promote teamwork and collaboration among employees.

In this context, the most critical issue is the relationship between organisational culture and human resource management practices. The higher the level of employee involvement, the greater the chance of positively impacting practice, control and assistance. At the same time, although employee activity and taking responsibility are interrelated, this correlation is not statistically significant. Organisational effectiveness is assessed in terms of efficiency, innovative innovations, employee quality, and satisfaction. Appropriate design of the workplace, implementation of proper supervisory practices and appropriate remuneration have a positive and significant impact on improving organisational performance. If the work allows the employee to use all his abilities, he is satisfied and interested. This, in turn, leads to improving the organisation's performance, increasing its effectiveness in achieving its goals. In addition, proper work planning allows employees to take initiative and develop their abilities and ideas.

The problem of supervising employees is very complex. On the one hand, under supervision, employees feel supported and safe and can take the initiative and solve work issues. Employees know that when they need help, they can turn to their manager, who will provide appropriate instructions for solving the problem. In this context, employee satisfaction and efficiency may increase. On the other hand, excessively close supervision reduces employee satisfaction, which may decrease productivity - especially when they feel that they are closely watched and cannot take the initiative to solve work issues in their way. This creates a negative impact on the efficiency of the organisation. Strict control over employees is perceived as a lack of trust. Strict control exerts pressure, and employees may feel they are not allowed to take responsibility. Therefore, it is necessary to develop proper supervision and control practices not to reduce employee performance. In turn, further research is needed to identify the reasons employees reduce their productivity.

The issue of motivation and rewards has different solutions. For example, an organisation that consistently follows its reward system can incentivise employees to improve their efficiency constantly. This can subsequently improve overall organisational efficiency. However, for many employees, material rewards will not be too significant a motivation compared to satisfaction from the work done. A separate aspect of the problem is competition. Often, many organisations do not treat their employees as an advantage over competing organisations. Therefore, they do not invest in improving the abilities and skills of employees and do not try to create a positive working climate. How an organisation and human resources are managed is, to some extent, influenced by the culture of a particular country and the culture of a particular industry. However, there are effective management practices everywhere - for example, a good working environment, careful work planning, supportive control over employees, promoting cooperation, rewarding, and showing initiative.

6. Novelty of the Research

There are several novel elements in the study. First, we distinguished job performance and workload, terms not frequently used together in business practice. Second, we developed an original Workforce Diversity - Performance and Workload framework (Figure 1), and we enriched the research models used before by adding additional dimensions, such as the ability to act on feedback for work activities (responsiveness). To investigate the extent to which effectiveness influences the other dimensions, it was important to verify whether good HR practices exist and which can be used in different countries despite different national cultures. The study's

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objectives were achieved based on the selected model, mainly because the model included various dimensions and was limited to public administration within a select single country.

7. Limitations and Recommendations for Further Research

Our study applies according to a specific organisation's needs and capabilities. It contributes to improving the effectiveness of achieving the organisation's goals - organisational development, customer and employee satisfaction, innovation, and quality improvement. This study makes a theoretical contribution to the existing knowledge of HR management and offers a practical application of the theory.

However, the study has its limitations. Our research framework is limited to a specific region (a select market in Nigeria where a field survey was implemented). The selected model allowed us to understand the differences in detail, although the analysis was quite tricky and might show varied results across multi-market setups. We acknowledge this limitation and recommend further research to test and deploy the model in a broader perspective of wider, economically and culturally diverse markets. Future studies could apply the design and methodology of this study, extending it to different regions of the world and examining also different industries and organisations, including the private sector. Another limitation of this study is the reasons that lead employees to a particular perception of reality and behaviour, where values and attitudes-based technologies such as Motival (Kaže et al., 2022) might be deployed as a particularly efficient approach for better understanding the diversity and related motivations. Although many limitations might exist, the study provides valuable insights for further exploration of the realms.

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ASSESSING THE IMPACT OF ECONOMIC AND ENERGY FACTORS ON CO_2 EMISSIONS: A CASE STUDY OF SAUDI ARABIA

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Abstract. This study seeks to evaluate the applicability of the Environmental Kuznets Curve (EKC) hypothesis in the Saudi Arabian context, a country characterized by its oil-dependent and resource-abundant economy from 1980 to 2022. This study provides insights into Saudi Arabia's progress towards sustainable development by exploring the relationship between CO_2 emissions per capita and economic, demographic, and energy-related factors. The primary objective is determining whether economic growth aligns with environmental sustainability, as outlined in Vision 2030. Utilizing an Autoregressive Distributed Lag (ARDL) model, this study evaluates the short- and long-term relationships between CO_2 emissions per capita and independent variables, including GDP per capita, the squared term of GDP per capita, foreign direct investment (FDI) per capita, energy production per capita, trade openness, and population growth. These findings confirm the existence of an inverted U-shaped relationship between GDP per capita and CO_2 emissions, thereby supporting the EKC hypothesis. Energy generation and population growth significantly contribute to higher pollution levels, and trade openness and FDI positively impact environmental quality by reducing CO_2 emissions. These results highlight the importance of Vision 2030, which emphasizes attracting foreign investment, promoting trade liberalization, and transitioning to renewable energy. This study underscores the need for policymakers to implement comprehensive strategies that support economic growth while achieving long-term environmental sustainability. These findings enhance the understanding of emission dynamics in resource-rich nations and offer valuable guidance for sustainable development planning.

Keywords: Environmental Kuznets Curve (EKC); CO_2 Emissions; trade openness; energy generation; Foreign Direct Investment

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JEL Classifications: Q01, Q56, Q5

1. Introduction

The Environmental Kuznets Curve (EKC) hypothesis outlines a nonlinear relationship in which economic growth initially exacerbates environmental degradation. Still, this trend shifts towards improvement at higher income levels (Banday & Ismail, 2017). It posits that environmental damage typically increases during the early stages of economic development yet declines in the long run as a country achieves higher income levels. Initially, economic growth contributed to rising pollution due to limited investment in cleaner technologies. However, as income levels rise, opportunities to adopt sustainable practices emerge, resulting in enhanced environmental quality over time. In the nascent stages of growth, capital is predominantly allocated to production rather than pollution control. As income grows, the demand for environmentally friendly products has escalated, prompting increased investment in pollution mitigation overproduction. Like other resource-rich nations, Saudi Arabia strives to balance economic growth with sustainability, guided by Vision the 2030s commitment to attaining net-zero emissions by 2030 (Sarwar et al., 2021). This study examines Saudi Arabia's

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economic data from 1980 to 2022, emphasizing significant transformations, particularly under the auspices of Vision 2030. Historically, Saudi Arabia's economy has depended significantly on hydrocarbons, with GDP trends closely tied to fluctuations in global oil prices (Figure 1). As of 2023, the country is the third-largest oil producer, a leading exporter, and a key player in OPEC, representing 40% of the Middle East's oil consumption and ranking fifth worldwide in liquid fuel consumption (U.S. Energy Information Administration, n.d.). Vision 2030 emphasizes enhancing electricity generation through natural gas and renewable sources (Figure 2). Remarkably, renewable energy experienced a growth of 153% between 2022 and 2023, although it still accounts for less than 1% of the total energy mix (U.S. Energy Information Administration, n.d.). By 2030, Saudi Arabia aims to generate 50% of its electricity from renewable sources, bolster energy security, diminish reliance on fossil fuels, and fulfil environmental objectives (Berradia et al., 2023). Developing solar and wind energy is expected to decrease domestic oil consumption, increase exports, and yield significant economic benefits (Al Shammre, 2024). CO_2 emissions closely mirror fossil fuel usage, and the shift towards renewable energy has considerable potential for mitigation (Figure 3). The country's trade openness, primarily driven by oil exports, facilitates its integration into global markets, although it remains less extensive than that of more diversified economies, such as Singapore (Figure 4). Saudi Arabia's exports mainly comprise crude oil, refined petroleum, and petrochemicals, with Asia being the leading destination. By contrast, imports include machinery, vehicles, and food products that are essential for industrialization and domestic consumption (U.S. Energy Information Administration (EIA), n.d..; Sultan & Haque, 2018). Historically, foreign direct investment (FDI) inflows have focused on oil, petrochemicals, and infrastructure from major economies. Recently, reforms have targeted emerging sectors such as renewables, tourism, and entertainment, aligning with diversification goals and strategically reducing oil dependency (Mahmood & Alkhateeb, 2018; Samargandi et al., 2022). The researcher highlights several key features in this study that set it apart from prior examinations of the Environmental Kuznets Curve (EKC) hypothesis in Saudi Arabia. This study covers a broader and more contemporary timeframe that reflects the country's significant economic development and environmental initiatives. As a leading oil producer and exporter, Saudi Arabia has historically depended on abundant natural resources for economic growth. However, this reliance has resulted in considerable CO_2 emissions, making the country one of the most prominent global emitters. In response, the nation introduced Vision 2030, aimed at diversifying the economy and promoting sustainability through renewable energy and environmental reforms. This study integrates factors such as foreign direct investment (FDI), population growth (POP), trade openness (TRADE), and energy production (EP) into a comprehensive model. Unlike prior studies that focused on energy consumption, this research emphasizes energy production, thereby addressing inefficiencies related to transmission and distribution. Moreover, these research results confirm the EKC hypothesis in Saudi Arabia from 1980 to 2022, showing that CO_2 emissions initially rise with economic growth but decrease at higher income levels. Energy production and population growth increase pollution, whereas FDI and trade openness help reduce emissions. This study underlines the importance of Vision 2030 strategies in transitioning to renewable energy, attracting foreign investment, liberalizing trade, and promoting sustainable development. These findings highlight the need for resource-rich nations to balance their economic growth with environmental stewardship. This paper is structured into four main sections: theoretical background, research objectives and methodology, results and discussion, and conclusions.

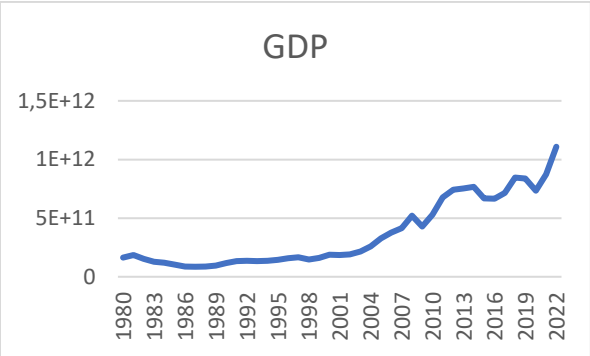


Figure 1. GDP of Saudi Arabia from 1980 to 2022
Data Source: World Bank

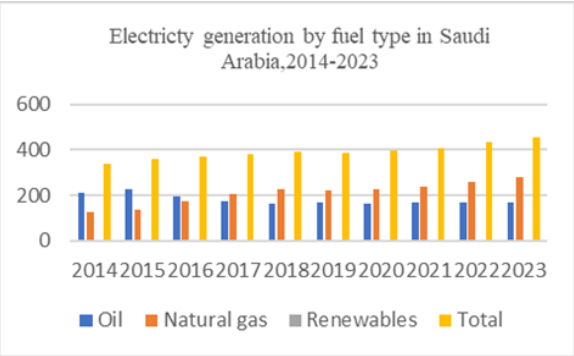


Figure 2. Electricity generation in Saudi Arabia.
Data Source: EIA

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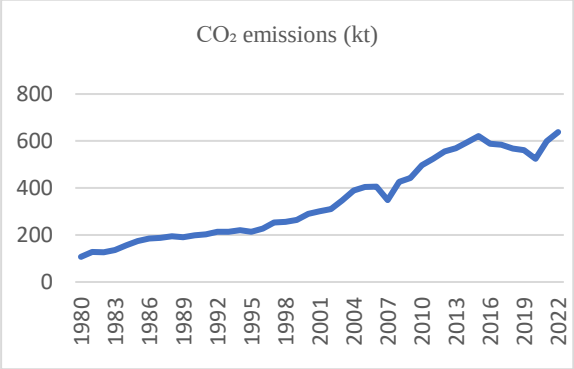


Figure 3. CO_2 emissions in Saudi Arabia
Data Source: EIA

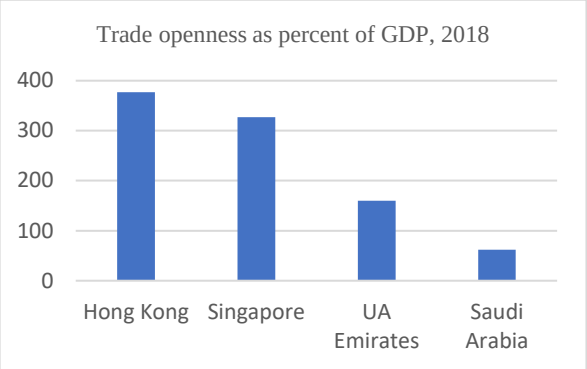


Figure 4. Trade openness
Data Source: the Global economy

2. Theoretical Background

Numerous studies have investigated the EKC hypothesis to explore the relationship between economic growth and carbon dioxide emissions. These studies utilized a range of variables and methodologies to analyze these connections. This paper is organized the existing research into two sections. The first examines studies that use panel data, whereas the second focuses on those that employ time-series data.

The first part of previous studies focused on analyzing panel data to examine the EKC hypothesis. Banday and Ismail (2017) evaluated panel data for the BRICS countries from 1995 to 2013, focusing on tourism revenue, economic development, and carbon emissions. Their findings confirm the EKC hypothesis, highlighting that while developing countries implement policies for long-term environmental improvement, economic growth can harm the environment in the short term. Similarly, Arouri et al. (2012) used panel error correction models (ECM) to study energy usage, GDP, and CO_2 emissions in the MENA region from 1981 to 2005. It was found that energy utilization significantly increased pollution in the long run, and the EKC hypothesis was confirmed for the region. However, Jebli et al. (2014), analyzing data from sub-Saharan African countries between 1980 and 2010, found that the EKC hypothesis did not hold in these economies. The results showed that while GDP per capita reduced CO_2 emissions in the long term, the squared term of GDP per capita positively affected emissions.

The second part of previous studies focused on those using time-series data to explore the EKC hypothesis. Sinha et al. (2017) analyzed India from 1971 to 2015 and found that renewable energy adoption significantly reduced pollution and confirmed an inverted U-shaped EKC pattern. Shahbaz et al. (2015) studied Portugal from 1971 to 2008, revealing that energy use, urbanization, and trade openness increased CO_2 emissions, with pollution declining after income reached a certain threshold. Shahbaz et al. (2014) validated the EKC hypothesis in the UAE (1975–2011), noting that electricity use and exports supported environmental sustainability, while urbanization increased emissions. Al-Mulali et al. (2014) found that the EKC did not apply in Vietnam (1981–2011), as fossil fuel use drove pollution, while renewable energy had little effect. Conversely, Al-Mulali et al. (2015) confirmed the EKC in Kenya (1980–2012), showing that fossil fuels, urbanization, and trade openness worsened pollution, whereas renewable energy improved sustainability. Mahmood et al. (2019) validated the EKC in Egypt (1990–2014), finding that energy use harmed the environment, while FDI had a positive impact. Numerous studies have examined the relationship between economic growth and environmental quality in Saudi Arabia, with mixed findings on the EKC hypothesis. Alruweili (2023) identified a nonlinear relationship between economic growth and environmental degradation, where emissions initially rise with economic growth but decline after reaching a certain threshold from 1981 to 2017. Trade openness and energy use have been highlighted as the key drivers of CO_2 emissions. Omri et al. (2018), analyzing data from 1990 to 2014, found that per capita income initially increased emissions but reduced them after surpassing a threshold, supporting the EKC hypothesis. Similarly, Alsaedi et al. (2022) confirmed the EKC hypothesis for 1980–2018, citing GDP and energy use as the major contributors to emissions. Mahmood and Alkhateeb (2017) validated the EKC hypothesis for 1970–2016, noting that trade reduced pollution. In contrast, Asif (2017) found no evidence supporting the EKC hypothesis in Saudi Arabia from 1971–2011.

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Previous studies on the EKC framework in the context of Saudi Arabia have relied on outdated time series data. This highlights the necessity for more recent research that considers the impact of Saudi Vision 2030 on both the economy and the environment. In contrast, this study analyzed data up to 2022 and evaluated the EKC while considering factors that previous research did not address. The findings will help policymakers identify elements that negatively impact the environment as well as those that can foster both environmental quality and economic growth.

3. Research Objective and Methodology

3.1. Model Specification

This study investigates the upside-down U-shaped correlation between economic growth and pollution in Saudi Arabia following Panayotou's (1997) generalized EKC hypothesis. The model incorporates squared GDP per capita (GDP^2) as an explanatory variable for CO_2 emissions per capita (CO_2). Furthermore, the study seeks to identify the key determinants of CO_2 emissions, including trade openness (TRADE), energy generation per capita (EP), foreign direct investment per capita (FDI), and population growth (POP). Based on the EKC hypothesis, rising GDP is associated with increased CO_2 emissions during the early phases of economic development. At this stage, countries invest more in producing goods and services than in pollution abatement. However, countries tend to allocate more resources towards pollution control than production as income levels rise. The following equation supports the EKC hypothesis and identifies the contributors to CO_2 emissions:

$$CO_2t=f\ (GDPt,\ GDP^2t,\ EPt,\ FDIt,\ POPt,\ TRADEt) \quad (1)$$

Time-series data from Saudi Arabia, covering 1980 to 2022, were analyzed using the ARDL approach to test the EKC hypothesis. Before estimating the model, an Augmented Dickey-Fuller test was conducted to ensure that all the variables were integrated at the first or second difference. After confirming the stationarity of all the series, the ARDL model was estimated using the method outlined by Pesaran et al. (2001). The estimated model is expressed as follows:

$$\Delta CO_2t=\beta0+\beta1\ CO_2t\text{-}1+\beta2\ GDPt\text{-}1+\beta3\ GDP^2t\text{-}1+\beta4\ EPt\text{-}1+\beta5\ FDIt\text{-}1+\beta6\ TRADEt\text{-}1+\beta7\ POPt\text{-}1+\sum\delta1j\ \Delta CO2t\text{-}j+\sum\delta2j\ \Delta GDPt\text{-}j+\sum\delta3j\ GDP^2t\text{-}j+\sum\delta4j\ EPt\text{-}j+\sum\delta5j\ FDIt\text{-}j+\sum\delta6j\ TRADEt\text{-}1+\sum\delta7j\ POPt\text{-}j+\psi t \quad (2)$$

An F-bound test was performed to assess the existence of cointegration. The null hypothesis for Equation 2 is H0: $\beta1 = \beta2 = \beta3 = \beta4 = \beta5 = \beta6 = \beta7 = 0$. If the F-bound test statistic surpasses the upper bound of the critical value, it provides evidence of cointegration. The short-run model was estimated using the following approach:

$$\Delta CO_2t=\beta0+\sum\gamma1j\ \Delta CO_2t\text{-}j+\sum\gamma2j\ \Delta GDPt\text{-}j+\sum\gamma3j\ GDP^2t\text{-}j+\sum\gamma4j\ EPt\text{-}j+\sum\gamma5j\ FDIt\text{-}j+\sum\delta\gamma6j\ TRADEt\text{-}1+\sum\gamma7j\ POPt\text{-}j+\upsilon\ ECTt\text{-}1+\psi t \quad (3)$$

where υ is the coefficient of the error correction term (ECT), and a short-run relationship between the variables exists if υ is negative and significant. The parameters of the difference variables captured the short-run effects.

3.2. Data

Time-series data for Saudi Arabia from 1980 to 2022 were obtained from the World Bank for GDP per capita, population growth, and foreign direct investment per capita, while CO_2 emissions per capita and energy generation data were obtained from the Energy Information Administration (EIA). CO_2 emissions, measured in metric tons, serve as the dependent variable representing pollution, while GDP per capita (in constant 2010 USD) is the primary independent variable measuring economic growth. To test the EKC hypothesis, GDP is expected to initially increase CO_2 emissions, with GDP squared (GDP^2) capturing the inverted U-shaped relationship proposed by Panayotou (1997). Previous studies such as those by Sinha et al. (2017), Alajmi (2022), and Arouri et al. (2012) found that an increase in GDP initially contributes to an increase in pollution, eventually leading to environmental improvement. Unlike most EKC studies focusing on energy consumption, this

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research follows Alajmi (2022) by using energy production to minimize transmission losses. Energy generation is assumed to drive CO_2 emissions, whereas FDI is expected to reduce them, aligning with Mahmood et al. (2019). Population growth is considered a factor in increasing emissions, which is consistent with the findings of Alajmi (2022). Additionally, trade openness is assumed to enhance environmental quality, building on Mahmood and Alkhateeb (2017).

4. Results and Discussion

4.1. Descriptive and Summary Statistics

Table 1 presents the descriptive data analysis for a dataset of 43 observations from Saudi Arabia from 1908 to 2022. The dependent variable, CO_2 emissions per capita (CO_2), ranged from 1.05E-05 to 1.90E-05, with a mean of 1.44E-05 and a standard deviation of 2.36E-06. The independent variables include GDP per capita (GDP) from 5998.224 to 30447.88; energy production per capita (EP) from 3.44E-08 to 1.20E-06, foreign direct investment (FDI) from -1310.558 to 428.4983, population growth (POP) from -0.129847 to 4.934164, and trade openness (TRADE) from 0.497135 to 0.961026. The Jarque-Bera test indicates that CO_2, GDP, POP, and TRADE are normally distributed, whereas EP, FDI, and GDP^2 are not. The Durbin-Watson test showed an observed value of 0.547091, indicating positive serial autocorrelation. Autoregressive models, such as the autoregressive distributed lag (ARDL) model, have been proposed to address this issue.

Table 1. Descriptive data analysis.

	CO_2	EP	FDI	GDP^2	GDP	POP	TRADE
Mean	1.44E-05	8.32E-07	-173.2834	2.40E+08	13901.56	3.080331	0.725487
Median	1.36E-05	8.73E-07	-19.01907	1.21E+08	10997.05	2.798785	0.695039
Maximum	1.90E-05	1.20E-06	428.4983	9.27E+08	30447.88	4.934164	0.961026
Minimum	1.05E-05	3.44E-08	-1310.558	35978694	5998.224	-0.129847	0.497135
Std. Dev.	2.36E-06	2.83E-07	404.0153	2.21E+08	6885.137	1.194761	0.119063
Skewness	0.330564	-1.906703	-1.252623	1.059702	0.553896	-0.335760	0.337089
Kurtosis	1.794855	6.188747	3.927041	3.387324	2.000649	2.836340	2.094669
Jarque-Bera	3.385292	44.27239	12.78472	8.316725	3.988080	0.855922	2.282836
Probability	0.184032	0.000000	0.001674	0.015633	0.136144	0.651837	0.319366
Sum	0.000618	3.58E-05	-7451.186	1.03E+10	597767[.0	132.4542	31.19595
Sum Sq. Dev.	2.35E-10	3.35E-12	6855592.	2.05E+18	1.99E+09	59.95309	0.595394
Observations	43	43	43	43	43	43	43
Durbin-Watson stat	0.547091						

4.2. Model Estimation

Table 2 presents the results of the Augmented Dickey-Fuller test performed to assess the stationarity of data. The findings indicate that all variables achieve stationarity at the first difference I(1) across three scenarios: intercept, intercept, and trend, and none, all at the 1% significance level. Thus, an ARDL model was applied. Following this, an F-bound test for cointegration was performed, and the results are shown in Table 3. The calculated F-statistic value of 8.966375 exceeds the critical value bounds at the 1%, 5%, and 10% significance levels. This finding indicates the presence of an equilibrating relationship, suggesting a long-run association and confirming the existence of cointegration. The diagnostic tests summarized in Table 3 confirm the robustness and reliability of the ARDL model. The Jarque-Bera test ($p = 0.9889$) indicated that the residuals followed a normal distribution, validating the model's statistical inferences. The Ramsey RESET test ($t = 0.5166$, $p = 0.6179$; $F = 0.2669$, $p = 0.6179$) confirmed that the model was correctly specified with no omitted variables. The Breusch-Godfrey serial correlation LM test shows no evidence of serial correlation up to two lags, and the Breusch-Pagan-Godfrey test supports the presence of homoscedasticity. Finally, Figure 5 shows the CUSUM test results, indicating that the model's parameters remain stable over time, as the test statistic is within the critical bounds. The goodness-of-fit measures in Table 4 indicate that the ARDL model explains 99.71% of the variance in CO_2 emissions, with an R-squared value of 0.9917 and an Adjusted R-squared value of 0.9685. Prob(F-statistic) = 0.000000 confirmed the model's overall significance. The Akaike Information

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Criterion (AIC = -26.49915) and Schwarz Criterion (SC = -25.26214) reflect model efficiency, whereas the Durbin-Watson statistic (2.567863) indicates no residual autocorrelation.

Table 2. Results of unit root tests

variable	Augmented Dickey-Fuller test statistic					
	Level			1st diff		
	intercept	trend and intercept	non	intercept	trend and intercept	non
CO_2	-1.500844			-6.517977***	-6.411793***	-6.464136***
EP	-3.198252**	-7.855783***	-0.201146	-6.066605***	-5.525515***	-6.385660***
GDP	0.514728			-4.180204***	-4.997954***	-4.249474***
GDP^2	1.083403			-4.567223***	-5.421937***	-4.370751***
FDI	-2.569519			-5.935461***	-5.789773***	-5.984618***
TRADE	-1.913183			-4.709999***	-4.676644***	-4.720244***
POP	-1.218834			-5.960843***	-5.778015***	-5.749734***

*** indicates significance at the 1% level, while ** denotes significance at the 5% level.

Table 3. Diagnostic tests

Serial Correlation: Breusch-Godfrey Serial Correlation LM Test:	F-value=1.095469	P-value=0.3798
Heteroskedasticity Test: Breusch-Pagan-Godfrey	F-value=2.646810	P-value=0.0540
F-Bounds test	F- value =8.966375 Critical F-values: At 10% (2.940), 5% (3.280), 1% (3.990)	
Jarque-Bera test for residuals normality	Jarque-Bera test =0.0222 p-value= 0.9889	
Ramsey RESET Test	T-Value= 0.5166 , P-value= 0.6179 F-Value= 0.2669, P-value= 0.6179	

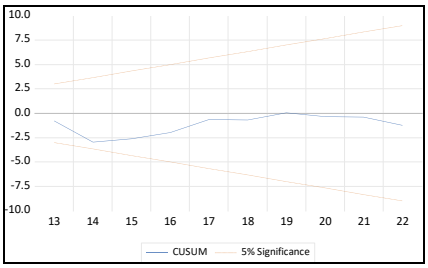


Figure 5. CUSUM test

Table 4. Goodness of fit

Goodness of fit	
R-squared=0.991711	Prob(F-statistic)=0.000000
Adjusted R-squared=0.968503	Mean dependent var=1.47E-05
S.E. of regression=4.00E-07	S.D. dependent var2.25E-06
Sum squared resid=1.60E-12	Schwarz criterion=-25.26214
Log likelihood=545.7334	Hannan-Quinn criter.=-26.05532
F-statistic=42.73138	Durbin-Watson stat=2.567863
Akaike info criterion (AIC)=-26.49915	

Table 5 summarizes the ARDL analysis results for Equations 2 and 3, revealing the long- and short-term relationships among the variables.

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Table 5. Results of ARDL cointegration

Variable	Coefficient	Std.Error	t-Statistic	Prob.
Long Run				
EPt	60.31351	25.71973	2.345029	0.0254
GDPt	5.72E-09	2.38E-09	2.402400	0.0223
GDP^2t	-1.38E-13	6.20E-14	-2.227906	0.0330
FDIt	-1.84E-08	8.18E-09	-2.252118	0.0313
TRADEt	-6.44E-05	3.19E-05	-2.022182	0.0516
POPt	4.25E-08	8.97E-07	0.047370	0.9625
Intercept	-3.92E-05	2.20E-05	-1.780190	0.0845
Short Run				
D(GDP)	1.00E-09	1.71E-10	5.859135	0.0000
D(GDP(-1))	-4.96E-09	4.30E-10	-11.53467	0.0000
D(GDP(-2))	-2.33E-09	2.95E-10	-7.880564	0.0000
D(GDP(-3))	-2.39E-09	2.68E-10	-8.906597	0.0000
$D(GDP^2)$	-3.05E-14	4.23E-15	-7.218660	0.0000
$D(GDP^2(-1))$	1.06E-13	9.49E-15	11.17580	0.0000
$D(GDP^2(-2))$	3.97E-14	6.56E-15	6.046499	0.0000
$D(GDP^2(-3))$	5.50E-14	6.60E-15	8.330466	0.0000
D(FDI)	2.51E-09	4.84E-10	5.188896	0.0001
D(FDI(-1))	2.78E-09	6.02E-10	4.612973	0.0002
D(FDI(-2))	6.75E-09	6.79E-10	9.940191	0.0000
D(EP)	16.29577	1.557487	10.46286	0.0000
D(EP(-1))	-2.512196	0.559110	-4.493205	0.0003
D(TRADE(-1))	4.64E-05	4.06E-06	11.42178	0.0000
D(TRADE(-2))	3.25E-05	3.25E-06	10.00825	0.0000
D(TRADE(-3))	2.11E-05	2.32E-06	9.133300	0.0000
D(POP)	6.70E-07	1.65E-07	4.065896	0.0008
D(POP(-1))	-1.12E-06	2.09E-07	-5.379503	0.0000
ECT t-1	-0.332636	0.030123	-11.04277	0.0000

In the long run, GDP positively impacts CO_2 emissions ($p < 0.05$), while GDP^2 has a significantly negative effect, supporting the EKC hypothesis in Saudi Arabia. Similar findings are noted in studies by Alruweili (2023), Omri et al. (2018), and Mahmood et al. (2017). Energy production (EP) significantly increases CO_2 emissions at the 5% level, reflecting the country's reliance on fossil fuels (EPA, 2023) and aligning with Alajmi (2022). FDI significantly reduces CO_2 emissions ($p < 0.05$), consistent with Mahmood et al. (2019), highlighting the need for policies that attract FDI to boost economic and environmental outcomes. Trade also negatively impacts CO_2 emissions at the 10% level, as supported by Mahmood et al. (2017). Population (POP), however, showed no significant impact on CO_2 emissions, possibly because of the time frame of the analysis, suggesting that a more extended study period may provide more precise insights. In the short run, GDP, GDP^2, FDI, and TRADE significantly affect CO_2 emissions, with EP contributing to higher emissions. The error correction term (ECT) of -0.332636 is negative and statistically significant at the 1% level, indicating that 33.26% of the deviations from equilibrium are corrected within one period. These findings suggest that over time, CO_2 emissions in Saudi Arabia decrease as income rises, underscoring the importance of transitioning to renewable energy sources such as biofuels, hydrogen, wind, and solar power to improve environmental quality.

Conclusions

This study applied the Environmental Kuznets Curve (EKC) hypothesis to assess the impact of economic growth, energy production, population growth, foreign direct investment (FDI), and trade openness on CO_2 emissions in Saudi Arabia from 1980 to 2022. The ARDL model was used to estimate the variables' short- and long-term relationships. The findings confirm the EKC hypothesis for Saudi Arabia during this period, aligning with the Vision 2030 targets for promoting economic and environmental sustainability. This study found that energy production, primarily from fossil fuels, increases pollution. Additionally, population growth is linked to higher CO_2 emissions. Conversely, the findings of this study indicate that FDI and trade openness enhance environmental quality. These results may encourage policymakers to continue implementing the plans outlined in Vision 2030, which aim to increase the use of renewable energy across various sectors, attract more foreign

investment, and ease trade regulations. Governments can foster economic growth by pursuing these strategies while prioritizing environmental conservation.

Among the limitations of this study is the potential influence of the COVID-19 lockdown on the emissions data. Like many other countries, Saudi Arabia likely experienced a decline in economic activity and emissions during the pandemic, which may have distorted the results in the post-2020 period. Future research could mitigate this issue by examining pre- and post-pandemic data to understand long-term trends and effects better.

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BRIDGING EXPECTATIONS: EXPLORING EMPLOYEE AND EMPLOYER ATTITUDES TOWARDS HR DIGITALIZATION*

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Abstract. The purpose of the present study was to reveal workers' and employers' attitudes and expectations when introducing new technologies for human resource (HR) management needs using ample primary data collected in Bulgaria. Our findings unequivocally showed that employees demonstrate, in general, trust in the latest technologies and Artificial Intelligence in the field of human resources. The paramount trust is in these systems' career development decisions, followed by rewards and incentives. Despite the demonstrated initial trust in the capacity of these new technologies in several crucial HR processes, such as recruitment and career development, when it comes to the overall evaluation of work performance, employees prefer human decisions based on the collected from the system information. At the same time, employers have two significant challenges in implementing new technologies and AI in HRM – high costs and concerns with the cyber security of personal sensitive data. However, the decision to further AI integration in HRM remains purely financial for most employers.

Keywords: digitalization; business organization; human resource management; Bulgaria

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JEL Classifications: O15, M10, M50

1. Introduction

Today's world is digital – every aspect of our personal and professional life reflects in digital reality – regardless of whether it is personal social media profiles or institutional digitalization efforts. The benefits of being digital for an organization are undeniable and complex – improved overall organizational performance, better efficiency, good public image, satisfied customers, etc. On the other hand, investments in digitalization should not be neglected, and the management of an organization should very carefully assess the right moment for its implementation.

Digitalization has won its apologists and critics in human resources in recent years. On the one hand, it could significantly help the management, from the selection process of new employees through improved time planning and task performance to data analysis for career development and specific training needs. In other words

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– the digitalization process in the field of human resources has the potential to lead management to a whole new level in relation to employer-employee.

At the same time, digitalization and, more specifically, some forms of algorithmic management have controversial practices, especially in human resource management. These contradictory aspects, which affect to no small extent part of the fundamental human rights, are the reason for rethinking the European legislation and for developing a special directive to ensure their compliance in using algorithmic practices in human resources management.

Our research is situated in this context, which aims to understand the opinions and attitudes of employers on the one hand and the opinions and attitudes of employees on the other hand regarding the digital transformation and the increasing use of Information and communication technologies and artificial intelligence in human resources management. Comparing employers' opinions with their employees' expectations and opinions will give the necessary direction for further development and elaboration of specific strategies for managing human resources in a digital environment.

2. Literature review

Human resource management (HRM) has always been the focus of scholarly interest, which is understandable given the key role and importance that employees have to the overall performance of an organization. In the modern business world, where there is exceptionally intense competition between companies in the concrete sector of the economy, the products and services offered to consumers' attention are ultimately slightly different. Therefore, the people working in the business organization become a valuable resource since they can provide the company with its much-needed competitive advantage and distinguish it in the ocean from other offered goods and services. In this line of consideration, HRM is one of the usual scholarly topics in the field of management, and its new discussion could be found, namely in digitalization and application of new technologies such as Artificial Intelligence (AI), algorithmic management, Internet of Things (IoT), Human Resource Information Systems (HRIS). At the same time, these aspects of HRM come with topics such as digital leadership, digital HRM strategies, digital employee performance, etc.

Human Resource Management Systems (HRIS) and their development are the most direct link in the transformation process from traditional human resources management to increasingly digitally structured business organizations. In this regard, Avey and Holley (2024) argue that business organizations are capable of, and indeed should be, incorporating elements of positive organizational behaviour into these systems. They believe positive psychological capital is a key aspect of positive organizational behaviour. It can address several critical contemporary challenges, including enhancing remote workforce engagement, advancing diversity, equity, and inclusion initiatives, and revitalizing employee well-being programs (ibid). The research of Ololade, Paul, Morenike and Esitse (2023), devoted to using HRIS, reveals that information from workforce planning, performance appraisals, and succession planning predicts employee behavioural outcomes. The study concludes that key barriers to successful HRIS implementation include management apprehension, concerns about employee privacy, internal organizational resistance, and the costs associated with system conversion (ibid).

In this regard, Anguelov and Kostev (2022) claim that the capabilities offered by HRIS largely determine the effective and efficient management of human capital. Therefore, according to the authors, enhancing the skills and competencies of entrepreneurs and managerial staff is crucial, emphasizing training to maximize the effective use of HRIS. This opinion is shared by Núñez, Ancillo, Gavrila and Gandía (2024), who admit that organizations and universities could provide relevant training and digital tools to foster innovation and enhance decision-making capabilities. This will equip and prepare the next generation of human resources and business leaders to effectively navigate future challenges (ibid). Liu (2023) combines the benefits of HRIS with Data Mining Technology, aiming to improve the quality and efficiency of HRM, especially in predicting future personnel flow of the enterprise. The author claims that based on the used model and data mining, the prediction accuracy rate is very high - over 95%.

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Ruiz, Benitez, Castillo and Braojos (2024) admit that the advent of technological mediation has significantly transformed both the design and operational aspects of work. The authors employ a sociotechnical perspective to introduce the concept of a digital HR strategy, which explicitly acknowledges the integration and interdependence of human resources processes with digital technologies. At the same time, Deng, Li, Wang and Zhu (2024) explore the relationship between employees` needs, the level of digitalization of HRM and employees` outcomes. The scholars found that the impact of misalignment in the digitalization of HRM on employees' cognitive responses is moderated by leadership influence tactics, specifically those involving leader empathy and coalition-building strategies.

Ulatowska, Wainio and Pierzchała (2023) surveyed the level of digital transformation in the HRM field within the service sector companies in two European countries (Finland and Poland). They discovered that approximately 90% of human resource management (HRM) employees report that their organizations have adopted digital innovations. Authors also admit that among the technologies implemented, the most commonly cited include chatbots, dashboards, application software systems, virtual HRM assistants, and various digital tools (ibid). At the same time, Zhang, Iqbal, Tian and Akhtar (2024) researched Chinese SMEs devoted to their digital transformation and impact on the company's productivity. They find that digital HR practices substantially impact digital transformation, innovative work behaviour, and overall productivity. Additionally, the authors consider that digital transformation is a key driver that enhances both innovative work behaviour and productivity within small and medium-sized enterprises. They conclude that innovative work behaviour contributes positively to productivity, highlighting the essential role of creativity and problem-solving skills in the workplace (ibid).

Piwowar-Sulej, Blštáková, Ližbetinová and Zagorsek (2024) pay attention to one intriguing aspect of the digitalization transformation of HRM – the employees` future competencies. Their research explored the effects of digitalization—specifically, the application of employee-centred digitalization—on developing future-oriented employee competencies and the moderating role of human resource development. The scholars provided empirical evidence of the substantial influence that employee-oriented digitalization has on enhancing competencies essential for the future workforce. In this context, Wang, Mansor and Leong (2024) examine the role of digital leadership and employee digital performance. Their findings indicate that digital leadership does not directly impact employees' digital performance or dynamic capabilities. However, it directly influences high-involvement human resource management practices (ibid).

Alakaş (2024) claims that the digital strategy serves as a mediator between digital transformational leadership and digital transformation, as well as between organizational agility and digital transformation. The scholar also admits that digital culture mediates the relationship between digital transformational leadership and digital transformation. Cai et al. (2024), in turn, prove through empirical study that digital leadership drives the competitive advantage of business organizations. Rialti and Filieri (2024) focus on the digital transformation process and the role of agile leadership. They admit that agile leaders facilitate successful digital transformation by implementing rapid decision-making cycles, actively engaging in ongoing digital transformation initiatives, and employing incremental and transformative practices. Scholars also claim that through agile leadership, employees become more involved in the broader decision-making process, enhancing their morale and fostering a sense of inclusion in the organizations' future. Scholars conclude that agile leadership emerges as an effective strategy for engaging organizational members in digital transformation efforts (ibid). Bellis, Cunial and Trabucchi (2024) also pay attention to digital leadership and the key role of agility. They confirm that agile management approaches can align the organization and its employees with the specifics of new technologies in the business world.

Lyu (2024) proves that digital leadership has a strong positive effect on knowledge sharing within teams. The scholar also finds that the influence of digital leadership on outcomes is fully mediated by team knowledge sharing. A positive team emotional climate also strengthens the relationship between digital leadership and team knowledge sharing (ibid). Temelkova (2020) focused on digital leadership and the relationship between swarm management and a lean organization implemented in an innovative organization.

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Using AI in HRM is now one of the very vivid scientific discussions in HRM. Gryncewicz, Zygała and Pilch's (2023) research indicates that interpretable algorithms, such as decision trees, are frequently used in HRM solutions. They emphasize that AI should be viewed as a tool rather than a replacement for human judgment in HRM. The authors also admit the growing trend of AI in HRM systems and the need for further research to understand its full impact on HRM practices and outcomes. Anguelov (2021) explores the application of AI in optimizing business processes using Enterprise Resource Planning Systems, including in the field of HR. Some of the benefits of using AI in HRM are presented by Dimcheva and Stoyanov (2023). They are convinced that AI aids managers in making informed management and business decisions, thereby enhancing their efficiency, optimizing business processes, and improving the overall competitiveness of companies. At the same time, the authors express some concerns about the limitations of AI, especially in the context of a corporate environment. Andrieux, Johnson, Sarabadani, and Slyke (2024) also pay attention to some ethical considerations regarding using AI for HRM. Interesting research on using AI for HRM purposes is provided by Chowdhury et al. (2023), Meijerink and Bondarouk (2023), Lathabhavan et al. (2024), Huang et al. (2023), Yin et al. (2024) etc.

Radonjić, Duarte and Pereira (2024) claim that the primary advantage of AI in the HRM field is its ability to store and process data at high speeds, enabling more insightful and efficient decision-making. Aguinis, Beltran and Cope (2024) propose a model of using generative AI as an assistant for the people in HRM units of the companies. Their study illustrates how ChatGPT can be a practical HRM assistant for strategic and operational functions. Scholars admit that to realize its full potential, developing well-crafted prompts that yield specific, useful, and actionable HRM recommendations is essential.

Tongkachok et al. (2023) scrutinize the possibilities of optimizing an organization's HR management through the Internet of Things (IoT). Podder, Samanta and Etemi (2024) also contribute to this subject. Their research reveals the role of the IoT in optimizing workspaces, mainly through occupancy sensors. These sensors enable more efficient office layouts, promote energy savings, and contribute to an enhanced overall work environment within smart cities. The authors prove the positive response to technological advancements within HR practices in contemporary organizations. Specifically, HR analytics are increasingly integrated with IoT applications, enhancing resource utilization and improving monitoring systems (ibid).

Abdussamad et al. (2022) consider that through Industry 4.0, technologies such as big data, IoT, and socially oriented elements, like fostering an attractive workplace, enhance the production of goods and services with advanced technical support. Consequently, the role of HR is evolving as IoT becomes integrated into organizational management and business processes. This conclusion complements the results made by Nikolova (2023), who claims the following: Recognizing the importance of investing in human capital, an increasing number of company leaders and managers are concentrating on adding value to their organizations by prioritizing employee training and development. Their efforts aim to cultivate knowledge, skills, competencies, and motivational attitudes that align with the evolving work environment of Industry 4.0. In this regard, Stoyanova and Stoyanov (2019) also recall the great importance of the integration of the practice of Corporate social responsibility of the business organization within the usual HRM, regardless of whether they are digital or traditional. Keeping in mind that digital processes usually possess more possibilities for development, it is expected that companies could further improve and support these practices. Elliott and Copilah-Ali (2024) trace the concept of corporate digital responsibility as a response to the new challenges organizations face due to their transformation to digitalization.

Despite ample literature in the field, there is still a gap in understanding employees' and employers' attitudes towards HR digitalization in various countries. This research will shed light on this gap using generated primary data in Bulgarian cities.

3. Methodology

The current research aims to understand employers' and employees' opinions and attitudes regarding digital transformation and the increasing use of information and communication technologies and artificial intelligence in human resources management. Comparing employers' opinions with their employees' expectations

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and opinions will give the necessary direction for further development and elaboration of specific strategies for managing human resources in a digital environment.

To achieve this primary objective, we have to implement consecutively the following specific tasks:
- to analyze the existing scientific literature, with a focus on the last 5 years from the point of view of the period and the point of view of content - with a focus on HRIS, the use of AI in HRM, algorithmic management, new aspects of HRM related to the digital environment and digital transformation;
- based on the analysis from the literature review, develop an initial version of a questionnaire to be distributed among employees in enterprises operating in various sectors of the economy;
- based on the analysis from the literature review, to develop an initial version of a questionnaire for open interview with the representatives of the employers;
- to test the draft version of both questionnaires;
- to prepare an internet version of the questionnaire for employees, using for this purpose google forms;
- to secure personal meetings with employers' representatives of companies operating in different sectors of economy located in the major cities in Bulgaria (Sofia, Plovdiv, Varna, Burgas, Veliko Tarnovo);
- to secure a relevant period for response collection;
- to analyze the collected information;
- to make conclusions and proposals based on comparing employees` attitudes and expectations and the employers` vision of future development.

Based on our initial research, we formulated three hypotheses as follows:
First hypothesis: Employees tend to rely on impartiality and trust in ICT and AI but prefer personal evaluation regarding the overall assessment of their work performance.
Second hypothesis: Employers are cautious about using the full potential of ICT and AI in HRM, and the main reason for this is the controversial acceptance by employees.
Third hypothesis: The central concern of using ICT is that incredibly generative AI, for the HRM needs of employees and employers, lacks sufficient cybersecurity measures to protect the collected sensitive personal data.

This research presents the final phase of a bigger 2-years lasting research project, Developing Strategies for Digital Human Resource Management in Innovative Business Organizations, implemented with the financial support of the University of National and World Economy (Sofia, Bulgaria).

Table 1. Demographic profile of the employees (sample = 270)

Profile characteristics					
Gender	Male – 87 (32%)			Female – 183 (67%)	
Age	From 18 to 30 years old- 97 (36%)	From 31 to 40 years old – 95 (35%)	From 41 to 50 years old – 54 (20%)	From 51 to 60 years old – 21 (8%)	Over 61 years 3 (1%)
The last completed degree of education	Primary education 6 (2%)	Secondary education 84 (31%)	Bachelor Degree 54 (20%)	Master Degree – 111 (41%)	Doctoral Degree 15 (6%)
Type of organization	NGO 21 (8%)	Business organization 159 (59%)	Public entities 90 (33%)		
Years of the current organization	Less than 1 year – 63 (23%)	From 1 to 3 years – 51 (19%)	From 3 to 5 years – 42 (16%)	Over 5 years – 114 (42%)	
Current position	Technician – 102 (38%)	Expert – 84 (31%)	Middle-level manager – 57 (21%)	High-level manager – 18 (7%)	Owner of the company – 9 (3%)
Type of employment	Full time – 231 (86%)	Part-time – 39 (14%)			
Headquarter location	Capital – 162 (60%)	Big City – 57 (21%)	Small city – 23 (9%)	Rural area – 7 (2%)	Abroad – 21 (8%)
Size of the or-	Micro (less than	Small (between	Middle-sized	Big (over 250 employees) –	

ganization based on the number of employees	10 employees) 27 (10%)	11 and 50 employees) – 60 (22%)	(between 51 and 250 employees) – 84 (31%)	 99 (37%)

The questionnaire for employees was available for completion for three months – from May to June 2024, while the meetings with employers of companies across the biggest cities in Bulgaria for secure semi-structured interviews were held for a more extended period, until September 2024.

The demographic profile of employees and respondents of the survey is presented in Table 1. Respectively, the profile of the employers with whom a semi-structured interview was conducted is presented in Table 2.

Table 2. Profile of the employers (sample = 24)

Profile characteristics					
Gender	Male – 17 (71%)			Female – 7 (29%)	
Age	From 18 to 30 years old- 1 (4%)	From 31 to 40 years old – 5 (21%)	From 41 to 50 years old – 6 (25%)	From 51 to 60 years old – 8 (33%)	Over 61 years 4 (17%)
The last completed degree in education	Primary education 0 (0%)	Secondary education 1 (4%)	Bachelor Degree 5 (21%)	Master Degree – 15 (63%)	Doctoral Degree 3 (12%)
Type of organization	NGO 3 (12%)	Business organization 21 (88%)	Public entities 0 (0%)		
Headquarter location	Capital – 13 (54%)	Big City – 9 (38%)	Small city – 0 (0 %)	Rural area – 0 (0%)	Abroad – 2 (8%)
Size of the organization based on the number of employees	Micro (less than 10 employees) 3 (12%)	Small (between 11 and 50 employees) – 7 (30%)	Middle-sized (between 51 and 250 employees) – 11 (46%)	Big (over 250 employees) – 3 (12%)	

As seen in Table 1, the profile of our average respondent is a female employee, aged between 18 and 30 years, with a Master's Degree in education. In terms of job position, our average respondent is a full-time employee, working in the business organization in the same technician position for over 5 years. The headquarters of the business organization are located in Sofia (the capital of Bulgaria), and the company is significant in terms of the number of employees (over 250).

At the same time, the average profile of our employer is a male, between 51-60 years old, owner of a middle-sized business company (in terms of number of employees), located in Sofia, with a Master's degree in education.

4. Results and Discussion

The questionnaire prepared for the employees collects different information about their attitude toward using new technologies, including AI, in other significant functions of HRM. We start with two similar questions: "Do you have information if in the organization you work used human resource information systems?" and "Do you have information if you used AI for human resource management?". Results are presented cumulative in Figure 1.

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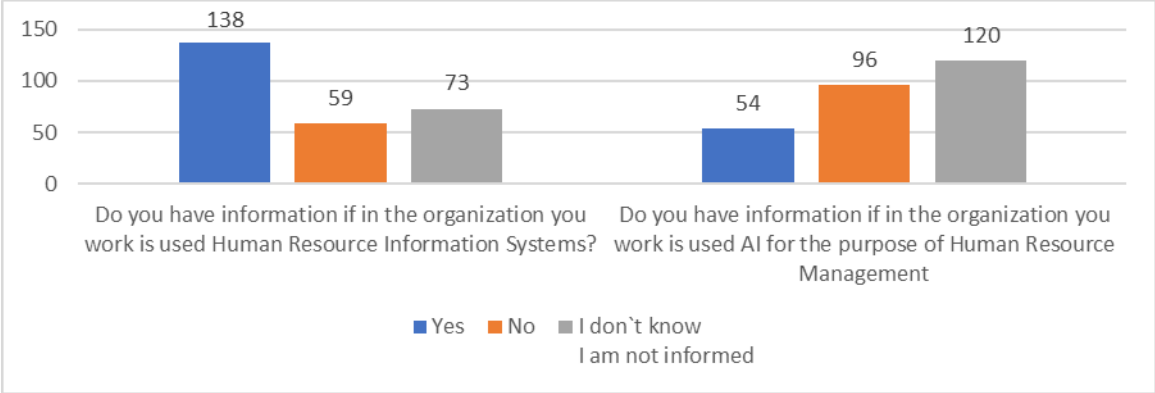


Figure 1. Answers of employees on the questions of using HRIS and AI in HRM (in number of responses)
Source: Own research

As shown in Figure 1, most employees responded to the first question positively, which is evidence that most companies used HRIS to secure proper HRM of the organization. The second group is formed by the employees, who report that they do not know or are not being informed if their organization is using HRIS, and the smallest group is of respondents choosing "N" for answers. These results differ from those obtained on the second question, collecting information for the information of AI for HRM purposes. Here, the majority report "N" (120 employees or 44%), followed by the group with the negative answers and only 54 employees (20%) are sure that the organization they work for uses AI in HRM.

In this context, the picture, composed of the answers from employers to the questions "Does your organization use HRIS in HR?" and "Does your organization use AI for HR?" is presented graphically in Figure 2.

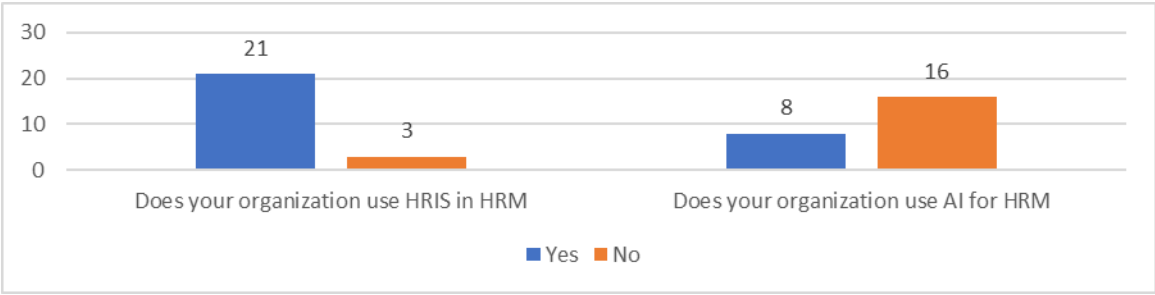


Figure 2. Answers of employers on the questions of using HRIS and AI in HRM (in number of responses)

Here, we do not have the options "I don't know" or "I am not informed" due to the specific positions of the respondents, namely employers. As evident from Figure 2, the majority claim "yes" to using HRIS in the HRM of their company, while only eight people (or 33%) respond positively to the usage of AI in the organization. Therefore, the use of AI for HRM is not as well known in Bulgarian companies as HRIS, which is perceived as part of the usual practice, at least for most business organizations.

To employers answering positively to one or both of these questions, we asked an additional question related to the specific purposes for which these systems are used. The results are summarized graphically in Figure 3.

Current satiation indicates that digital technologies and/or AI support three major HRM processes – recruitment, payroll and compensation management, and career development.

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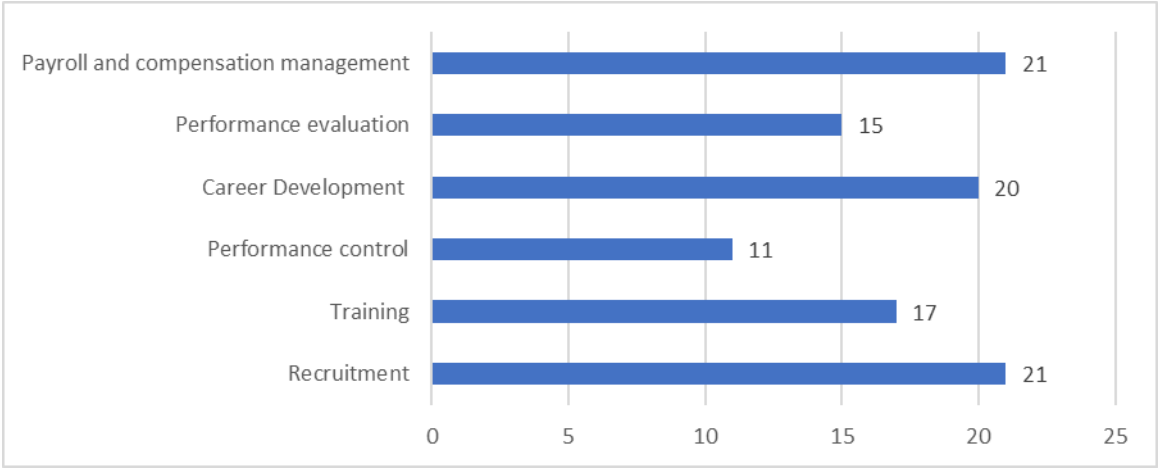


Figure 3. Results from the employers collected to the question "What HR processes have been improved through digital technologies and/ or AI in your organization" (in number of responses)

We asked employees and their employers similar questions about several key processes of using AI for HRM, especially recruitment and career development matters, including decisions on incentives and rewards and the imposition of penalties and demotions. To secure a more precise picture for comparison purposes, the results of these questions will be presented parallelly in Figure 4 – both for employees and their employers.

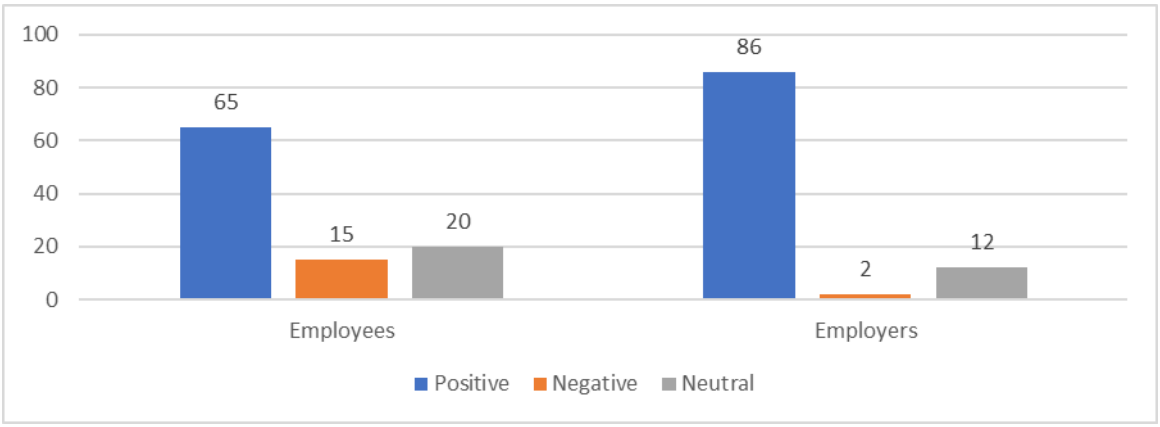


Figure 4. Results obtained from the question "What is your opinion of the use of digital technologies in HR" (in %)

For both groups, we have a clear positive opinion of the majority: employers express more than workers (86% to 65%). At the same time, we have a difference in the negative votes – the share of people answering "no" from the employers` part is only 2%, while the employees here are 15%. The relatively significant share of people choosing neutral responses is interesting for both sides. Considering that digital technologies have been well known for the past 10-15 years, this share of neutrality is hard to explain, except with the innate human distrust of autonomous systems.

Here, we observe a significant difference in the opinions of workers and their employers. While a large proportion of employers respond positively to the use of AI for HRM purposes (64%), from the workers" side, the largest share is centred on a neutral response - more than half of workers state their neutrality on this question (52%). (see Figure 5 below). This divergence of opinion is undoubtedly due to a complex of factors, among which may be the lack of sufficient information on the use of AI for HRM, including its benefits and limitations. On the other hand, the more conservative opinion of employees may also be related to collecting more sensitive information, including continuous monitoring of the workplace, etc.

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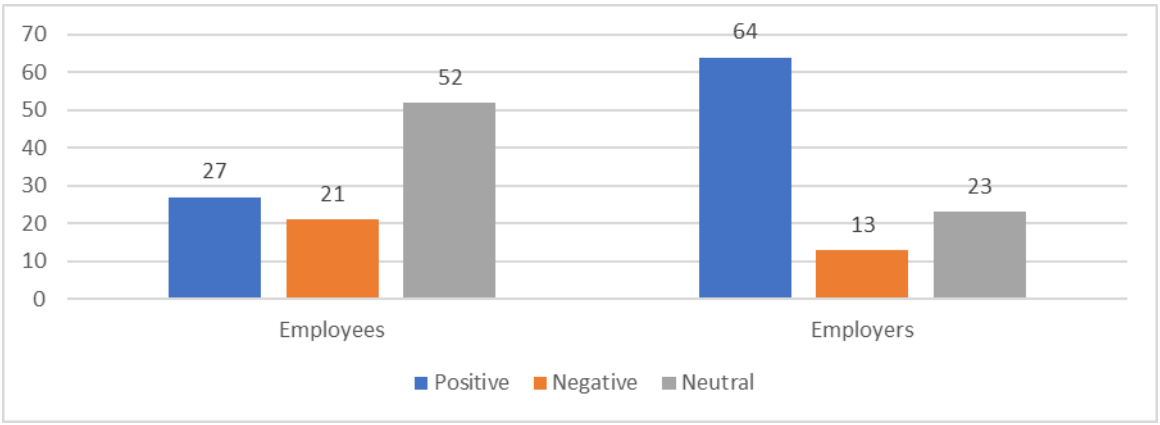


Figure 5. Results obtained from the question "What is your opinion of the use of AI in HR" (in %)

The next question collects information about the effectiveness of digital technologies and AI in HR (Figure 6). Here again, we have differences in opinions between employees and their employers. As seen from the figure, the employers are optimistic about the effectiveness of digital technologies and AI in the organizational environment – 76% of respondents claim "yes, completely", while the employees are more sceptical. The good news is that a significant part of employees (56% in total) are positively oriented, but 34% responded "party", while only 22% are convinced of the effectiveness of these new technologies. Here, we also have to highlight almost the equal results achieved in the answers of employees with the opposite opinion, 22 % "yes, completely" and 23% of respondents choosing the answer "no".

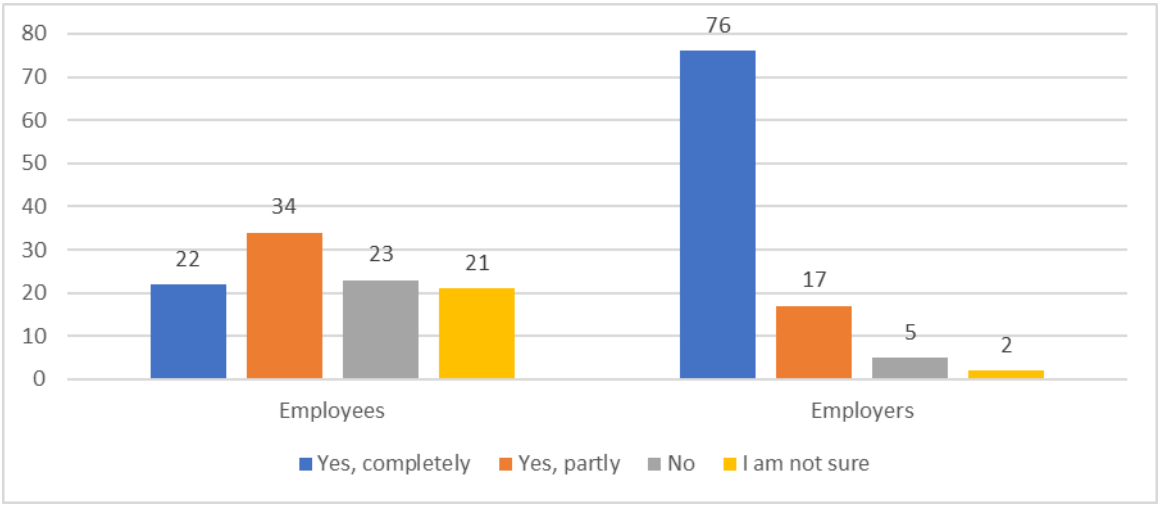


Figure 6. Results obtained from the question "Do you think that using digital technologies and AI in HR processes can make the work environment more efficient" (in %)

The next question was, "Do you think digitalization and AI can help personalize HR service further?" Again, we asked both employees and employers.

Employers remain positive in general, but here, we observe a decreased level of positive answers, especially compared to the share of positive answers of employers collected to the previous question (76% to 61% now). At the same time, the share of employers with the answer "I am not sure" increases drastically – from 2% of the previous question to 34% of the present question (see Figure 7 below). This result could be explained by the employers' lack of sufficient knowledge of the possibilities that digitalization and AI could bring to HR. At the same time, we also have to point out that the level of uncertainty in the employees` answers is relatively high, and scores have increased compared to the previous question (from 21% to 53%). This is the answer that accumulated the majority of responses here. This indicates that employees and employers need to be further informed about the benefits of personalization that digitalization and AI can bring to HRM.

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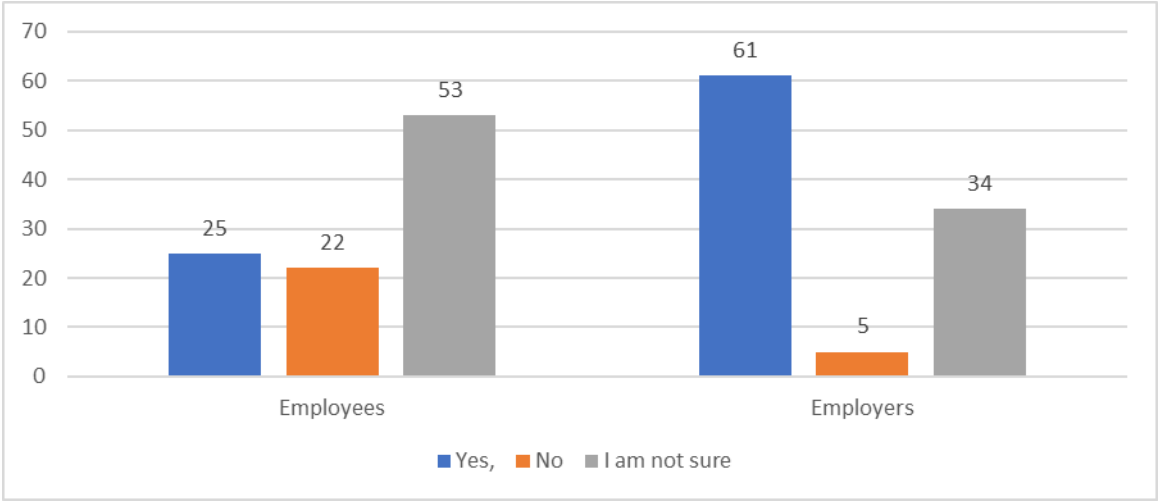


Figure 7. Results obtained from the question "Do you think that digitalization and AI can help to personalize HR service further?" (in %)

The following four questions collect information and opinions only from employees. The first is the following: "What concerns do you have about using AI in HR processes?" The respondents could select more than one answer according to their understanding. The results are presented in Figure 8.

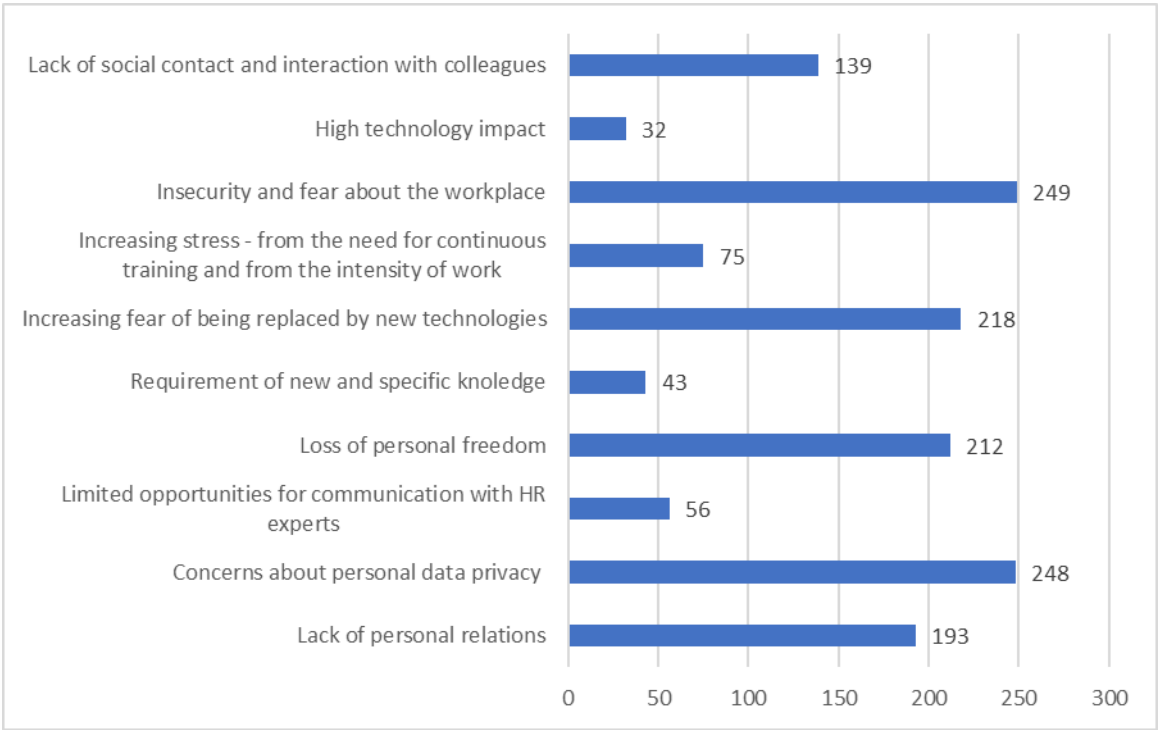


Figure 8. Significant concerns on the increasing digitalization and AI in HRM (in number, n=270)

As can be seen from the figure, four concerns surpass 200 answers. First among these top four is the insecurity and fear about the workplace, which 249 respondents selected. The second place, with one response difference, concerns personal data privacy. This difference is so tiny that it could be ignored, and we could claim that these are the two significant burdens from the employees` perspective in front of complete digital transformation and implementation of AI in HRM. The third place is for the fear of being replaced by new technologies (218), followed by loss of personal freedom (with 212 responses).

At the bottom of this rank are the requirements for new and specific knowledge (selected only from 43 employees). This last position for this burden could be based on the relatively young age of most of our respond-

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ents (between 18 and 30), who are open and usually express their willingness to learn new knowledge and training.

The second position from the bottom is for the limited opportunities for communication with experts from HR unit. This result could be considered in two general and different directions – the first is the idea that there is usually no such vivid communication between experts in HR units and the rest of the company's staff in Bulgarian organizations. Secondly, this result could be based on the fundamental understanding that when systems and/or AI assess somebody, the subjective moments of assessment are minimized. Therefore, there is no need for further communication.

The following question is directly connected to the fear of job loss among employees due to new technologies in HRM. The question is: "Do you think that AI in HR processes threatens your role or job security?" (see Figure 9 below).

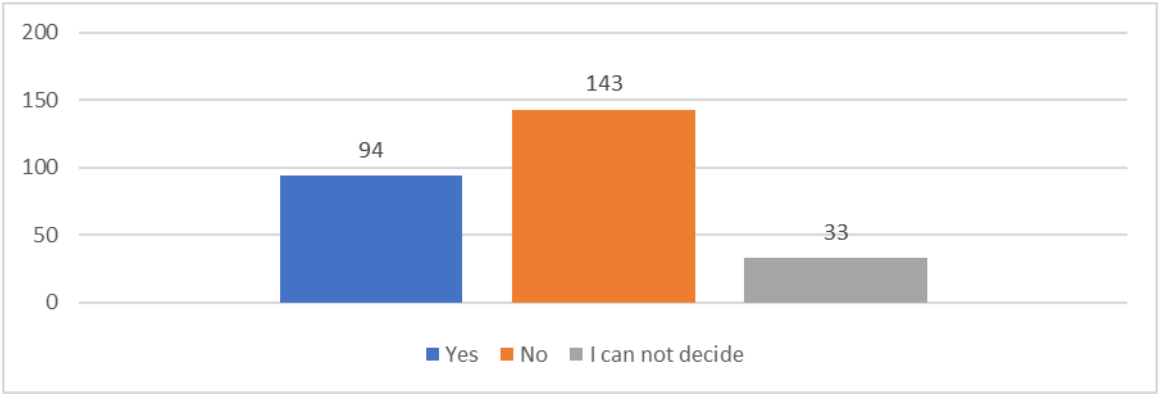


Figure 9. Fear of job loss due to the integration of AI in HRM (in number, n=270)

The promising finding here is that most employees entering our survey are not sensitive to job loss due to the integration of AI in HRM. At the same time, 35% of respondents claim they are threatened by using AI in HRM, and the other 12% cannot decide. In order to secure a smooth implementation of AI in HRM, the employer has to explain and provide clear information to all employees about the information AI will collect, etc.

The third question within these specific three, devoted only to employees, was connected to different aspects of control, evaluation, and career development. The question was, "Do you trust HRIS and AI?". Results are cumulatively presented in Figure 10.

As a general observation from the figure, the employees demonstrate trust in HRIS and AI. The major thrust is in the career development decisions made by these systems, as a result of a lack of subjective evaluation and based only on the individual results and performance of the employees. Second place is for the recruitment process, followed by the rewards and incentives. The most minor level of trust is in the punishment process, but still, the share of people choosing positive answers prevails.

The results of this question can also be interpreted in another direction. In decisions related to improved motivation and career development, increased trust in HRIS is observed, which may lead to a larger share of decisions made through these systems. On the other hand, when there are decisions related to imposing penalties that will negatively affect a given employee, then the initial decision of HRIS should necessarily be confirmed by a person from the human resources department.

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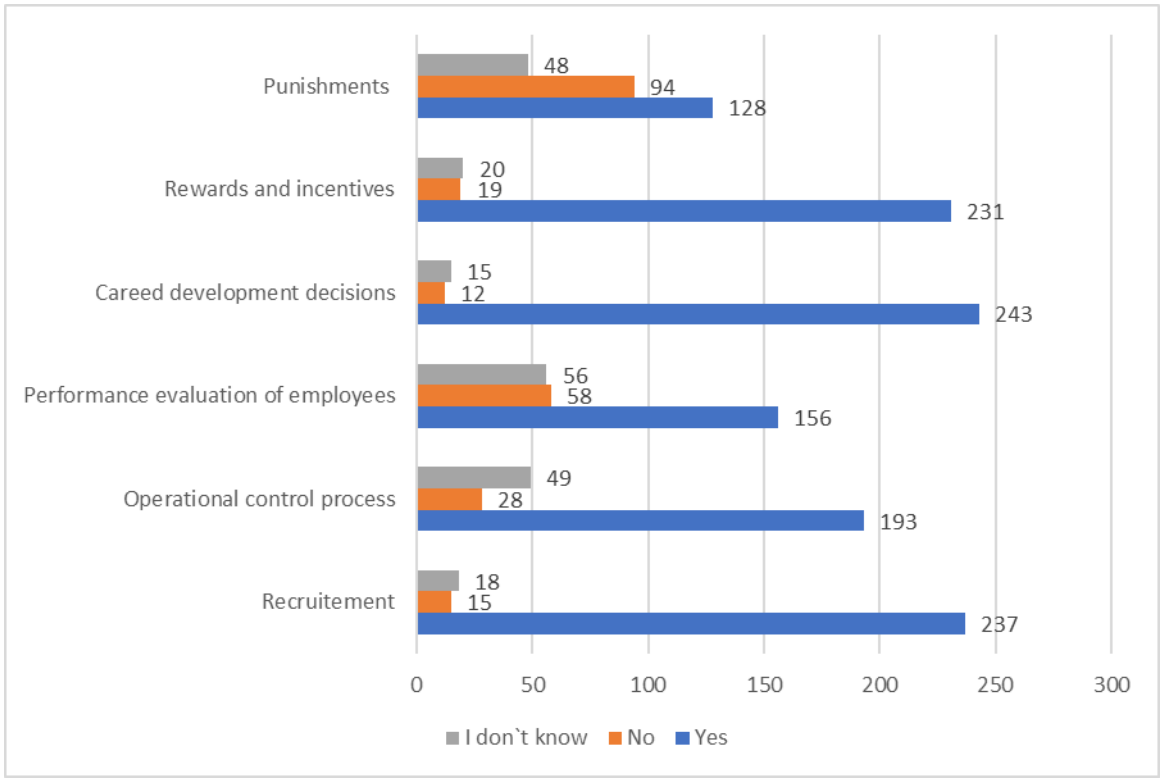


Figure 10. Employees trust in HRIS and AI in different HR processes (in number, n=270)

The last question devoted to employees is oriented to the near future and their expectations: "According to your personal beliefs and understanding, how would you prefer to be evaluated for your work performance?" (see Figure 11 below).

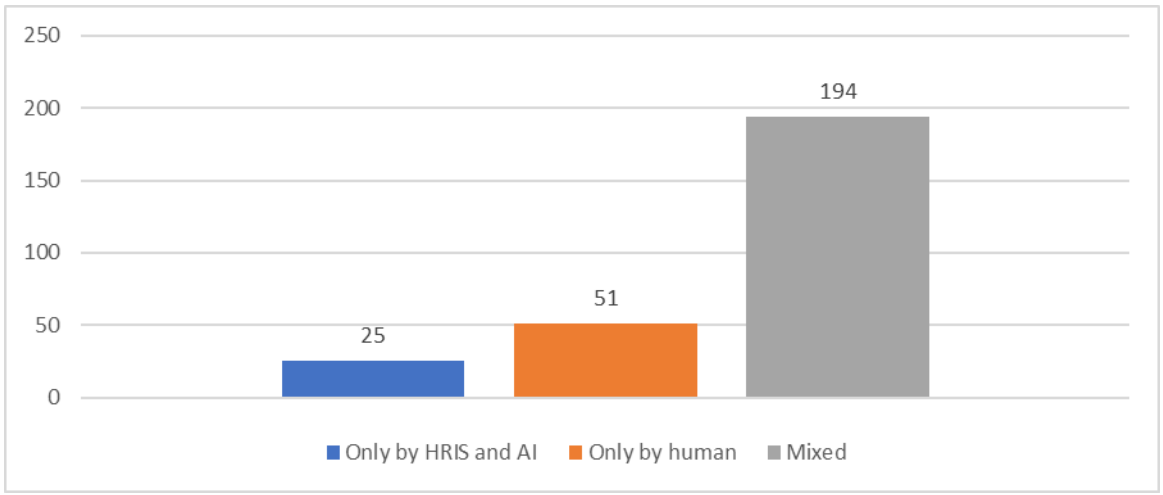


Figure 11. Preference of work performance evaluation by employees (in number, n=270)

From the point of view of employers, the primary concern is the high costs of implementing AI in the HRM systems, followed by the low level of cyber security so far. The difference between these two challenges is only one response. Therefore, we could conclude that these are the leading limitations and only partly confirm our third hypothesis (Third hypothesis: The primary concern of using ICT and incredibly generative AI for the needs of HRM for both employees and employers is the lack of sufficient cybersecurity, protecting the collected sensitive personal data.)

As seen from the results in Figure 12, Bulgarian employers are still cautious about using the full potential of AI in HRM. Still, the main reason is connected to the high costs of implementation and the cybersecurity of

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collected data. This finding rejects our second hypothesis: Employers are cautious about using the full potential of ICT and AI in HRM, and the main reason for this is the controversial acceptance by employees.

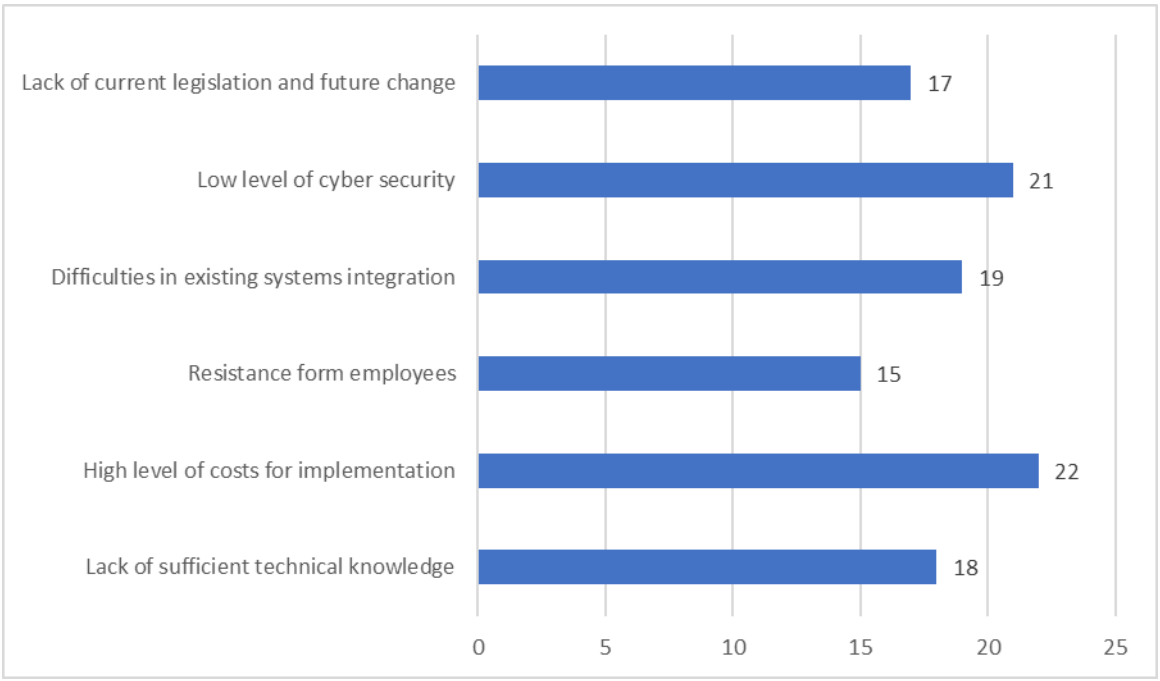


Figure 12. Significant challenges for employers in implementing AI in HRM (in number, n=24)

The very last question for employers was the following: "Do you plan to integrate in the next 3 years AI for the HRM purpose"? (Figure 13).

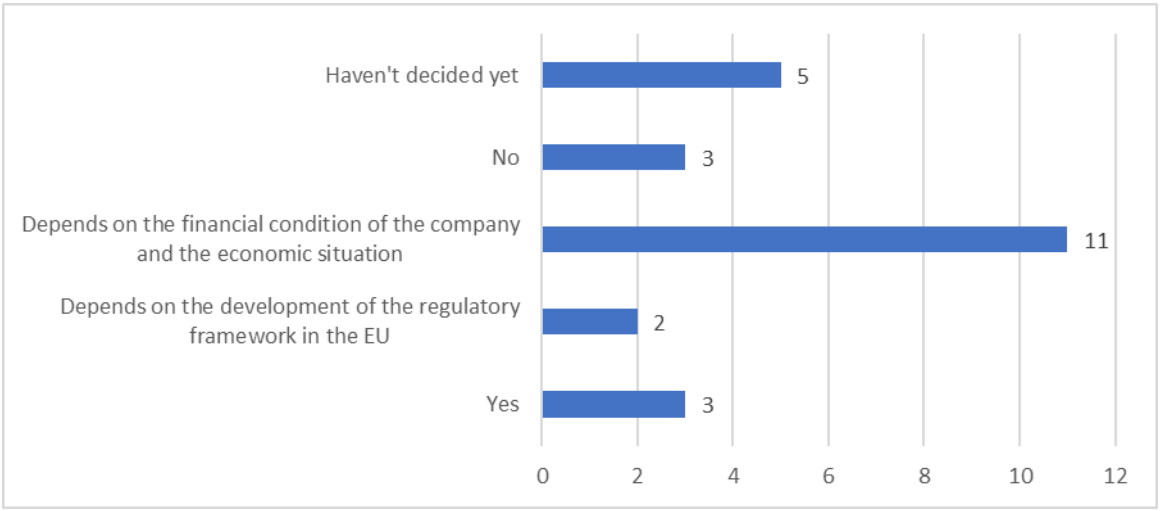


Figure 13. Decision of employers for implementing AI in HRM (in number, n=24)

Most employers participating in our survey claim that the decision to implement AI in HRM in the company mainly depends on the financial condition of the organization as well as the favourable economic situation. 5 of the employers claim that they have not decided yet. Only for 3 of the employers, this decision depends on the legislative framework of the European Union. Therefore, the final decision to integrate AI in the company's HRM remains a purely financial and business question.

Conclusion

The complete digital transformation and the desire to achieve higher levels of efficiency and effectiveness in the company are current goals for many business managers. At the same time, however, it should be borne in mind that the digitization of human resources management and the more profound introduction of new technologies, including AI, may lead to undesirable consequences for some staff. Therefore, managers should carefully approach human resource management optimization when planning future strategies.

The purpose of the present study was to establish the attitudes and expectations of both workers and employers when introducing new technologies for HRM needs. Our findings unequivocally showed that employees generally trust HRIS and AI. The major thrust is in the career development decisions made by these systems due to a lack of subjective evaluation and based only on the individual results and performance of the employees. Second place is for the recruitment process, followed by the rewards and incentives. The most minor level of trust is in the process of punishment, but still, the share of people choosing positive answers prevails. On the other hand, this trust is limited and must be carefully used. For instance, despite the demonstrated trust in the capacity of these new technologies in several crucial HR processes, such as recruitment and career development, when it comes to the overall evaluation of work performance, employees prefer human decisions based on the collected from the system information.

At the same time, employers have two significant challenges in implementing new technologies and AI in HRM – high costs and concerns with the cyber security of personal sensitive data. However, the decision to further AI integration in HRM remains purely financial for most employers.

The novelty of the research lies in disclosing the attitudes of employers" and employees on HR digitalization in Bulgaria, specifically. The generated primary data can be further used for further study. It is suggested that research be continued using a similar methodology to clarify whether the obtained results may be considered universal or if there are countries with specific peculiarities in this area of digital transformation.

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USER EXPERIENCE JOURNEY MAP: THEORETICAL AND PRACTICAL ASPECTS

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Abstract. Recently, due to rapid technological development, the user experience journey has become an essential factor in creating commercially successful products and services. The impact of user experience on overall satisfaction level depends on how individuals interact with and provide digital platforms, applications, and websites. Therefore, the user experience journey map helps understand and predict users' primary needs, behaviour, and motivation to create seamless, intuitive, and enjoyable experiences. A well-designed user experience journey map drives satisfaction and significantly impacts the user's intentions, influencing their decisions, loyalty, and overall engagement. The article analyses the process of creating the user experience journey map and provides practical analyses of implemented user experience journey maps.

Keywords: user experience; user experience journey; user experience journey map; marketing

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JEL Classifications: M30, M31

Additional disciplines: psychology

1. Introduction

User experience design is a dynamic and iterative process used by design teams to carefully design experiences for users. It is a comprehensive approach that covers the entire consumer journey from the initial interaction with the product to the seamless product integration into their lives. The multifaceted nature of user experience design includes elements of branding, aesthetics, usability, and functionality that work harmoniously to create a cohesive and impactful user experience. User experience design focuses on more than just creating user-friendly software interfaces. Designers are also delving into orchestrating various additional experiences associated with the product. This includes engaging marketing campaigns that focus on the target audience, conceptualisation and design, creating visually appealing packaging that conveys the essence of the product, and supporting exceptional after-sales to enhance the overall consumer journey.

Most importantly, user experience design is focused on the main problem – how to provide solutions that directly help solve issues and user needs. It's not just about ease of use; it‘s about overcoming key user challenges. A well-done user experience design ensures that software is easy to navigate and extends its reach to positively impact the broader ecosystem surrounding the product.

The research objectives are to provide a theoretical overview of the user experience concept, user experience journey, and user experience journey map; perform a case study analysis of implemented user experience mapping techniques; evaluate main user experience mapping results and discuss them.

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2. User experience: theoretical aspects

2.1. User experience concept

Rapidly changing consumer needs encourage companies to look for new ways to engage and retain customers more effectively. In recent decades, special attention has been paid to user experience as one of the strategic elements of marketing management. Today, user experience is viewed as a complex, multidimensional phenomenon encompassing technical or functional, emotional, cognitive and social aspects of user interaction with a brand. The concept of user experience is gaining increasing importance in today's context, as consumers tend to value their overall relationship with an organisation. New technologies, a wide range of communication channels, and individualised marketing strategies create opportunities for a unique, personalised, and seamless user experience. The latter becomes a means of retaining customers and a potential competitive advantage. Organisations that systematically analyse, evaluate and improve user experience have better opportunities to form greater customer satisfaction and promote loyalty and positive recommendations to other consumers.

Berni et al. (2021) mention that the term "user experience" was suggested by Donald Norman. According to the scientists, user experience design is about experience. Later, amendments expanded this definition and included affective and behavioural factors embedded in "joy of use" and "joy of possession". Therefore, human-product interaction was exciting until "user experience" was born.

Hussain et al. (2022) state that UX (hereafter referred to as user experience) is broadly defined as users' sentiments about a product, system or service. The authors think that many factors influence UX. Luther et al. (2020) highlight that it is essential for companies to adopt customer experience when their activity is related to digital products and depends on customer loyalty. According to Merritt et al. (2021), a better understanding of the user allows one to justify creativity and increase the potential of innovation. Finally, the UX is the most critical element of the innovation process, as unsatisfied customers are unlikely to use the product.

Ntoa et al. (2021) consider that the customer experience dominates the concept of usability. Valencia et al. (2021) state that the main UX component is usability. Marques et al. (2021) mention that the UX is a *qualitative dimension* considering emotions. Additionally, Feng et al. (2019) state that a good UX is desirable for both consumers and businesses. Feng et al. (2019) conclude that providing a positive UX increases consumer satisfaction and loyalty, thus promoting the company's commercial success. For products that cannot offer a good user experience, the authors suggest applying a UX measurement system, which should help solve the problems and improve the experience and the overall product perception.

Musulin et al. (2023) see the UX as a result of individual interaction, even with digitised products and services, increas*ing customer* value. In other words, every company must have an accurate strategy for its operation to establish itself. This is one of the essential techniques that can help you clarify your company's strategy and unique features and, ultimately, show your customers why they should choose you. Koonsanit et al. (2022) are critical for evaluating a product and deciding whether to continue using a product or service or even to recommend it to others. Corrales-Paredes et al. (2023) mention that the UX is central in designing applications. For example, Dirin et al. (2018) have described the UX as the user's emotions based on experiences while using a service, product or application. According to Dirin et al. (2018), negative emotions can make a huge difference. The authors investigate the case of Pokémon Go, where the game's artificial reality features drain batteries and slow down smartphones.

Verhoef et al. (2009) argue that using a product or service – it encompasses every touchpoint, including encountering a company's advertising, visiting a website, the purchasing process, receiving products, and post-purchase service. It combines the consumer's expectations, perceptions, and emotions that they experience throughout their interaction with a company.

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Bellos et al. (2025) stated that User experience focuses on engaging individuals. Analysing the relationships between customer experience, satisfaction, and intention helps us better understand the factors and conditions that most strongly influence customer attitudes and actions. This knowledge is valuable in developing customer-centric strategies, enabling us to effectively meet customer needs and foster loyalty. A thorough understanding of these concepts and their interrelationships contributes to a company's competitive advantage and long-term growth by helping to create emotionally engaging and memorable customer experiences. User experience benefit is presented in Table 1.

Table 1. User experience benefit concept

Author	**Highlights**
Chiossi et al. (2022)	Social virtual reality requires interaction concepts that consider human social capabilities to provide a satisfying user experience.
Lee et al. (2022)	Users can experience high ease of use and satisfaction with the rapidly developing metaverse platform
Li et al. (2022)	Cognition and emotion play an essential role in the user experience.
Shourmasti et al. (2021)	Beneficial to the process, as changes can be made immediately, moving to alternative designs, thus saving time and costs.
Díaz-Oreiro et al. (2019)	User experience is also a consequence of brand.
Berdasco et al. (2019)	The accuracy of their responses.
Bascur et al. (2020)	User experience is essential in maintaining a company.
Pardini et al. (2022)	User experience and ease of use are vital to understanding and improving the implementation of hardware components and virtual setting designs in future VR-based digital interventions.
Giannakoulopoulos et al. (2024)	Artificial intelligence functions are implemented.
Zardari et al.	Key factors in the adoption of e-learning.
Takano et al. (2023)	Verifying user identities.
Xu et al. (2023)	helps promote sustainable AI development in various fields to improve the user experience
Cheng et al. (2024)	the quality of user experience often directly affects their perceptions and attitudes toward a particular product or environment.
Mehta et al. (2018)	People communicate socially using emotions, which are considered a universal language, and emotions transcend cultural diversity and ethnicity.

Summary of the model benefits of user experience presented in Table 1, it can be stated that user experience improves the implementation of hardware components and virtual settings in future VR, artificial intelligence functions implemented to improve the user experience, help promote the sustainable development of artificial intelligence in various fields. Users experience benefit model is presented below in Figure 1.

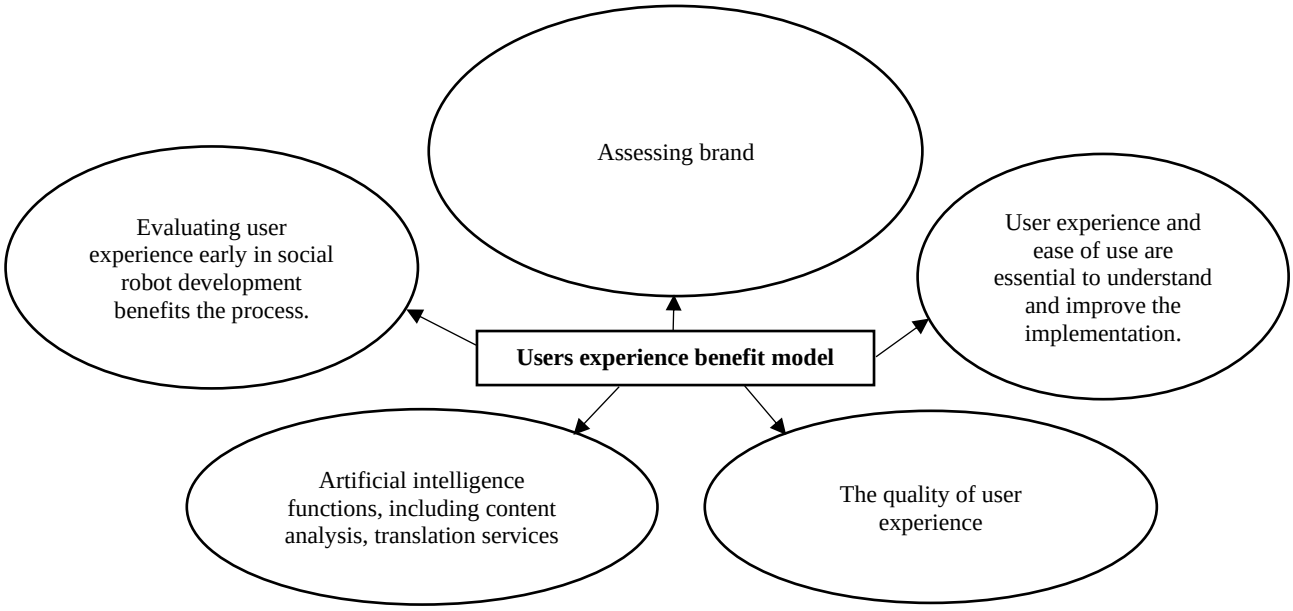


Figure 1. Users experience benefit model
Source: the authors

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The concept of the UX and the whole user experience design is a series of processes to create products that satisfy users by providing relevant experiences based on existing knowledge. In other words, it is making products to fulfil consumer needs. Many technologically advanced products, such as mobile phones, smartphones, smart speakers, etc., are designed in cooperation with users and keep their needs in mind.

2.2. User experience journey

In the 21st century, the user experience journey has become one of the main fields of investigation for researchers and practitioners around the world, and although the term UX is mainly associated with technology, examples of its application can be found in other areas. According to Pellas et al. (2021), designing and developing digital gaming interventions would improve learners' cognitive and practical skills through problem-solving activities. Corrales-Paredes et al. (2023) think that the likes and dislikes of human-robot interactions have become more meaningful to users, where the experience of use and interaction provides the main guidelines that mark the design process.

Falconnet et al. (2023) state that as the amount of available data has increased dramatically in recent years, many methods and technologies have emerged to help companies, employees and customers process such data more efficiently. Various recommendation systems (RS) have been developed since the mid-1990s, and many of these systems have been adapted to perform multiple tasks.

Finally, Vinney (2022) considers these elements of UX journey: 1. Strategy; 2. Scope; 3. Structure; 4. Skeletons. After deciding what the structure of the product will be, its frame can be designed. This means that each page has to determine where the previous plane navigations and functional elements will be. 5. Surface.

To summarise, the user experience journey is a central object in modern research and is considered a key factor in achieving competitive advantage, satisfied consumers, and consumer loyalty. As the experience is related to the perceived value of all involved people, the user experience depends on what the user can and wants to do and how much the organisation allows them to do. The user experience journey evaluates the solution's convenience, intuitiveness, and ease of use, focusing on clarity and eliminating distractions and obstacles. The user experience journey is based on the principles of psychology, neuroscience, and sociology, so details such as how bright the text should be compared to the background to avoid straining the eyes when reading becomes essential. The concept of the user experience journey is undoubtedly responsible for ensuring that a company‘s products or services meet users' needs and provide what they expect.

2.3. User experience journey map

Alvarez et al. (2020) think the user journey map allows the designer to have a single visualisation tool. Pantouvakis et al. (2022) add that the user journey map shows multiple possible responses, and each answer shapes the experience. Ai et al. (2020) agree that although many visual user experience design tools were developed and widely used, the most famous is still the user experience journey map. As the primary matrix, Ai et al. (2020) recommend that the user journey experience map, which was first developed, consists of the client's behavioural process.

Kokins et al. (2021) show how different user experience journey map elements are interrelated, explicitly focusing on the main touchpoints of journeys. The author thinks avoiding further escalation of a gap in client-centred research approaches is necessary before exploring innovation opportunities. Similarly, Lee et al. (2023) have analysed the use of the patient journey map method and indicated its effectiveness in understanding user experience journeys and facilitating stakeholder communication. Investigated patient journey map is mainly used to assist medical personnel and related parties in making medical decisions; therefore, establishing a patient-centred user experience journey map as a means of communication between patients. Cateriano-Arévalo et al.'s (2021) study explores the potential of a user experience journey map to understand better self-related issues and behaviour performed during chores. They investigated the activities women would perform to prepare the lunch. Bradley et al. (2021) try to justify the possible trade-offs for individual consumers from railway companies. Their research uses user experience journey maps and personalities to create a more unified and systematic model of optimal user experience journey in the railway transport system.

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A user experience journey map visually represents a user‘s experience with your product or brand. It simply means that its visualisation tells the story of how a particular user acts at each point of interaction and experiences each area. It‘s also essential to include touch points and what‘s real. The user experience journey exists and is not created. Still, focused and conscious creation is vital for a business to grow and operate profitably, creating more excellent value and emotions for the user and a closer connection with him. Evaluating and creating customer experiences is essential for the company, allowing it to predict business prospects and realise the advantages of the services or products.

3. User experience journey map cases: research methodology and analysis

3.1. The research methodology

According to Česynienė et al. (2010), case analysis is a research method focused on applying various approaches based on general knowledge by properly evaluating “know what”. The article examines user experience journey maps of brands such as “Michelin“, "Amadeus ePower“ and "Starbucks“ using a comparative case study method.

Mačėnaitė (2018) stated that a case study is a research method that focuses on a person's abilities in real life apply a variety of knowledge to the situation. According to Mačėnaitė (2018), cases are classified in different ways: by thematics, goals, volume, and complexity. Case studies can be focused on collecting both quantitative data and qualitative data. To investigate a particular chosen problem, the researcher may examine a specific single problem (case) or several such cases and may also seek to select instances representing the boundaries of the problem being studied or the topic being examined.

A comparative analysis of a case study involves systematically comparing multiple case studies to identify numerous perspectives (King, Fortune, Byrne & Brophy, 2021). According to Krehl & Weck (2020), comparative case study analysis methodology should ensure transparency and consistency. Finally, many authors (Harder et al., 2016; Charlton, Redmond & Cooney, 2021) indicate that challenge, solution, and result are the main elements of the comparative case study analysis methodology. In short, case studies need to be tested (Harder et al., 2016) by discussing *challenges* and describing leading *solutions* (Charlton, Redmond & Cooney, 2021).

3.2. Case study analysis

“Michelin” case study. According to Levdikova (2020), international tyre manufacturing corporation “Michelin” products are delivered to more than 170 countries worldwide. The company shares and “Bridgestone” are first in tyre production volumes globally. “Michelin” offers exclusive and technologically advanced solutions that fully meet the customer‘s expectations. The best evidence of “Michelin” competence is the continuous improvement of its innovations in close cooperation with the most prestigious car manufacturers and its dedication to motorsport and its results.

Challenge. According to Levdikova (2020), “Michelin” faced specific challenges when implementing regional projects. Given these challenges, the tyre manufacturer has chosen a go-to-market strategy that addresses cultural differences.

***The solution*.** Levdikova (2020) states that the CX team tested several tools and discovered UXPressia, which was easy to use and rich in features, sharing options, and visual capabilities.

The result. Levdikova (2020) states that “Michelin” continues to follow a “go to market” strategy that has helped it launch many successful projects in the region.

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"Amadeus ePower" case study. "Amadeus ePower" is a customised online booking engine that travel agents and travellers use.

Challenge. Customer journey mapping and persona development projects were two phases of the more exhaustive work.

Customer journey map. The client's travel planning work was completed.

Advantages. The "Amadeus ePower" team has created powerful customer experience journey maps for two main user groups – travel agents and travellers.

Starbucks Case Study. "Starbucks" is one of the largest coffee chains in the world, selling coffee and snacks. It started in Seattle, Washington, when the founders came up with the idea of selling high-quality coffee beans and roasting equipment. The company aims to have the best coffee in the world, maintaining its unwavering principles as it grows.

Customer Journey Mapping Strategy. The company involved teams from various departments, such as marketing, store operations, and product development, to comprehensively understand the customer journey. Understanding the customer journey. "Starbucks" conducted extensive research to understand how customers interact with the brand online and offline. The company collected data through customer interviews, surveys, observations, digital analytics, and transactional data. Identifying pain points and opportunities. Customer journey maps revealed several areas where "Starbucks" could improve its customer experience, such as long wait times, inconsistent product quality, and challenges with its rewards program. The company also identified opportunities to improve the store experience, such as incorporating digital technologies and personalising customer interactions. According to Krause (2023), "Starbucks" was able to simplify and adapt its customer journey maps, which helped them find the intersection of convenience and connectivity in improving customer experiences in retail and digital commerce, which satisfies customers wherever they are and extends the third-party impressions in the physical store. "Starbucks" invests in its partners, creating personalised customer experiences and improving its digital and retail strategy.

4. Discussion

User experience (UX) is critical to business success across industries. Case studies have shown that user experience journey mapping is essential to create an attractive, enjoyable environment for product or service users. This comparative analysis examines how "Michelin", "Amadeus ePower", and "Starbucks" have leveraged customer journey mapping and persona development. Each company faced distinct challenges, developed strategic solutions, and achieved significant results through customer-centric approaches.

Table 1. The case studies: comparative analysis

User experience journey map	**"Michelin"**	**"Amadeus ePower"**	**"Starbucks"**
Year	2020	2023	2023
Target market	Wider society	Wider society	Wider society
Challenge	The tyre manufacturer "Michelin" has chosen a go-to-market strategy.	"Amadeus ePower" strived to ensure product development focused on the user experience and, most importantly, understanding the customer journey.	"Starbucks" launched a comprehensive customer journey planning.
Solution	"Michelin" created user profiles.	The client journey planning work was completed in 5 weeks.	Customer journey maps revealed several areas
Benefit	"Michelin" continues to follow the "go to market" strategy.	The "Amadeus ePower" team has created powerful customer journey maps	"Starbucks" created a customer experience plan.

Source: created by the authors

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Challenges. The primary challenge for "Michelin" was addressing cultural differences in regional markets while implementing projects. The company sought to optimise communication channels to enhance customer interactions and satisfaction. The travel technology company "Amadeus ePower" faced the challenge of understanding travel agents' and travellers' direct customer journeys. The objective was to identify unmet needs and improve the overall user experience.

Solution. "Michelin" developed customer profiles using UXPressia, a tool allowing detailed personal creation and identification of the most effective communication channels. This approach helped "Michelin" tailor interactions for different markets and enhance regional engagement. "Amadeus ePower" undertook a structured customer journey mapping project, including remote interviews, workshops, and visual design work. This methodology enabled the company to create journey maps for two key user groups - travel agents and travellers, ensuring a more refined product development process. "Starbucks" conducted extensive research through surveys, customer interviews, digital analytics, and observations. By mapping customer journeys, the company identified bottlenecks in service delivery and devised strategies to enhance convenience and personalisation.

Benefit. "Michelin" successfully improved regional project execution, enhanced communication strategies, and increased customer satisfaction by ensuring interactions were tailored to specific markets. "Amadeus ePower" strengthened collaboration among its teams, leading to a more customer-focused product development approach and improved user experience for travel agents and travellers. "Starbucks" leveraged its customer journey maps to refine its digital commerce strategy, improve service efficiency, and create personalised customer interactions, ultimately increasing customer engagement and loyalty.

Table 2. The case studies: solutions and implementations

Company	Solution Implemented	Key Tools Used
"Michelin"	Created customer personas and optimised communication channels	UXPressia
"Amadeus ePower"	Conducted workshops, interviews, and visual journey mapping	Customer Journey Maps
"Starbucks"	Analysed customer interactions across touchpoints and optimised digital and in-store experiences	Digital analytics, Surveys

Source: created by the authors

All three companies strongly emphasised understanding customer behaviours and needs through journey mapping and persona development, known as *the user-centric approach* (see Table 2). Some of them relied heavily on technology utilisation: "Michelin" and "Amadeus ePower" relied on specialised tools (UXPressia, journey mapping software), whereas "Starbucks" used a broader mix of digital analytics and in-store observations. As a result, the strategic impact is different – while "Michelin" focused on optimising communication channels, "Amadeus ePower" sought to enhance product development, and "Starbucks" aimed to refine both digital and physical customer experiences.

Case studies have shown that the user experience must be *user-centric*, helping to understand consumers' needs, wants and habits. Several rules need to be kept in mind:

- Design and use should be as simple and understandable as possible.
- Users should not face complicated or unnecessary steps to achieve their goals.
- Ongoing feedback and product or service development is a crucial aspect.
- Monitoring user behaviour, collecting feedback and continuously improving the product or service based on this data is essential.
- The user experience must be accessible to all, including people with disabilities or diverse needs.
- Accessibility includes ease of use, readability, and understanding, which can help ensure that all users can use products or services.
- The product or service's response time and speed of use should be as fast as possible.
- Users often rate experience based on how quickly they can achieve their goals.

The case studies illustrate how companies across industries can leverage customer journey mapping and persona development to address unique challenges.

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Conclusions

We agree with the opinion of Jain et al. (2017), who think that the principles of user experience management include a comprehensive approach to the entire user journey, from the stage before the purchase of a product or service to the stage of the purchase of the service and the stage after. This requires recognising and responding to the various cues consumers experience throughout the purchasing process. Ultimately, combining these cues creates a deep-seated preference for a particular experience.

User experience professionals use various user experience maps to identify the factors influencing user experience. These factors are then used to develop a user experience management strategy. Practitioners must use these techniques to build awareness, willingness, knowledge, and ability and keep the user engaged in the experience for as long as possible. Continuous monitoring and evaluation are performed to ensure a positive user experience.

Case studies have shown that positive user experience interactions can increase user satisfaction by creating positive emotional and functional impressions.

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MANAGING FINANCIAL THREATS IN THE CONTEXT OF SOCIAL RESILIENCE: A CASE OF THE BALTIC STATES*

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Abstract. Since regaining independence from the Soviet Union, the Baltic States have faced many challenges and threats, such as financial instability, energy dependence, high levels of emigration, and, more recently, illegal immigration from third countries, encouraged by Belarus, the war between Ukraine and Russia, etc. The dynamic nature of socioeconomic situations, especially during crises such as pandemics and natural disasters, thus affects a country's resilience. The paper aims to estimate indices for social and financial resilience. The paper employs expert assessment, SAW, and correlation methods. The research focuses on filling in the resilience theory gap while focusing on financial and social issues. It has been noted that scientific literature lacks financial and social resilience integration. The research provided an alternative measurement of financial and social resilience. The results showed that financial resilience has been more unstable than social resilience. The decline in financial resilience contributes to external shocks such as the Russian–Ukrainian war and the COVID pandemic. Both financial and social resilience have declined during the period of 2020-2021. Hence, there is no correlation between financial and social resilience in the Baltic States.

Keywords: financial security; financial security challenges; threats to national financial security; international financial security; Baltic States

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1. Introduction

Social resilience regarding financial risks is a significant research domain, especially as communities and individuals encounter escalating economic difficulties. Financial threats may originate from diverse causes, such as economic recessions, unforeseen expenditures, and systemic financial crises (Verma & Chattarje, 2025). The capacity of individuals and communities to endure and recuperate from these dangers is profoundly affected by their financial resilience, which includes access to resources, financial literacy, and social support networks.

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In the current climate of global instability and uncertainty (He et al., 2024), the emergence of new challenges, hazards, and threats amplifies the significance of a nation's financial security and social resilience as essential prerequisites for the existence and advancement of an independent, sovereign state (Wang et al., 2025). A nation's financial security is vital for sustainable development and enhanced competitiveness (Bayai & Ikhide, 2018). It indicates a nation's fiscal well-being and capacity to endure economic adversities, maintain the stability of its payment and settlement systems, and counteract the destabilising impacts of global financial crises and foreign influences (Saule & Yessentay, 2018). Terms like 'challenge', 'threat', and 'danger' frequently arise in the examination of financial security, as the financial systems of nations in a globalised context are perpetually vulnerable to diverse shocks (Sethi, Mahadik, 2025; Reznik et al., 2020). Economic conditions and safeguards against financial security threats and difficulties determine a society's stability and effectiveness. The correlation between financial stability and social resilience is undeniable. Financial instability, originating from internal or external causes, can significantly impact a nation's security. A debilitated financial system can hinder a nation's economic progress, impair the provision of vital public services, and damage community support systems (Cavallaro & Villani, 2024). Consequently, it leads to political and social instability.

In contrast, robust financial security can augment a nation's capacity to safeguard its communities' interests, provide support, and respond adeptly to emerging dangers. Salignac et al. (2019) characterise financial resilience as the ability to withstand and recuperate from financial disruptions, highlighting the significance of income, savings, and credit access. Kass-Hanna et al. (2022) support this viewpoint, asserting that inclusive financial institutions enable vulnerable communities to save, borrow, and mitigate risks, thus improving their resilience. Effective management of financial resources is essential for individuals and families with economic difficulties since it directly influences their ability to address financial risks. The significance of the research topic pertains to the need for a more in-depth examination of the theoretical and practical aspects of financial security concerns and dangers; nevertheless, despite advancements in this area, numerous issues remain unaddressed. This renders the research on this subject both pertinent and opportune. The research objective is to assess societal resilience and the interconnections of financial concerns. Therefore, financial and social resilience alternative indices have been estimated. The paper is divided into four sections for methodological purposes. The initial section is dedicated to the literature review. The second section delineates the data and methodologies employed. The third presentation yields the outcomes of the findings. The fourth section summarises the research.

2. Literature review

2.1. The concept of social resilience

Social resilience is characterised as a strategy for alleviating risk and uncertainty. Jermalavičius et al. (2018) define social resilience as the resilience exhibited by a society. It pertains to the country's capacity to sustain societal cohesion against foreign and internal challenges stemming from socio-political changes and/or violent disruptions. Balžević (2021) delineates a complex concept of community. She asserts that "a community is a socioeconomic ecosystem operating within a designated geographical area, characterised by a common structure of resources, service systems, governance, and a distinct socio-cultural identity." Cultural components define a society's individuality and are more difficult to identify using conventional data methods. This definition of community corresponds with the Law on Local Self-Government of the Republic of Lithuania (effective 1 April 2023), which equates a municipality with a community. However, a community's unique characteristics, such as its identity or association with a specific religious organisation, may surpass the legally defined geographical boundaries.

A resilient community adjusts to unexpected disturbances. There are three categories of social resilience. The first is characterised by its adaptability to change and its maintenance of the status quo. The second is characterised by gradual adaptation or slight alterations. The third is characterised by adaptability and openness to change. The third category of resilience has demonstrated the greatest efficacy in research. Taneja et al. (2025) identify three attributes of social resilience: coping ability, adaptive capacity, and transformative capacity. In the previous situation, communities can withstand and overcome adversity. Secondly, society can extract lessons from historical experiences and adapt to impending challenges in everyday life. Thirdly, communities can create institutions that improve individual well-being and promote enduring societal resilience

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to future disasters. The intricacy of social resilience illustrates the interaction of the individual, the community, and the social milieu (Poznanski, 2024), especially when societal changes correlate with the determinants of cultural identity and when social transformations, nationalist feelings, and cultural adaptations transpire. Community solidarity and mutual support are essential components of social resilience. Communities with strong interpersonal connections typically respond more rapidly and effectively to crises due to their need for social support and assistance. In the context of social resilience, social capital denotes the social connections or networks that provide essential resources and empowerment, assisting households in navigating obstacles and dangers or leveraging social support opportunities (Mei et al., 2021).

Haynes et al. (2023) underscore the importance of social support and distinguish between its functional and structural components. Functional components comprise emotional support (e.g., comfort, empathy), instrumental help (e.g., aid with material needs), and informational support (e.g., personal guidance) offered by others. Social relationships constitute a fundamental element of social support. Social capital is established through the cumulative value of these social connections. Collective agency and community belonging, encompassing participation in community life via social ties and networking, are regarded as key determinants of a community's involvement, adaptation, and resilience to external influences and disruptions (Pooyan & Hokugo, 2025).

A more integrated society enhances the overall resilience system, as everyone can contribute to the common good. Social institutions, including families, churches, and educational entities, foster social resilience among youth. They assist youth in surmounting adverse influences and enhancing their resilience. The interrelationship between sleep and stress management (Bush, 2022), positive thinking, self-awareness, and stress management capabilities (Lei et al., 2022), enhances an individual's physiological and psychological resilience. Furthermore, individual resilience is influenced by interpersonal interactions, a supportive work environment, and social support.

Authentic research indicates that psychological resilience regulates the association between life satisfaction, depressive symptoms, and happiness (Chang et al., 2023). Certain studies (Hart et al., 2016) contend that resilience strategies should encompass the alteration or transformation of systemic difficulties, including societal stigma and mental health challenges. Resilience is the ability to overcome adversity while potentially modifying or significantly transforming elements of that adversity. Meanwhile, vulnerability is inherent in social systems before catastrophes, influencing exposure to risk and harm. At the same time, resilience pertains to the factors that enable social systems to absorb, manage, and adapt to hazards and disasters.

Access to healthcare, education, social safety, and other vital services enhances social resilience by equipping individuals and communities to prepare for and respond to changes and difficulties effectively. Consequently, social resilience policymaking has concentrated on strategies to improve societal resilience during health crises. Economic prospects, including employment, income, and social safety systems, significantly influence individuals, as they are more susceptible to vulnerability in poverty or economic instability conditions. Discrimination, social exclusion, and inequality undermine resilience by marginalising specific populations who may lack crucial resources and support (Yıldırım et al., 2025).

Public institutions that deliver social services, crisis intervention, and long-term resilience strategies are crucial in fostering social resilience. Likewise, the stability of the legal and political system is vital as it offers legal protection and guarantees equitable resource distribution. Community networking and institutions positively influence resistance to natural disasters, including earthquake hazards. Ultimately, robust community identity and social connections facilitated by social media can enhance social capital and community resilience. A resilient community guarantees that all members, irrespective of their social or economic status, receive support and the opportunity to make significant decisions.

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2.2. Financial threats and security system

International financial security is a broad term that includes many things that affect a country's ability to be financially stable and trade with other countries (Vasylieva et al., 2020). To get a complete picture of foreign financial stability, you need to look at it from different points of view. International financial relations are based on a system of interconnected parts. These parts include the external economic and financial security of each country's economy, the financial security of major economic and legal coalitions and alliances (like the European Union, OECD, BRICS, and the Russia-Belarus-Kazakhstan Customs Union), and the ability to respond financially to major short-term trends and global threats. The financial health of every country is affected by international financial security. An important part of a country's economic security is its ability to keep its finances stable. Other studies emphasise that financial security is when the financial and credit sector is stable, can handle bad things from inside and outside the country, and can help the national economy work well and grow (Reznik et al., 2020). This definition only describes one part of a country's financial security. Threats to a country's financial security make it harder or impossible to reach its economic and financial goals (Apergis, 2019). Threats to a country's financial security are very unstable, varied, and, most importantly, hard to predict because the financial system can be affected by changes in the economy and government of other countries. Even if things are going well and you know a lot about your country's interests, you still need to think about the unpredictable things that could cause risks when looking for threats to financial security. The country's leading financial and economic goals are to make the financial system more efficient, be the major regulator of market interactions, keep a closer eye on inflation, attract foreign investment, and make the laws more consistent and fair.

2.3. Aspects of financial security and risk management in the Baltic States

In the last thirty years, the Baltic region has undergone significant economic advancement and a reorganisation of its financial system. The Baltic States have successfully transitioned from a centrally planned Soviet economy to market economies, ultimately attaining full membership in the European Union, the eurozone, and the banking union. This transformation has encountered significant challenges, necessitating substantial modifications in economic development, reforms, and expenditures for all stakeholders in the financial system.

An essential condition for sustainable growth, important for a nation's economic transformation, is public agreement on accepting unavoidable adversity. The Baltic States have enacted significant reforms in the financial sector during their transition to a market economy, which, alongside liberalising the financial system, have involved establishing institutions, competencies, markets, instruments, and legal and regulatory frameworks. In this phase of financial liberalisation, before establishing a robust, market-oriented financial sector, all three experienced banking crises (McNaughton, 2024). Foreign bank ownership provided expertise, legitimacy, and capital from the primary corporate entities. Before the euro's adoption, the Baltic States anchored their currencies to the dollar and subsequently to the euro, resulting in little exchange rate volatility. Public debt levels in the region conformed to the Maastricht criteria. Concurrently, dangers have been escalating inside the banking industry. The competitiveness of enterprises in the tiny, open Baltic States diminished progressively as real exchange rates increased, real estate markets exhibited overvaluation, and banking sectors relied on the financial stability of foreign parent companies (Buch et al., 2024).

Further, economic transformations have profoundly affected real wages and labour markets. Consequently, the Baltic economies have enhanced their competitiveness and initiated a sustained transformation in the real economy. Unit labour costs have decreased throughout all Baltic States, but via various causes, including reduced nominal pay, increased productivity, and workforce reductions (Blanchard et al., 2013).

The Baltic economy experienced a significant recession from 2008 to 2009. Estonia, Latvia, and Lithuania had economic declines of 18%, 21%, and 12%, respectively (Staehr, 2015). Consequently, unemployment surged markedly, reaching 15-20% in 2010 (IMF 2024). In response to the crisis, the Baltic governments instituted a series of economic reforms. To alleviate the impacts of the crisis, the Baltic governments enacted structural changes, encompassing fiscal contraction and labour market deregulation. Notwithstanding government intervention, the banking sector saw challenges stemming from a rising amount of non-performing loans (NPLs), as a significant number of individuals failed to fulfil their loan obligations, resulting in severe

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complications for the banking industry. The non-performing loan ratios have increased to 20% in Latvia and Lithuania, and 5% in Estonia (Baudino et al. 2022).

The significant presence of other Nordic banks necessitates meticulous coordination and oversight among nations. The Nordic-Baltic Macro-prudential Forum, founded in 2011, primarily facilitates cooperation on banking regulation and macro-prudential policy in the Nordic-Baltic region. The Nordic-Baltic Stability Group, founded in 2010 to enhance cooperation and readiness for potential financial crises, consolidates financial institutions. The Baltic financial industry is more bank-centric compared to other European nations. Financial institutions are essential to their economies (Pataccini, et al., 2019). The Baltic States, like other European nations, are diligently enhancing the resilience of their financial institutions against cyber-attacks and enacting rigorous measures to prevent money laundering. The European banking authorities, particularly the ECB, are essential for maintaining the stability and security of the financial industry.

2.4. Social resilience response to financial threats in the Baltic States

Social resilience regarding financial dangers denotes the capacity of individuals, communities, and organisations to endure and recuperate from financial disruptions, including economic recessions, unemployment, or unforeseen expenditures. This resilience is widely acknowledged as essential to comprehensive community welfare and economic stability. Comprehending the mechanisms that foster financial resilience can guide the development of policies and programs designed to bolster communities' ability to withstand financial risks. The Baltic States—Estonia, Latvia, and Lithuania—have had various financial difficulties, including the global financial crisis of 2008 and the economic repercussions of the COVID-19 pandemic. Aidukaite et al. (2021) observe that the Baltic States have experienced substantial transformations in their social policy frameworks since regaining independence in the early 1990s, especially under economic crises. Following the dissolution of the Soviet Union, the populace encountered economic hardships, corporate insolvencies, unemployment, national instability, and the emergence of criminal organisations. During a crisis, individuals experience significant emotional and psychological effects, characterised by elevated tension, worry, and anxiety. Psychosocial issues have emerged as an issue for all communities. Certain community members experienced an inability to cope, resulting in stress, unhappiness, and suicidal ideation. Lithuania has consistently held the highest suicide rates in Europe for many years. As of the second decade of the 21st century, the Baltic States have the highest suicide rate inside the European Union. Lithuania's suicide rate, expressed as a proportion of total deaths, is notably significant, being twice the EU average. Consequently, the Baltic States enact initiatives to promote mental health.

In Lithuania, even seven psychological helplines have been created. In the Baltic States, diverse initiatives are being executed to enhance employment, entrepreneurship, or education. Nevertheless, these are insufficient. Consequently, the communities lack sufficient information regarding strategies to tackle economic and social issues or harbour distrust and frustration towards the institutions. This indicates that the social resilience of communities in the Baltic States is inadequately developed. Conversely, it is noteworthy that the Baltic States reacted to the COVID-19 epidemic with greater promptness and efficacy, leading to a comparatively low mortality rate in contrast to other EU nations.

Financial literacy, which includes having the knowledge and skills to make sensible financial choices, is essential to being financially resilient. Kass-Hanna et al. (2022) say that financial literacy and inclusion are important for providing people, especially those from disadvantaged groups, the power to save, invest, and protect themselves from financial risks. At the same time, Lithuanians' knowledge of funds has dropped by more than 20%, making it below the average of 39 other countries. The Financial Literacy Centre of the Bank of Lithuania (2024) started a study on financial literacy in Lithuania. The method used was created by experts from the Organisation for Economic Cooperation and Development (OECD). Lithuania last took part in an international study like this in 2015. In our country, financial literacy decreased from 62 points in 2015 to 56 points in 2018. Only 23% of people who answered the survey in Lithuania have reached the basic level of knowledge, at least 70 out of 100. Poor financial literacy is seen in people with lower incomes and less schooling and people under 30 and over 60 years old. A slight difference exists between men and women: women are less likely to be literate. This shows that Lithuanians are not responding well enough to financial threats. People who know much about money can better deal with problems and make smart choices that stabilise their finances.

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It is also important to have the idea of financial robustness, which means being able to handle operational risks and adapt to changing circumstances.

Financial robustness, as indicated in the literature, encompasses the establishment of contingency plans, adherence to regulations, and the capacity to manage financial shocks proficiently. This resilience is crucial for organisations, as it allows them to sustain stability and persist in operations despite unfavourable financial circumstances. The effects of financial shocks on households have been thoroughly examined, especially regarding the COVID-19 epidemic. Salignac et al. (2019) characterise financial resilience as the ability to withstand and swiftly recuperate from financial disturbances, highlighting the significance of access to economic resources, financial literacy, and social capital (Sun et al., 2022). Furthermore, the role of migrants is crucial for societal resilience in addressing financial risks in the Baltic States. Rausser et al. (2018) examine the role of remittances from expatriate workers in fostering economic development in their home countries, offering a safeguard against financial crises and bolstering local economies. The influx of financial resources can strengthen community resilience by allowing people to manage economic challenges and invest in local enterprises. The broader economic situation also affects financial, individual, and societal resilience. The robustness of financial systems and institutions is essential for sustaining economic stability. Korostelkina et al. (2020) emphasise the necessity of ongoing surveillance of financial markets to evaluate their security and resilience to external disruptions. This systemic viewpoint emphasises the interrelation of individual, community, and institutional resilience against financial threats.

3. Materials and methods

The predominant studies concentrate on economic resilience, sustainability, or security concerns. Nevertheless, the evaluation of societal resilience to financial threats remains unexamined. Zaman and Vasile (2014) categorise a nation's economic resilience and economic fragility as metrics of its ability to endure and recuperate from external and internal disruptions. The scholarly literature emphasises a limited selection of principal indicators (Jermalavičius et al., 2018). These typically encompass gross domestic product as a gauge of economic activity resilience and total employment as an indicator of labour market resilience (Gleeson et al., 2020). Some scholars consider unemployment rates as an indicator of vulnerability (Zaman, Vasile,2014). Wage income (Blanchard et al., 2013), family income (Gleeson et al., 2020), yearly business turnover (Blanchard et al., 2013), and debt-to-equity ratios (Dankiewicz et al. 2022), utilised to assess business resilience (Baudino ety al., 2022), have been incorporated in various research. Social resilience refers to the ability of individuals and groups to withstand, adapt, and learn. Consequently, educational achievement is a criterion in the evaluation (Mylord ir kt., 2023). Mortality rates, child mortality rates, and life expectancies indicate a population's ability to access sufficient healthcare and maintain conditions conducive to a long and productive life (Chang et al. 2023). Gender equality is evidenced by the representation of women in senior and mid-level managerial roles (Šimelytė & Peyravi, 2024). The Simple Additive Weighting (SAW) method evaluates the financial and social resilience indices. SAW is a quantitative indexing methodology utilised in several studies across disciplines to provide indexes and rankings. The SAW method, as an indexing approach, assigns weights to several criteria and then combines them to produce a comprehensive index. This notion enables a methodical and organised approach to decision-making and assessment processes.

Additionally, the SAW technique has been employed in other fields, such as decision-making for paints and coatings, the development of a sustainable energy index (Ligus & Peternek, 2022), and the assessment of land fragmentation for sustainable urban regeneration (Kilić et al., 2019). It was employed to prioritise action plans in disaster management (Büyüközkan et al., 2022) and to evaluate success factors of AI applications in supply chain management (Güler et al., 2014). The SAW methodology provides a methodical and clear framework for developing indices and rankings by allocating weights to criteria and consolidating them to generate an overall score. It is a crucial tool for decision-making, assessment, and indexing methodology. It is assumed that each element possesses equal importance in bolstering or weakening a nation’s resilience.

$$.\sum_{n}^{i=1} \boldsymbol{w_i} = \mathbf{1} \ (1)$$

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As dimensions of the factors' measurement, they will be normalised. The following formulas are applied:

For the maximising factors:

$$\boldsymbol{x_{ij}} = \frac{\boldsymbol{a_{ij}}}{\boldsymbol{a_j^{max}}} \text{ (2)}$$

For minimising factors:

$$x_{ij} = \frac{a_{ij}^{min}}{a_{ij}} \text{ (3)}$$

Where, w_i is the weight of the factors, a_{ij} is the attribute of each criterion, x_{ij} – normalised performance rating, a_{ij}^{max} – the maximum value of the criterion; a_{ij}^{min} is the minimum value of each criterion. Further, each member of the normalised matrix of the same alternative is multiplied by its significance and added with other members of the alternative.

$$\boldsymbol{I} = \sum_{\boldsymbol{i=1}}^{\boldsymbol{n}} \boldsymbol{x_{ij}} \times \boldsymbol{w_i} \text{ (4)}$$

Due to the lack of data on some factors, the index is estimated for each year from 2014 to 2023.

Table 1. Factors and sub-factors of the proposed financial resilience index and social resilience index

Criterion	Sub-criterion	Measurement	Min or max
Financial	Progress in economy	Real GDP per capita	Max
	Circulation of cash flows	% of GDP	Min
	Credit to the private sector domestically	% of GDP	Min
	Government expenditures	% of GDP	Max
	Non-performing credits	% of all credits	Min
	Foreign capital	FDI Net inflows, % of GDP	Max
	Value added of banking sector	% of Gross added value	Max
	Households with heavy financial burden due to the housing cost	% of all households	Min
	Increase in price of goods	Inflation, %	Min
Social	Level of Education	Spending on education in current euros	Max
	Mortality rate	Crude (per 1,000 people)	Min
	Health system	Medical expenditure in % of GDP	Max
	Employment	15+, total population (%)	Max
	Gender equality	Females in senior or middle management as a share of employment in %	Max
	Internet availability	% of population	Max
	Life expectancy	Average in years	Max
	Infants mortality	Number of deaths per year	Min

Source: Authors

The dataset for the analysis has been compiled using multiple databases, including Eurostat and World Bank, focussing on financial and social factors.

3. Results

An experts' evaluation was performed to determine the weights of the criterion, which included six experts. The experts were asked to assign the weight for each sub-criterion when the sum of the weight would be equal to 1. In addition, none of the sub-criterion might be assigned 0 or evaluated in negative value (Table 2). To assess the reliability of this approach, an assessment of the consistency of the experts' opinions was carried out. The level of consistency is expressed as a concordance coefficient. A concordance coefficient of W = 0.505 was calculated based on the available expert judgements. The significance of the concordance coefficient is tested by calculating Chi-square = 45.4, df=15, $p<0.001$.

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Table 2. Weights assigned by the experts

Criterion	Sub-criterion	E1	E2	E3	E4	E5	E6	Average
Financial	Progress in economy	0.2	0.15	0.2	0.25	0.15	0.18	0.18
	Circulation of cash flows	0.2	0.1	0.15	0.1	0.15	0.3	0.16
	Credit to the private sector domestically	0.1	0.09	0.1	0.1	0.1	0.12	0.1
	Government expenditures	0.05	0.1	0.1	0.05	0.05	0.1	0.07
	Non-performing credits	0.05	0.2	0.05	0.05	0.05	0.02	0.07
	Foreign capital	0.15	0.2	0.2	0.2	0.2	0.1	0.175
	Value added of banking sector	0.05	0.05	0.05	0.1	0.1	0.01	0.075
	Households with heavy financial burden due to the housing costs	0.05	0.01	0.05	0.05	0.05	0.09	0.05
	Increase in price of goods	0.15	0.15	0.1	0.1	0.15	0.08	0.12
	Total sum	1	1	1	1	1	1	1
Social	Level of Education	0.3	0.12	0.2	0.15	0.1	0.15	0.17
	Mortality rate	0.12	0.12	0.1	0.15	0.2	0.15	0.14
	Health system	0.1	0.12	0.1	0.15	0.2	0.18	0.14
	Employment	0.1	0.23	0.15	0.2	0.2	0.2	0.18
	Gender equality	0.03	0.1	0.1	0.05	0.05	0.03	0.052
	Internet availability	0.1	0.16	0.15	0.1	0.05	0.07	0.105
	Life expectancy	0.15	0.1	0.1	0.1	0.1	0.1	0.108
	Infants mortality	0.1	0.15	0.1	0.1	0.1	0,12	0.11
	Total sum	1	1	1	1	1	1	1

The progress in the economy has been articulated as the real GDP per capita. Over the past decade, Estonia had the highest real GDP per capita, averaging 16,940 EUR, succeeded by Lithuania at 14,420 EUR and Latvia at 13,245 EUR. In 2023, Estonia's real GDP per capita exceeded 18,000 EUR, whilst Lithuania's was about 1,000 EUR lower, and Latvia's was over 1,500 EUR lower.

The Baltic States have all demonstrated a current account deficit throughout the analysed period. The financial resilience index will include domestic lending to the private sector as a percentage of GDP. This ratio specifies the financial resources designated for the private sector by financial corporations that provide a repayment obligation, such as loans. By the end of 2023, Estonia's ratio increased to 20%. This ratio is significantly lower than those of neighbouring nations, such as Latvia (45.1%) and Lithuania (37.53%) in 2023. Estonia, the smallest of the Baltic States, received the highest net inflow of foreign direct investment. It represented 19.79% of the GDP, while in Lithuania, it accounted for only 4.3%.

Since 2021, inflation has significantly impacted purchasing power and the global economy. The Baltic States, comprising Lithuania (19.71%), Estonia (19.4%), and Latvia (17.4%), encountered substantial inflation relative to other EU nations. Societal considerations significantly influence economic conditions. The alternative selected ratio indicative of financial resilience is households experiencing significant financial strain from housing expenses. Between 2014 and 2023, the highest average proportion of households experiencing significant financial strain was in Latvia (26.65%), followed by Lithuania (23.1%). Conversely, in Estonia, this figure is far lower at 16%. Nonetheless, the highest number of households experiencing significant financial strain occurred in 2014-2015. Since then, this figure has diminished; in 2023, it reached merely 11% in Estonia. Financial resilience is dependent on the financial and insurance sectors. In the last decade, the banking sector's contribution to Estonia has decreased by an average of 0.93% annually, while Latvia has experienced a decline of 0.42%. The banking sector in Lithuania has consistently generated wealth, averaging an annual increase of 1.49%.

Latvia allocates 4.7% of its budget on healthcare, Lithuania 5.2%, and Estonia 6%. Life expectancy for both genders varies from 73.2 years in Latvia to 74 years in Lithuania and 76 years in Estonia; Lithuania exhibited the highest infant mortality rate at 74, whereas Estonia reported the lowest at 11. The statistics include the employment-to-population ratio, which varied from 57.16% in Latvia to 61.33% in Estonia. The representation of women in senior and middle management indicates fair career possibilities for all genders, with Lithuania

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having the highest percentage of female senior and middle managers at 25%, followed by Latvia at 23%. Conversely, this figure is halved in Estonia, constituting merely 12%. Wealthy countries demonstrate a higher percentage of women in senior and intermediate management roles, reflecting more national satisfaction and heightened social cohesiveness and patriotism. Estonia's results demonstrate the highest robustness and social resilience among the Baltic States from 2014 to 2023, alongside the most significant positive financial resilience index over the entire duration. This indicates that Estonians can respond to and recuperate from financial shocks more swiftly than others.

Table 3. Estimated financial resilience and social resilience index

	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Financial resilience										
Estonia	0.814	0.658	0.789	0.817	0.765	0.698	0.837	0.612	0.857	0.586
Latvia	0.453	0.788	0.704	0.727	0.764	0.764	0.298	0.576	0.774	0.621
Lithuania	0.610	0.401	0.278	0.648	0.606	0.540	0.515	0.679	0.658	0.665
Social resilience										
Estonia	0.843	0.855	0.795	0.954	0.845	0.884	0.965	0.749	0.900	0.927
Latvia	0.593	0.681	0.717	0.728	0.913	0.913	0.776	0.547	0.764	0.784
Lithuania	0.858	0.720	0.779	0.541	0.705	0.628	0.683	0.770	0.795	0.700

The findings indicate that both estimated indices have changed over the past decade. Latvia experienced the most significant decrease in financial resilience in 2020. This may be attributed to the COVID period. In contrast, Estonia and Lithuania had less adversity. In 2022, Latvia and Estonia experienced a dramatic boost, but Lithuania achieved only modest growth. Lithuania and Estonia had the most significant reductions in 2015 and 2016. The ramifications of the conflict between Russia and Ukraine in 2014 may elucidate this. The Baltic States have been significantly reliant on the Russian market. Consequently, the social resilience index has not fluctuated substantially between 2014 and 2023. This may be attributed to social indicators, such as mortality rate, life expectancy, and gender equality, which do not fluctuate as rapidly as inflation, government expenditures, foreign capital, or other financial ratios.

Further, the research focused on the interlinkages between social and financial resilience. For that reason, the correlation coefficient has been estimated. However, it was estimated that the relationship between financial resilience and social resilience is insignificant for all three Baltic States (Estonia $r=0.334$ $p=0.423$, Latvia $r=0.135$, $p=0.67$, Lithuania $r= 0,276$, $p=0.32$).

4. Discussion and Conclusions

Social resilience denotes a community's capacity to adapt, recuperate, and flourish amidst adversities, such as crises, social upheaval, and environmental alterations. The Baltic States' distinctive histories, persistent socioeconomic disparities, and demographic transformations render them particularly significant subjects for examining social resilience. Social capital is a crucial element of social resilience in these nations. Financial instability and risk profoundly affect individuals, enterprises, and the nation. Comprehending these aspects is essential for tackling a nation's financial system issues. Threats to financial security denote conditions and factors that undermine the financial system, fiscal framework, banking infrastructure, and monetary supply.

The research has shown that financial and social resilience differ in the Baltic States. However, Estonia and Lithuania experienced similar trends in financial and social resilience indices. Hence, Latvia demonstrated a remarkable decline in financial resilience during the COVID period, which showed that Lithuania and Estonia have been prepared for the external shocks. These findings are partially in line with the research of Chen and Sun (2025), who claimed that financial resilience changes over time depending on the economic cycle and included ratios. Meanwhile, our research is opposite to Stevenson et al. (2020), who found the interlinkages between financial resilience and social welfare. These differences might have occurred due to the focus on different regions.

Contributions to science and practice. The analysis enhances the concept of resilience by evaluating alternative measures of financial and social resilience. These findings are essential for successfully enhancing social resilience, especially in response to shifting demographics. The results might be used to analyse the changes in financial and social resilience and the impact of fluctuations of the sub-criteria. Furthermore, the results contribute to the long-term resilience strategy of each Baltic State.

Limitations and future research. This study exclusively examines the influence of social connections and networking on bolstering social resilience against financial risks. Further research should explore psychological elements and their effects on community responses to catastrophes.

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APPLYING DIGITAL TECHNOLOGIES TO SUSTAINABLE DELIVERY OF GOODS *

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Abstract. This study explores how digital transformation drives sustainable practices in supply chains and related industries. The objectives focus on examining the integration of advanced digital technologies – to enhance environmental sustainability in logistics and production systems. Methodologically, the research analyses current literature and industry cases to identify key mechanisms and outcomes of digital initiatives. Key findings indicate that digital transformation significantly improves resource efficiency, reduces emissions, and minimises waste across supply chain operations. Digitalised supply chains improve transparency and optimise logistics, thereby cutting excess inventory and lowering the carbon footprint of transportation. In broader industry applications, Industry 4.0 technologies facilitate cleaner supply chain processes and real-time environmental monitoring. These advancements translate into tangible environmental benefits, including reduced energy consumption through smart automation and enhanced pollution control via data-driven decision-making. The study underscores that embracing digital transformation is pivotal for advancing sustainability goals. It enables firms and supply chains to achieve higher ESG performance, social responsibility, environmental and governance stewardship. However, it also highlights the need to address challenges, ensuring that digital innovations yield long-term environmental benefits without unintended drawbacks.

Keywords: digital technologies; ESG; supply chain management

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1. Introduction

Modern economies undergo rapid digital transformation, fundamentally altering how businesses operate and compete. Since the onset of the Fourth Industrial Revolution, information and communication technology (ICT) has become a key driver of transformation in business and organisational practices (Yang et al., 2021). Recent technological advances—from AI and cloud computing to IoT and blockchain—have spurred worldwide innovation across all economic sectors (Hasanova & Romanovs, 2020; Khan et al., 2022; Mugunzva & Manchidi, 2024). Digitalization has significantly reshaped social and economic life, effectively enabling a sustainable economy and aligning with global development goals (Gebresenbet et al., 2023). In this context, understanding the intersection of digital transformation and sustainability is of paramount importance.

Sustainability, particularly environmental sustainability, has emerged as a critical concern alongside digital growth. There is increasing recognition that digital technologies can be crucial tools to drive sustainable

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development (Wei et al., 2019). They offer innovative solutions to environmental, social, and economic challenges by improving efficiency and enabling smarter resource management (Kayikci, 2018). For example, IoT sensors and data analytics allow real-time monitoring of environmental parameters such as air quality and energy usage, leading to more responsive and effective pollution control and resource conservation (Chan et al., 2023). Similarly, AI-driven analytics optimise energy consumption and help control industry emissions, as evidenced by their widespread use in developed economies (Sharma et al., 2022). These capabilities illustrate how digital transformation and sustainability agendas can reinforce each other: digital tools boost productivity and help reduce ecological footprints (Mubarik et al., 2024).

A growing body of literature explores this digital-sustainability nexus. Green supply chain management is one area where digitalisation's impact is evident. As consumers and regulators become more environmentally conscious, companies are pressed to incorporate environmental considerations throughout their supply chains (Wang et al., 2023). In response, many firms are building green supply chains that balance profitability with environmental objectives (Liu et al., 2023). Digital technologies offer new solutions, and their adoption in supply chain operations is widespread (Zekhnini et al., 2022).

Recent studies identify several focal areas in which digital tools advance supply chain sustainability:

- Green logistics – IoT and telematics systems monitor fuel use, emissions, and traffic conditions to optimise transport routes and modes, reducing energy consumption and shipping-related emissions (Fareed et al., 2024).
- Lifecycle analysis – Big data and cloud computing enable firms to collect and analyse data on a product's entire life cycle, from raw material sourcing to end-of-life disposal, providing a basis for sustainable decision-making (Wei et al., 2019).
- Transparency and traceability – Blockchain and digital tracking systems ensure visibility of sourcing and production, verifying sustainable practices and enabling consumers to trace products to environmentally responsible origins (Kwilinski et al., 2023).
- Partner collaboration – Digital platforms and networks enhance communication and coordination among supply chain partners, improving overall efficiency and aligning stakeholders with sustainability goals (Mahroof et al., 2022).

Despite optimistic findings, scholars also note complexities and emerging challenges. Digital transformation can be a double-edged sword for sustainability. While it creates efficiencies, it also introduces new environmental impacts, such as energy-intensive data centres and electronic waste from rapidly obsolete gadgets (Duan et al., 2025). A balanced view in recent literature examines both the benefits and drawbacks of digitalisation (Frick, 2016). This paper builds on and contributes to this discourse by investigating how digital transformation initiatives concretely advance environmental sustainability in supply chains and industry.

This study's primary objective is to analyse digital transformation's role in fostering sustainable practices, with a focus on environmental outcomes in supply chain and logistics contexts. Additionally, this research aims to evaluate the challenges and limitations associated with implementing digital solutions for sustainability. The authors will assess the impact of digital transformation on sustainable patterns, mainly focusing on adopting the best ESG practices in the supply chain to reach a competitive advantage. The set objectives are:

1. To conduct a literature review of the topic and bibliometric analysis of the ESG thematics research papers.
2. To present case studies showing the ESG and the application practices of digital technologies.
3. To provide discussion and conclusions summarising the research findings.

2. Bibliometric Clustering of ESG Literature: Methodology and Analysis

The authors performed a bibliometric analysis of the research papers covering ESG thematics. The analysis will consist of four stages:

1. Data collection and preprocessing stage
2. The application of clustering techniques stage
3. Validation of clusters stage

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4. Interpretation of formed clusters
5. The summary on limitations and possible future improvements.

Data Collection and Preprocessing

The dataset was built by identifying ESG-related literature published in 2023. A comprehensive search of academic databases used keywords such as "ESG" and "environmental, social and governance" in titles, abstracts, and keywords. In some cases, domain-specific filters were applied. A manual relevance check was performed for each title and abstract. The papers were reviewed to ensure the work substantively engaged with ESG, not just in passing. By the end of the screening, the dataset was narrowed to core relevant 2023 ESG publications.

Once the final list of publications was set, their bibliographic data were exported for analysis. Preprocessing involved cleaning and standardising the data. For instance, bibliographic records were checked for author names, keywords, and references consistency. In bibliometric analyses, it's common to merge synonymous terms in keywords and ensure uniform formatting. Reference lists from each article were also extracted because these would be used in later clustering analysis. The cleaned dataset – consisting of the 2023 ESG articles and their metadata (authors, keywords, citations) and references – was then ready for bibliometric mapping.

Application of Clustering Technique

We employed a network-based clustering approach to identify knowledge structures within the 2023 ESG literature. The fundamental assumption in bibliometric clustering is that papers sharing common features (references or keywords) likely deal with related themes. In this study, we constructed a network where nodes represented the scholarly publications (the 2023 ESG articles), and links between nodes represented bibliographic relationships indicating topical similarity. Specifically, we utilised bibliographic coupling as the clustering method: if two articles cite many of the same references, they are considered related and linked in the network. This choice is appropriate for a single-year dataset because bibliographic coupling groups *recent papers* by their shared references, thus revealing current thematic clusters in the field.

Using the cleaned bibliographic data, a similarity matrix of the documents was created based on their shared references. We applied the association strength measure to quantify the similarity between two papers, a standard weighting that accounts for the number of common references normalised by each paper's reference list length. The result is a network graph (or matrix) where each 2023 paper is connected to others with an edge weight reflecting how strongly they are bibliographically coupled. We then visualised this network using tools like *VOSviewer*, which implements the visualisation of similarities (VOS) mapping technique. In this map, closely related papers gravitate together, forming clusters of nodes in the network.

In our case, the *VOSviewer's* clustering routine (a variant of the Louvain algorithm) was used; it optimises a modularity-based function to find the best division of the network. This algorithm aims to maximise within-cluster connections and minimise between-cluster connections – effectively yielding groups of papers that are tightly linked to each other and weakly linked to papers in other groups. The clustering process is data-driven: we did not pre-specify topics but let the network structure reveal groupings. The result was a set of distinct clusters (communities of papers) identified solely by patterns in the bibliographic data. Performing bibliographic coupling on a set of ESG papers might result in around 5–10 clusters, depending on how diverse the topics in that year are. Each cluster corresponds to a coherent research theme or topic area within ESG research.

We interpreted and labelled each cluster after the *VOSviewer* algorithm grouped the papers. Typically, clusters are characterised by examining the content of the papers or their keywords. We used an automated aid: the Log-Likelihood Ratio (LLR) algorithm in CiteSpace was employed to extract significant terms that distinguish each cluster. We cross-checked these labels by reading representative papers from each cluster to ensure they accurately captured the theme. In summary, the clustering technique involved building a bibliographic coupling network of 2023 ESG papers, using a modularity-optimisation algorithm to find clusters, and assigning each cluster an informative label reflecting its thematic focus.

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Validation of Clusters

Ensuring the robustness and validity of the identified clusters was a critical step, as we wanted to confirm that the clustering truly reflects meaningful groupings in the data (and not arbitrary or spurious splits). We employed several validation approaches:

- **Modularity Check.** First, we looked at the network partition's modularity score (Q). Modularity is a standard measure of the strength of the division of a network into clusters – it compares the density of links inside clusters to links between clusters. In our analysis, the modularity Q-value was well above the typical threshold of 0.3, indicating a pronounced community structure. High modularity suggests that shared references highly interconnect the papers within each cluster, and there are relatively few shared references across different clusters – precisely what we expect if the clusters represent distinct topics. This confirmed that the clustering was not an artefact of noise.
- **Silhouette Analysis.** We further assessed cluster quality using the silhouette coefficient. Silhouette is a validation metric that gauges how similar an item (here, a paper) is to its own cluster compared to other clusters. It ranges from -1 to 1, where a higher value means the item is much closer to members of its cluster than to any other cluster. We computed an average silhouette score for each cluster. The results showed strong intra-cluster homogeneity: most clusters had silhouette values well above 0.5, which is generally considered a reasonable quality cutoff. Several clusters had average silhouette scores exceeding 0.8, indicating an *excellent* fit. This means, for example, that a given ESG paper and its nearest neighbours in the same cluster shared very similar reference patterns (and likely covered a similar topic). In contrast, that paper's similarity to any other cluster was much lower. Such a clear separation between clusters is evidence of robust clustering.
- **Statistical and Robustness Validation.** We considered additional checks to validate the clusters further. One approach in cluster analysis is to perform stability testing – for instance, randomly removing a small subset of papers or references and re-clustering to see if the overall group structure remains similar. While a complete resampling analysis was beyond our scope, the stability of cluster assignments was implicitly supported by the high modularity and silhouette values. Additionally, we compared our clustering solution with alternative methods; for example, we examined a keyword co-occurrence map of the same dataset to see if similar thematic groupings appeared. The keyword co-occurrence analysis (grouping papers by shared keywords rather than references) revealed a comparable topical structure, increasing confidence that the clusters are not an artefact of one particular method. Consistency across different methods provides a form of convergent validation.
- **Expert Judgment.** Finally, the interpretation of clusters served as a qualitative validation. We took a close look at the content of each cluster – reading the abstracts or full texts of several representative papers in each group – to verify that they indeed revolved around a coherent theme. This domain knowledge check confirmed, for example, that papers in the cluster we labelled *"ESG reporting and disclosure"* discussed aspects of sustainability reporting, transparency, or non-financial disclosure frameworks. Similarly, another cluster centred on *"ESG and financial performance"* contained papers consistently examining how ESG metrics relate to profitability, risk, or firm value. This manual verification step ensured that the algorithm's output made logical sense and corresponded to real subtopics in ESG research. The alignment of quantitative metrics (high silhouette, high modularity) with qualitative sense-making (clusters reflected intuitive themes) indicates that the clusters are statistically sound and substantively meaningful.

In summary, combining a strong modularity score for the overall clustering, high silhouette values for individual cluster cohesion, and agreement with human judgment provides robust evidence that the identified clusters are valid. These validation steps give us the confidence to interpret the clusters as genuine research themes in the 2023 ESG literature rather than arbitrary groupings.

Each cluster above represents a vital thread in the tapestry of ESG research circa 2023. Together, they demonstrate the multifaceted nature of ESG scholarship – spanning financial implications, communication and disclosure, strategic sustainability integration, investor perspectives, and governance mechanisms. These themes are highly interrelated (indeed, we observed some cross-links between clusters, such as between Cluster 2 and 3 on disclosure and sustainability or between Cluster 4 and 5 on how governance influences investor-

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relevant ESG metrics). The cluster interpretation maps the intellectual structure of ESG research for that year and reaffirms that ESG is a convergence of multiple disciplines (finance, management, environmental science, ethics) all examining how organisations can be run more sustainably and responsibly.

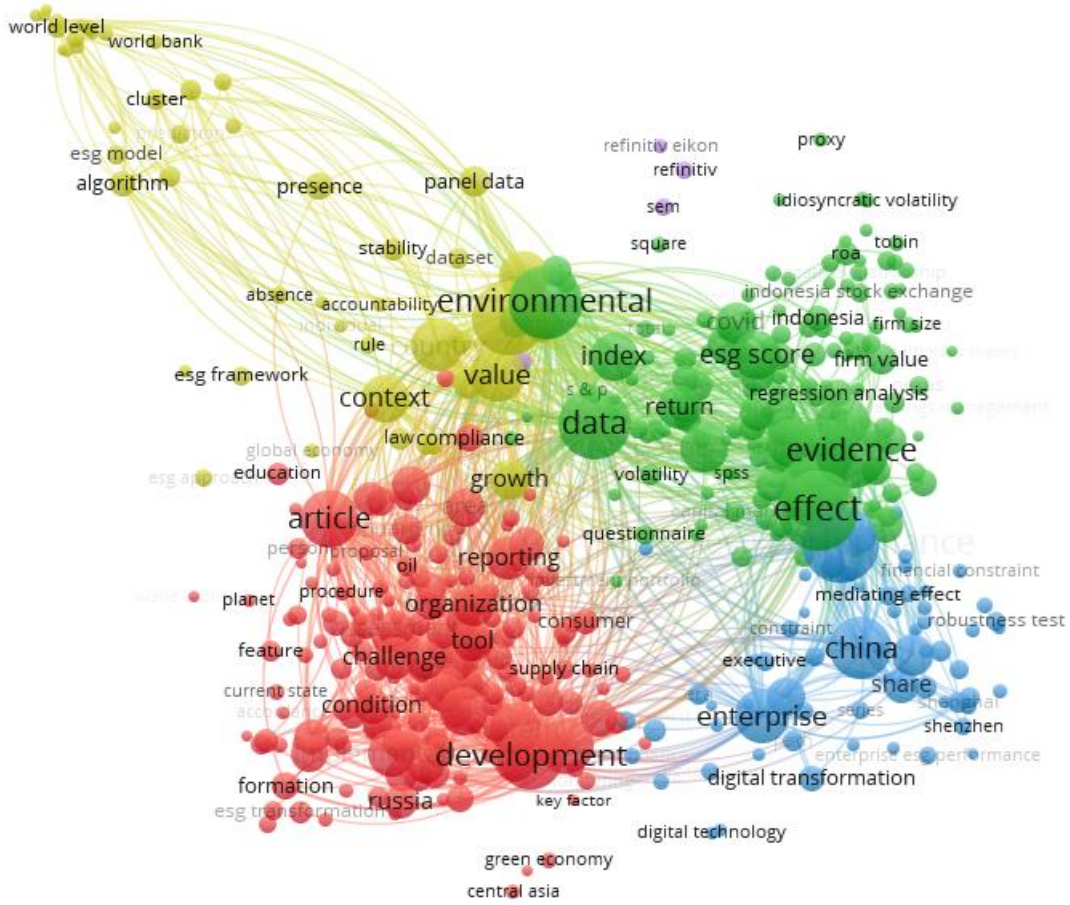


Figure 1. Formed five clusters received with *VOSviewer*

Interpretation of Formed Clusters

The clustering process yielded distinct thematic clusters within the 2023 ESG literature. Each cluster represents a group of papers with a common focus or research theme. Below, we provide a structured discussion of the identified clusters, including their composition (i.e. the general topics covered by papers in each cluster) and the relevance of these themes to ESG research. The clusters are numbered for reference, but the numbering does not imply rank or importance – all are significant streams in the ESG scholarly conversation:

- Cluster 1: ESG Activities and Financial Performance – this was the largest cluster, comprising about 28 articles, and it centres on the relationship between companies' ESG initiatives and their economic outcomes . Research in this cluster investigates how ESG performance (such as a firm's sustainability practices or ESG ratings) correlates with traditional financial metrics like financial performance, firm value, or stock returns. Many papers here build on the long-standing debate in the literature about whether adopting ESG principles helps or hurts financial performance. For example, some studies in Cluster 1 find that strong ESG engagement can enhance firm value or reduce risk (supporting a business case for ESG), while others discuss potential costs or diminishing returns of ESG activities. This theme is highly relevant to ESG research as it addresses a core question for scholars and practitioners: does sustainability align with profit motives?

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- Cluster 2: ESG Reporting and Disclosure – this cluster (around 25 studies) focuses on how companies report ESG information and the frameworks or standards for non-financial disclosure. The papers in this group examine sustainability reporting guidelines, integrated reporting (combining financial and ESG reporting), assurance of ESG reports, and transparency in communicating ESG performance to stakeholders. Cluster 2 highlights the importance of information disclosure – a key governance issue – because consistent and reliable ESG reporting enables investors, regulators, and the public to evaluate a firm's social and environmental impact. The relevance of this cluster to ESG research lies in its exploration of the mechanisms that ensure accountability. Without transparent reporting, even strong ESG performance might not translate into stakeholder trust or value. Themes in this cluster often include assessments of reporting quality, the adoption of standards, and how disclosure levels relate to outcomes. In essence, Cluster 2's theme underscores the "governance" aspect of ESG by overseeing transparent reporting of sustainability metrics.
- Cluster 3: ESG Performance and Corporate Sustainability – this cluster (23 papers) links ESG metrics with broader notions of corporate sustainability and CSR (Corporate Social Responsibility). The research here often treats ESG as part of the continuum of sustainable business practices, examining how ESG performance aligns with long-term sustainability goals, stakeholder engagement, or corporate ethics. Many papers in Cluster 3 delve into conceptual relationships: for instance, how ESG relates to or differs from CSR, and how firms integrate ESG criteria into their overall sustainability strategies. This cluster's relevance is evident because it situates ESG within the more significant movement towards sustainable development in the corporate world. It often bridges academic conversations between ESG and older concepts like CSR or corporate sustainability, highlighting continuity and evolution in thinking. Themes include the development of ESG indices or ratings as measures of sustainability, the impact of ESG initiatives on environmental or social outcomes (beyond just financial metrics), and the role of ESG in achieving the Sustainable Development Goals (SDGs). Overall, Cluster 3 emphasises that ESG performance is not just an isolated scoreboard for companies, but part of a holistic approach to being a sustainable and socially responsible enterprise.
- Cluster 4: ESG Factors in Investment– studies on ESG characterise this group (roughly 16 articles) in the context of investment decisions. It includes research on how ESG scores or performance influence investor behaviour, asset pricing, and portfolio management. For example, papers in this cluster may analyse the performance of ESG-focused investment funds (like socially responsible or green funds). A key theme is whether incorporating ESG criteria leads to better risk-adjusted returns – connecting to concepts like sustainable investing, impact investing, or ESG integration in portfolio selection. The relevance of Cluster 4 is significant as it represents the interface between ESG company performance and market performance.
- Cluster 5: ESG Governance– this cluster (16 articles) focuses on the governance aspect of ESG. Studies in this cluster might examine whether companies with more sustainability committees achieve better ESG results or how leadership commitment drives ESG strategy. The relevance to ESG research is evident: governance ("G") is the structural pillar that often determines how well environmental and social objectives are embedded into a company's policies. Cluster 5 highlights that effective ESG implementation, inclusive leadership, and policies prioritising sustainable decision-making often start at the top. This cluster provides insight into why some firms excel at ESG and others lag, attributing differences in performance to leadership and organisational structure. This theme is crucial for translating ESG ideals into action, as it deals with internal drivers of ESG integration within consumable products selling firms.

The Summary of Limitations and Future Improvements

While the clustering approach provided valuable insights, it is essential to acknowledge its limitations and consider avenues for improvement in future research:

- Our analysis focused only on literature from the single year 2023. This one-year snapshot, although rich, may not capture longer-term developments or the foundational literature pre-2023. Important concepts or seminal works published earlier (or in early 2024) are not included, which could omit context. Future studies should consider a broader timeframe or a longitudinal dataset. Expanding to a multi-year span (e.g., five or ten years of ESG publications) would allow us to see how clusters evolve, identify emerging and fading topics, and incorporate influential earlier studies. Time-series or dynamic clustering could be performed to track the growth of new themes and the convergence or divergence of research streams year by year. Additionally, a longitudinal approach could provide a more robust picture of the ESG field's development and mitigate the risk of one year.

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- The dataset was gathered from a single source (e.g., open access database). Relying on one database can introduce bias – some relevant ESG publications might be missing if they are indexed elsewhere or appear in books, conference proceedings, or other journals not covered in the database. Also, our inclusion criteria (English language, certain subject areas or journal rankings) mean the sample might not fully represent global ESG research. To improve coverage, multiple databases can be combined (e.g., merging results from Scopus, Web of Science Core Collection, and Google Scholar) to ensure no significant publications are overlooked. Careful deduplication would be needed, but multi-source integration would yield a more comprehensive set of ESG literature. Additionally, relaxing some filters (while still maintaining quality) could be explored – for instance, including high-quality conference papers– to see if the cluster structure changes. In future analyses, a broader net should be cast to capture interdisciplinary or emerging venues of ESG research (like policy documents or specialised sustainability reports), acknowledging that the academic journal literature is one part of the knowledge ecosystem.
- The choice of bibliographic coupling (or any single clustering technique) carries inherent biases. Bibliographic coupling emphasises grouping by shared references; new research areas that don't yet have established common literature might be under-clustered, and papers citing popular references might cluster by default. Also, automated clustering algorithms force every paper into a cluster, even if a few papers are on niche topics (they might attach to the closest cluster). Moreover, our cluster labelling relied on an algorithm (LLR), which, while systematic, might not always capture the nuance of what a cluster is about. Combining multiple clustering methods could enhance rigour. For example, performing co-citation analysis in parallel can reveal the field's classical knowledge base (key cited works that form their own clusters) while bibliographic coupling shows current themes – comparing the two can validate if current clusters are grounded in distinct intellectual traditions. We could also incorporate a keyword co-occurrence cluster analysis as a content-based check: if the grouping of documents by shared keywords yields a similar cluster structure, that reinforces the validity of the themes. Using different algorithms (e.g., comparing VOSviewer's clustering with another algorithm like hierarchical clustering) is another way to test robustness – stable clusters should appear across methods.
- Bibliometric clustering is a quantitative technique that treats papers as nodes and references as links. Still, it does not directly account for the content of the papers beyond what is reflected in citations or keywords. Thus, some subtle thematic differences or overlaps might not be captured. Two papers might be in the same cluster because they cite similar literature, yet their conclusions or perspectives could differ. Also, the method doesn't automatically explain *why* a cluster of papers forms a theme – it requires our interpretation. To address this, future analyses can be enriched with text mining or topic modelling on the articles. For example, running a Latent Dirichlet Allocation (LDA) model on the same set of 2023 ESG papers could identify latent topics and keywords, which we could then map onto our bibliometric clusters to see how well they align. This would provide content validation for the clusters. We could also extract qualitative insights by reading more papers in each cluster to supplement the bibliometric findings. Essentially, mixed-method approaches – combining network analysis with qualitative content analysis – would yield a more nuanced understanding. One study noted that bibliometric methods are powerful for objectivity and should be complemented by fine-grained analysis for deeper insights.
- ESG research overlaps with CSR, sustainability, corporate citizenship, etc. Our strict focus on "ESG" might have excluded papers that discuss similar ideas under different terms. Conversely, some included papers might use "ESG" but align more with other debates. This can blur cluster boundaries or omit clusters. Future work could be more inclusive in search terminology – for instance, mapping ESG research alongside to see the intersection and differences. One could perform a factor analysis of keywords to detect if terms cluster in expected ways. Additionally, periodic updates to the search query are needed as the field's terminology evolves. Monitoring new keywords would ensure they are incorporated into cluster analysis as the ESG discourse expands.

In conclusion, while our bibliometric clustering of 2023 ESG literature provides a systematic and rigorous snapshot of the field's structure, these limitations highlight areas for improvement. Future research should strive to broaden the dataset, use multi-method validation, and integrate qualitative analysis to fortify the robustness of the findings. By doing so, we can enhance confidence in the clusters identified and ensure they faithfully represent the evolving landscape of ESG research. Each refinement – including more data, employing complementary clustering techniques, or engaging in deeper content analysis – will contribute to a more

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comprehensive and nuanced understanding of how ESG knowledge is organised. Such improvements will ultimately make bibliometric insights more actionable for academics and practitioners navigating the rich and complex ESG literature.

3. Industry Applications and Case Studies focusing on e-Grocery Supply Chain

Digital twins for ESG analysis are being applied across various industries, from mining (Cranford, 2023) to manufacturing, but the e-grocery sector offers a particularly illustrative example because of its complex, fast-moving supply chain and significant sustainability challenges (food waste, packaging, last-mile delivery emissions). In this section, we examine how digital twins are used in practice to monitor ESG performance, drive sustainability initiatives, and support regulatory compliance in e-grocery and related domains. We will highlight use cases including carbon footprint reduction in logistics, sustainable agriculture integration, and real-time ESG risk management. Additionally, we consider ESG risk assessment models for different supply chain segments (logistics, agriculture, manufacturing, energy) and how agent Large Language Models (LLMs) enable dynamic decision-making such as real-time ESG scoring. Case studies are presented below.

1) Carbon Footprint Reduction in Logistics (Environmental Impact)

For e-grocery, delivery logistics (warehousing, transportation to customers) is a significant source of carbon emissions. Digital twins are being used to optimise these operations to reduce fuel use and emissions:

- *Route Optimi*sation: Companies can simulate different routing strategies by mirroring the delivery network in a digital twin. For instance, the twin can ingest live traffic data, orders, and vehicle telematics and then use algorithms or ABM simulations to find optimal routes that minimise distance travelled or idle time. Blume Global (a supply chain solutions firm) notes that digital twins help optimise transportation routes and reduce warehouse energy consumption, enabling real-time evaluation of supply chain decisions on environmental impact (The Blume Global Team, 2023). An e-grocery can thereby cut unnecessary mileage – if the twin finds that reassigning some deliveries from route A to route B reduces overlapping paths, the manager can implement that, cutting fuel by 5%. This directly lowers Scope 1 emissions.
- *Fleet Management and Electrification:* A twin can simulate the introduction of electric delivery vans or optimising load factors. For example, it might show that if specific urban delivery routes are switched to e-vans (with charging logistics modelled in twin), CO_2 emissions drop significantly with minor cost increases. Walmart has used digital modelling to redesign delivery networks for efficiency; while not public in detail, we can extrapolate that e-grocers too simulate fleet transitions to meet emissions targets.
- *Real-Time Emission Tracking:* The twin continuously calculates emissions from ongoing operations (taking data from vehicle sensors). If real-time ESG scoring is enabled, the organisation might set a carbon budget (like X tons per week). If the twin's running total shows an approaching breach, it can trigger actions. E.g., it might instruct an LLM agent to advise dispatchers to consolidate some deliveries or delay non-urgent shipments until off-peak (reducing fuel due to less traffic). This is dynamic decision-making: adjusting operations on the fly to stay within ESG targets.

Case Study – Last-Mile Delivery. A European online grocer implemented a digital twin for its delivery network in a pilot city. The twin identified that specific neighbourhoods could be served with a micro-fulfilment centre and bicycle couriers for short distances by integrating live order data, traffic API, and driver behaviour data. Simulation in the twin predicted a 20% cut in delivery van miles. They tested it in reality and saw a substantial cut in fuel use and positive customer feedback for bike deliveries. This showcases how the twin can simulate a change (introducing a new delivery mode) before making any investment or de-risking sustainability initiatives.

2) Sustainable Agriculture and Sourcing (Environmental & Social Impact in Upstream Supply)

E-grocery retailers rely on agricultural producers for fruits, vegetables, dairy, etc. Ensuring those upstream activities are sustainable is key for overall ESG performance:

- *Farm-to-Store Digital Twin:* Companies like Tesco or Carrefour are exploring digital twins that extend to farms – essentially creating a virtual supply chain from farm fields to store shelves (Abazeri & Vollbracht, 2024). This can incorporate remote sensing data for crop conditions and link to procurement systems. Doing so allows them to monitor things like pesticide use, water stress, or yield issues in real-time.
- *ESG Risk Assessment for Agriculture:* One study noted that digital twins could transform agriculture and supply chains by *"curbing greenhouse gas emissions, food waste and malnutrition"* (Tzachor et al. 2022).

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For example, a twin might simulate different farming practices, such as switching suppliers from conventional tillage to regenerative agriculture. It could integrate data on soil carbon sequestration from literature and model how that affects the carbon footprint of produce over time. If the simulation significantly improves, the retailer can work with that supplier to implement the change. Additionally, ABM could be used to model farmer behaviours (agents as farmers deciding on fertiliser use vs. cost), giving insight into how to incentivise sustainable practices.

- *Social Impact – Farmer Livelihoods:* On the social side, e-groceries are concerned about fair trade and no exploitative labour. A twin could track metrics like price volatility and smallholder farmer incomes. If an agent LLM scans news and finds, for instance, evidence of labour protests at a tea plantation supplier (Owlin, 2025), the twin can flag a social risk. The retailer might preemptively send an audit team or engage the supplier. This is an example of **real-time ESG risk monitoring** from the Owlin use case applied to agriculture suppliers.

Case Study – Deforestation-Free Supply Chain. A large food company committed to zero deforestation used a digital twin coupled with satellite data to police its palm oil supply chain. They uploaded concession maps of all their suppliers' plantations into the twin's geospatial layer and connected it with a satellite alert system (such as Global Forest Watch). Whenever an alert of forest loss popped up within a supplier area, the twin would generate an incident entry, and an AI agent would notify sustainability managers. In some cases, they suspended purchases until the supplier took corrective action. Over a year, they observed a reduction in deforestation alerts linked to their supply chain, indicating the pressure and transparency had an effect. This approach directly applies to e-grocers concerned about embedded deforestation in coffee, cocoa, or beef products.

3) Storage and Processing (Energy and Waste in Facilities)

E-grocery often involves large distribution centres, refrigeration units, and sometimes processing (like cutting produce, packaging, and maybe central kitchens for ready meals). Digital twins of these facilities help in:

- *Energy management:* As seen in the Advantech example, smart factories with edge AI monitor energy and optimise processes in real-time (Ruiz, 2022). An e-grocery distribution centre twin might dynamically adjust refrigeration setpoints or lighting based on occupancy to save energy while maintaining food safety. Edge AI on-site ensures this happens continuously, with data fed back to the central twin for tracking performance.
- *Refrigerant leak detection:* Many refrigeration systems use HFCs, which are potent greenhouse gases if leaked. IoT sensors can detect leaks, and the twin can schedule immediate maintenance to prevent large leaks. This is both environmental (prevent GHG release) and regulatory (avoiding fines).
- *Waste reduction in processing:* If an e-grocery has a packing facility where they, say, cut fruits or portion bulk goods, the twin can track yields vs waste. By ABM or process simulation, changing cutting equipment or scheduling yields less waste. For example, digital twin simulations at a bakery plant showed how adjusting recipes and oven loads could reduce burnt waste significantly (hypothetical but plausible scenario).
- *Health & Safety:* On the social side, a digital twin of a facility can include a live model of workforce and equipment interactions. ABM can simulate workers (agents) moving in a warehouse and identify collision or high-risk zones (perhaps confirmed by IoT like forklift proximity sensors). If a pattern emerges (like frequent near-misses in a particular aisle), the twin surfaces this insight so management can intervene (reconfigure that area or provide extra training). This proactive safety management improves the S (social) performance – fewer accidents and a safer workplace.

Case Study – Smart Warehouse ESG Management. A global retailer implemented a twin for a new automated warehouse. The twin monitored the energy use of the automation system and optimised it, cutting electricity use by 15% in off-peak hours by slowing down conveyors when order volumes were low. It also tracked every safety incident and near-miss. With AI, it identified that most incidents occurred during a particular shift and at a specific picking station. Upon investigation, they found lighting was poor in that area at night. They improved lighting, and incidents dropped. This small example shows how detailed data in a twin can improve workplace conditions (S) and operational efficiency (which also ties to E by saving energy).

4) Smart Warehouse Automation with IoT & Robotics (Energy Efficiency & Operational Speed)

Modern e-grocery warehouses must efficiently process high volumes of orders while minimising energy consumption and waste. IoT and robotics play a vital role in optimising warehouse operations, ensuring sustainability, and increasing order fulfilment speed.

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- *Dynamic inventory management:* IoT-enabled sensors track inventory movements in real-time, ensuring optimal stock levels and preventing over-ordering. The system automatically adjusts storage conditions (temperature, humidity) to reduce spoilage of perishable goods. Unlike traditional static inventory tracking, IoT prevents out-of-stock and overstocking, improving efficiency (AHG, 2025).
- *AI robots for picking and packing:* Automated robots powered by AI move, sort, and pack items faster than human workers, reducing processing time. Unlike manual handling, robots use optimised picking routes, minimising unnecessary movement and energy consumption. For example, Ocado is a unique and fully independent online grocer specialising in home delivery of high-quality food, drink and household items) automated warehouses deploy swarms of AI-driven robots to fulfil grocery orders three times faster than conventional warehouses, cutting energy costs and reducing waste (Murdivien et al., 2025).
- *Energy-optimised warehouse processes:* IoT sensors monitor and control lighting, HVAC systems, and cooling, ensuring energy is used only when needed. Unlike traditional systems that operate under fixed settings, IoT-based smart grids can dynamically adjust power consumption, resulting in significant energy savings (Cimetrics Analytika, 2025).
- *Predictive maintenance using IoT and AI:* IoT sensors detect early signs of equipment failure, preventing unexpected breakdowns and costly downtime. Unlike traditional maintenance based on fixed schedules, predictive maintenance ensures only necessary repairs are performed, reducing material waste and energy loss (Murtaza et al. 2024).

Case Study – AI-Driven Warehouse Robotics. A notable example of warehouse robotics driven by AI is found in Ocado (2025), a British online supermarket that has transformed its logistics and warehouse management through AI-powered robotics. To improve efficiency, lower operational expenses, and achieve greater accuracy in order fulfilment, the company implemented an automated warehouse system utilising AI-driven robots.

Ocado (2025) has developed the world's most sophisticated grocery automation system, featuring state-of-the-art technologies integrated into its Customer Fulfillment Centres (CFCs). Central to Ocado's automated operations is 'The Hive', a groundbreaking innovation allowing for remarkably swift grocery order processing. Ocado realises exceptional efficiencies in fulfilling grocery requests by utilising a blend of robotic bots and robotic arms. This system enables the processing of 50-item orders in a mere five minutes. In action, the process and technology at Ocado (2025) feature an automated system that employs fleets of robots navigating the CFC to manage and process items effectively. These robotic arms work in perfect harmony with the bots to pick and pack customer orders with a level of precision and accuracy akin to that of humans. Thanks to the implementation of On Grid Robotic Picking (OGRP), robots can make instantaneous decisions, packing grocery items without needing prior information about the items or their arrangement. This cutting-edge technology guarantees a flexible and adaptable process, enhancing both speed and accuracy. After the orders are packed, the process of automation advances with Automated Frameload (AFL), which autonomously places totes onto van frames for shipment without any human involvement. AFL technology addresses labour shortages and rising regulatory demands by automating the complete loading procedure. This system allows for loading as many as 350 totes each hour, greatly enhancing operational efficiency.

Significant Developments: Grid Robotic Picking (OGRP) involves robotic arms that make instantaneous decisions to pack grocery items into bags without familiarity with the products, enhancing the overall process and increasing operational flexibility. Automated Frameload (AFL) refers to technology that automates the loading of totes onto van frames, thereby removing the need for manual labour and significantly improving efficiency.

Intelligent Delivery System: After orders are packed, Ocado (2025) streamlines the distribution process through automation, facilitating quick preparations for same-day or next-day deliveries. Ocado's robotic system minimises energy use linked to the fulfilment process by decreasing reliance on human labour and manual interventions.

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5) Packaging and Circular Economy

E-grocery uses a lot of packaging (bags, boxes, insulation for cold items). Digital twins can help manage and reduce this impact:

- *Material flow modelling:* A twin can model the flow of packaging materials through the system – from suppliers delivering products in packaging to the packaging used for final delivery to how much is returned or recycled. It can simulate scenarios like switching to reusable packaging. For instance, the twin could simulate if we switch to a reusable crate system with customers (like some grocers do for delivery), how many crates circulate, how to sanitise them, what cost and emissions trade-offs vs. cardboard. This is complex, but a twin is suited to such multi-step flows.
- *Partnership with Customers (Social behaviour):* Getting customers to return or reuse packaging is a social aspect. The twin could integrate an agent-based model of customer behaviour regarding packaging returns (some may always return, some never, and some if incentivised). Running simulations can estimate return rates and needed incentives (coupons, deposit fees). An interesting use case is the use of digital tokens (blockchain-based) to reward returns – the twin can track tokens issued and redeemed, linking governance (transparency of program) with environmental outcomes (less waste).
- *End-of-life and waste management:* If an e-grocer partners with recycling companies or food banks for unsold food, the twin models those loops. For example, a charity picks up unsold bread daily – the twin ensures inventory marked as unsellable is flagged for donation and optimises the logistics of that (like which items go to which charity based on needs). The IoT For All article on food banks highlights that retailers could do more to channel unused food to charities (Limer, 2024). A digital twin can coordinate this by forecasting what stock will likely not sell in time and arranging redistribution before it spoils.

Case Study – Food Donation via Digital Twin. A French supermarket chain, responding to regulations requiring them to donate unsold food (France's 2016 law) (Limer, 2024)., leveraged their inventory digital twin to reduce food waste. They tagged each perishable product in the twin with its expiry date and constantly predicted, via AI, the chance it would sell. If that chance fell below a threshold, the twin automatically notified partner food banks and triggered an offer in their system. The food bank could claim it via a portal. This was essentially an automated "clearing house" for unsold food. As a result, this chain significantly reduced waste and helped distribute thousands of meals that otherwise would be trash. The IoT For All piece essentially describes enabling such processes, *"retailers always have a clearer picture of inventories with visibility towards food products that need redistribution before waste happens"* (Limer, 2024). By converting inventory data into action (alerting ahead of time), the twin solved logistic challenges and created a win-win for the environment and society.

6) Real-time ESG Scoring and Decision-Making with LLM Agents

Pulling it all together, leading companies are using digital twins not just to monitor but to score and make decisions in real-time:

- *ESG Dashboard and Score:* For instance, a retailer could have a "Sustainability Cockpit" powered by the twin, where at any given day, an ESG score (perhaps composite or separate E, S, G scores) is shown. This score updates as data flows in, such as the carbon footprint year-to-date vs target, workforce metrics vs target, etc. If the score dips (indicating performance issues), the twin (via an LLM agent) explains why: e.g., "Energy usage in DCs increased 10% this week due to heatwave – causing environmental score drop (The Blume Global Team, 2023). Suggest increasing solar power or adjusting AC." Managers can drill down through the twin to see specifics.
- *Automated Alerts and Actions:* As mentioned earlier, Owlin-like monitoring means the twin knows if any ESG violation or risk is detected in the external world. For example, suppose a law is passed in a city banning diesel delivery trucks by 2025. In that case, the twin's LLM agent might flag: "New regulation in City X – 30% of your deliveries happen there – need the plan to transition to EV by the deadline." The twin can even simulate compliance plans.
- *Balancing Trade-offs:* Sometimes improving one ESG aspect could worsen another (e.g., using biofuel reduces carbon but maybe drives up delivery costs and could affect food prices, a social concern). A rich twin can simulate multi-criteria: one can run two scenarios and see how they score on the E, S, and G pillars. This supports decision-making that aligns with the company's values and stakeholder expectations.

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- *Continuous Improvement & Learning:* The twin can learn what strategies yield improvements over time. If an initiative underperforms, the twin's data will show it. This learning feeds into future planning. The twin can be used in ESG risk assessment models for different areas important for supply chain delivery cases:
  - *Logistics:* assessing risks like fuel price volatility (affecting cost and possibly emissions if switching to cheaper but dirtier fuel), or accident risk (social). The twin can model these.
  - *Agriculture:* climate risks (drought affecting crop yield – twin can integrate climate model data to stress test supply).
  - *Manufacturing:* regulatory risk (new emissions rules – twin can simulate the cost of compliance and see if any facility would violate limits).
  - *Energy:* energy sourcing risk (if relying on fossil grid vs building solar – twin can evaluate ROI and carbon impact).

Competitive Advantage. Companies using such twins can respond faster and make more informed decisions than those relying on periodic reviews. For example, during the COVID-19 pandemic, supply chain twins helped companies reconfigure quickly (Wang et al., 2022). In an ESG context, consider a sudden raw material shortage due to an extreme weather event – a digital twin connected to climate data may foresee this earlier and help pivot to alternatives, ensuring continuity and reducing the risk of price spikes or shortages, which could hurt communities.

Industry Traction. According to a Capgemini survey, 57% of companies believed digital twin tech is crucial for ESG management (Lee, 2024). Accenture estimated that scaling digital twins could reduce carbon emissions by 7.5 million tons by 2030 (Lee, 2024). These figures suggest that industry leaders are actively pursuing twin-driven sustainability. We see examples:

- Unilever (consumer goods) mapping climate and deforestation risks via digital twin-like geospatial platforms to assure sustainable sourcing.
- Amazon reportedly uses digital simulations in warehouses to improve efficiency and safety simultaneously (though details are proprietary).
- Ocado (online grocery technology company) uses digital twins extensively for robotics and may extend that to energy optimisation of the fulfilment of ESG applications, which are not publicly detailed.

The e-grocery industry stands explicitly to gain because it intimately interfaces with producers and consumers. A digital twin can help them assure consumers (with data) that their order was fulfilled sustainably – for example, showing at checkout an estimated carbon footprint of the basket (calculated by the twin from farm to door) and perhaps how that footprint was offset or reduced through confident choices. Some startups already allow consumers to see product-level sustainability info; a robust twin is what generates that info reliably.

In conclusion, digital twins in practice are helping companies in the e-grocery sector and beyond to monitor ESG metrics in real-time, proactively manage risks, and find efficiencies that benefit both sustainability and the bottom line. The case studies and use cases above illustrate reductions in carbon emissions, prevention of waste, improved labour conditions, and better compliance – all enabled by integrating IoT, AI, and data in a digital twin platform. The following section will discuss how we measure the success of these initiatives (evaluation metrics), how ESG performance improvements are quantified, the remaining challenges, and how emerging technologies might address them.

4. Evaluation Metrics and ESG Performance Indicators to Enlarge Business Competitiveness

Having implemented a digital twin for ESG in an e-grocery supply chain, it is crucial to define how success is measured. Evaluation metrics refer to both the performance of the digital twin system itself and the actual ESG outcomes achieved. In this section, we outline the key performance indicators (KPIs) used to evaluate ESG improvements and the effectiveness of the digital twin approach. We also consider how traditional ESG performance measurement is evolving in real-time data and what benchmarks or standards are used to gauge performance.

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1) ESG Outcome Metrics. These are the actual sustainability performance indicators (many of which overlap with the indicators in Table 1) that reflect whether ESG goals are being met. Some critical ones include:

- *Carbon Footprint Reduction:* Measured in absolute tons of CO_2e reduced year-over-year, or intensity metrics like CO_2e per delivery or per revenue. For example, if the twin helped optimise routes, we might see a measurable drop in emissions per delivery measured as the percentage of reduced transport costs compared with initial transport costs. This can be benchmarked against science-based targets (e.g., a company aiming to cut emissions 50% by 2030). Accenture's projection of a 7.5 million ton reduction by 2030 due to digital twins (Lee, 2024) provides a macro-benchmark; at the company level, one could set a KPI like "% toward climate target achieved via digital twin initiatives" if attribution is possible.
- *Energy Efficiency:* kWh saved, or improvement in energy productivity (output per kWh). Metrics like % of energy from renewables can also be tracked if twin initiatives include solar or wind integration. The twin might help hit renewable procurement targets by simulating different energy-sourcing options.
- *Waste Reduction:* Reduction in total or food waste, measured in tons or % of input. For instance, an e-grocer might aim to halve food waste (aligning with SDG 12.3) (Limer, 2024). If the baseline was 1000 tons/year and it's 600 tons after twin implementation, that's a clear KPI success (40% reduction). Similarly, packaging reduction (e.g., eliminating x tons of plastic by shifting to reusables) is a tangible metric.
- *Delivery Efficiency and Customer Metrics:* A sustainable supply chain often correlates with efficiency improvements. KPIs like on-time delivery (service level), cost per delivery, etc., remain crucial for operations – the twin should ideally improve these or maintain them while implementing ESG improvements. If sustainability efforts degrade customer service, that's a problem; thus, a balanced scorecard is needed.

2) ESG Ratings and External Benchmarks. Ultimately, many companies gauge ESG success via external ratings (Morgan Stanley Capital International (MSCI), Corporate Sustainability Assessment (S&P CSA), etc.), inclusion in indices (Dow Jones Sustainability Index (DJSI), or compliance with frameworks (like achieving a certain Carbon Disclosure Project (CDP) score, or reaching UN Global Compact Advanced level).

- *Improvement in ESG Ratings:* A tangible measure is climbing from a BBB to an A rating in MSCI or improving the Sustainalytics score (lower risk). These scores should improve if digital twin efforts address previous data gaps or performance issues. For instance, inconsistent reporting (a common issue flagged by raters) could be solved by the twin's consistent data, thus boosting transparency scores (Cranford, 2023) (the mining study mentioned inconsistent reporting as an issue, which a twin helps bridge).
- *Meeting Regulatory Targets:* For example, compliance with the EU's CSRD (Corporate Sustainability Reporting Directive) is measured by successfully producing required reports and audits. Or meeting mandated reductions (like city emissions zone requirements, etc.). Zero violations is a clear success metric.

3) Holistic Balanced Scorecard. Many organisations use a balanced ESG scorecard combining multiple metrics. For supply chain ESG, one might have:

- Environmental: CO_2e, waste, energy.
- Social: safety incidents, labour compliance rate, employee engagement score, community investments.
- Governance: audit scores, policy implementation (e.g., code of conduct coverage), data transparency.
- Economic (because sustainability must align with economic viability): cost savings, revenue from green products, risk reduction value.

The digital twin's impact can then be mapped to each. For example, cost savings and risk reduction could be tallied in dollars to show shareholders that ESG via twin adds financial value (resilience and efficiency).
Traditionally, ESG performance was evaluated annually when a sustainability report was published, and rating agencies updated their scores. This lag meant companies might only find out their shortcomings after the fact. With the twin, evaluation is continuous. Companies are moving to *continuous auditing* of ESG data. For instance, some firms use software that continuously calculates an internal "ESG score" for operations daily or weekly (Pan, 2023). These internal scores might not be public, but they keep everyone on track. We might liken it to financial management: you don't wait till year-end to check profit; you monitor monthly or daily in some cases; similarly, ESG is now monitored frequently with tools like digital twins.

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Group Caliber provides an *"ESG perception tracker"* with real-time sentiment data (Group Caliber, 2025). If a company sees its public perception dipping due to some issue, that's a cue to take action immediately (maybe increased communications or remedial measures). Combining that with the twin's operational metrics gives a 360 view – internal performance and external perception.

Benchmark against peers or standards. The twin, fed with industry data or benchmarks (maybe via an LLM that knows sector averages), can contextualise metrics. E.g., "Our carbon intensity is 20% lower than the industry average of 0.5 $kgCO_2$ per delivery" – a sign of leadership – or vice versa if above, a target to beat. For context, many companies use benchmarks like GRI-published averages or World Bank ESG data.
If metrics from the twin are externally assured (common for ESG data now), an evaluation metric passes assurance with no significant issues, indicating data robustness. Blockchain can help by showing immutable data trails (Synergy, 2025), which auditors love because it reduces the likelihood of tampering. So one could measure, for example, "% of ESG data points assured without adjustment" – ideally 100% if the twin data is solid.

There's increasing evidence that strong ESG correlates with better financial performance in the long term. Some metrics tie ESG to finance, e.g., a reduction in insurance premiums due to better risk management (safety, environmental risk). Or access to sustainability-linked loans (where the interest rate is lower if ESG targets are met). Achieving those targets (like a loan might say reduce CO_2 by 30% in 3 years for a 0.1% interest cut) is a clear evaluation metric with monetary impact.

Summarily, evaluation metrics should reflect *impact* (are we more sustainable?) and *process maturity* (are we managing ESG efficiently and proactively?). A company might compile these into an ESG performance dashboard that executives review as often as they do financial KPIs. The digital twin makes that possible by providing timely, accurate data.

One can imagine a quarterly review where the COO and CSO (Chief Sustainability Officer) look at twin outputs: "This quarter, emissions down 10% (ahead of our 7% target, good), waste down 5% (short of our 8% target – investigate, twin shows the main issue in produce category), safety incidents unfortunately up by 2 cases (twin suggests it's one site, action taken), ESG rating improved from 75 to 80." Each of these is backed by the rich analysis of the twin, which not only flags the what but provides the why through its integrated model and AI agents.

Companies create a feedback loop for continuous improvement by continuously evaluating such metrics. It's akin to Total Quality Management but for sustainability: measure constantly, identify deviations, and correct them in near real-time.

4) Assessment to Enhance Business Competitiveness. The significance of advanced technological solutions on business is substantial, especially considering the rising global demand for efficient operations, sustainability, and environmental consciousness. This study presents a range of potential outcomes, including promoting increased green practices and enhancing competitiveness through reduced reliance on traditional business technologies, marking a novel approach in this field. Policies and initiatives aimed at fostering sustainability have been increasingly adopted by the EU, the United Nations, and G20 nations (Gallo et al., 2020). Sustainability-promoting policies can be categorised into three main areas: environmental, socio-economic, and technological. These sustainable policies encompass climate, air quality, and environmental ethics. Consequently, companies must view environmental sustainability as a goal rather than merely a marketing strategy. The impact of advanced technological solutions on business operations is substantial as they respond to the increasing global demand for sustainability, efficiency, and environmental consciousness. By incorporating green technologies, businesses improve their environmental practices and boost their competitiveness, thereby framing sustainability as a strategic imperative rather than a choice. This research introduces innovative multi-criteria assessment methods that merge environmental, socio-economic, and technological indicators to analyse the dynamics of corporate competitiveness. The study identifies distinct variations in adopting sustainable practices across different countries and uncovers overlooked issues such as energy inefficiency and waste management. Additionally, it sheds light on less-explored challenges, including

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the effects of environmental noise on corporate performance, and contributes fresh insights to sustainable development research. Organisations such as the G20 countries, the United Nations, and the European Union (EU) are increasingly adopting initiatives and innovations designed to promote sustainable development. The European Commission's Green Deal underscores the significance of reducing environmental impacts through technological advancements. Nevertheless, the uptake of eco-friendly deliveries within the EU remains inconsistent. The research underscores the significant potential for enhancing energy efficiency in goods deliveries, which could reduce operational expenses and environmental impact. It is estimated that inefficiencies result in up to 50% of energy waste, highlighting an urgent call for sustainable approaches. By tackling these inefficiencies, companies not only lessen environmental harm but also improve their competitiveness through cost reduction. Another often-overlooked pollutant is environmental noise, which significantly affects public health and business efficacy. Prolonged noise exposure can cause health problems like cardiovascular conditions, sleep disruptions, and psychological strain, diminishing workforce productivity. These indicate that addressing noise pollution is essential for promoting community health and business competitiveness. Reducing noise levels becomes increasingly vital for businesses in urban settings, as it impacts residential and commercial preferences, ultimately influencing market positioning. This study emphasises the transformative potential of green technologies and sustainable practices in contemporary business. This research investigates the categorisation of green technologies to evaluate their effects on environmental sustainability and business competitiveness. It centres on assessing how these technologies can enhance business performance through an industry competitiveness lens. To achieve this, a multi-criteria framework was established that incorporates indicators reflecting the evolving nature of corporate competitiveness.

Companies evaluate the environmental effects of services or equipment before selection and implement strategies that impact the energy usage of transport equipment. Such indications explore the resources and expertise necessary for successful sustainability strategies, promoting enduring environmental advantages.
The crucial impact of eco-friendly solutions is the improvement of corporate competitiveness and environmental sustainability. Through an analysis, it identifies significant challenges like energy inefficiency and waste while emphasising the advantages of sustainable practices. Adopting green technologies reduces environmental harm and enhances business performance, positioning sustainability as a strategic imperative instead of merely an option.

Conclusion & Discussion

The findings of this study reinforce and extend the growing consensus in the literature that digital transformation is a catalyst for sustainable business practices. Consistent with prior research, our analysis confirms that implementing digital technologies can yield substantial environmental benefits in supply chains and industrial operations (Yang et al., 2021; Wang et al., 2023). Digital technologies and advanced analytics contribute to the optimisation of processes—transportation routes are streamlined, inventory levels better matched to demand, and energy usage fine-tuned—all of which minimise waste and emissions (Kwilinski et al., 2023).

Beyond supply chains, broader industry applications of digital transformation also show positive sustainability impacts. Smart manufacturing (“Industry 4.0”) technologies, such as sensor-equipped equipment and AI-driven quality control, lead to less scrap and rework, thereby conserving materials and energy (Mahroof et al., 2022). Even in agriculture, digital platforms and precision farming tools help optimise water use and reduce chemical inputs (Gebresenbet et al., 2023). These examples illustrate a key point: digital transformation provides the tools to fundamentally change processes that align with environmental sustainability—through real-time environmental monitoring, improved resource circularity, or dematerialisation of traditional services (Liu et al., 2023).

However, our discussion also uncovers significant challenges and limitations. One major concern is the paradox of digitalisation's environmental footprint. The ICT sector, which underpins digital transformation, contributes an estimated 1.5–4% of global carbon emissions (Duan et al., 2025). High energy consumption by data centres and rapid hardware obsolescence lead to increased electronic waste (Frick, 2016).

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To address these challenges, policymakers should:

- Invest in sustainable digital infrastructure, such as energy-efficient data centres.
- Establish clear standards for data-sharing and interoperability in digital supply chain platforms.
- Support SMEs through grants and training programs to ensure broader access to sustainable digital technologies (Hasanova & Romanovs, 2020).

Industry leaders must integrate sustainability metrics into their digital strategies, adopting green IT practices such as optimising software for lower energy use and prolonging device lifecycles.

Digital transformation is a transformative pathway toward greener, more sustainable supply chains and industries. When effectively implemented, digital technologies substantially reduce environmental impacts by improving efficiency, transparency, and resource control. However, realising this promise requires addressing implementation barriers and ensuring long-term sustainability benefits. By aligning digital innovation with sustainability goals, businesses and policymakers can accelerate the transition toward a low-carbon economy.

Bibliometric analysis is an essential tool for assessing the evolution of research trends, identifying key themes, and mapping intellectual structures within digital transformation and sustainability. By analysing a vast corpus of scholarly publications, bibliometric methods reveal the interconnectedness of research themes and the influence of foundational works on emerging studies (Duan et al., 2025). Recent bibliometric studies have highlighted the increasing convergence between digitalisation, green supply chain management, and circular economy practices, demonstrating a shift from conventional business strategies toward technology-driven sustainability models (Wang et al., 2023). For instance, citation network analysis indicates that blockchain technology and AI-driven analytics are among the most frequently cited innovations in supply chain sustainability research, underscoring their role in improving transparency and efficiency (Kwilinski et al., 2023). Additionally, co-occurrence analysis of keywords shows rising interest in terms such as "smart logistics," "carbon footprint reduction," and "IoT-enabled supply chains," signifying the growing recognition of digital tools as enablers of sustainability (Liu et al., 2023).

Another key insight from bibliometric analysis is the geographical distribution of research contributions. The global variation underscores the different priorities of digital sustainability research based on regional economic and industrial conditions. Furthermore, collaborative network analysis reveals that partnerships between academia and industry have intensified in recent years, with joint publications highlighting real-world applications of digital transformation in logistics, energy efficiency, and waste reduction (Fareed et al., 2024). These insights validate the significance of digitalisation in contemporary sustainability research and provide a roadmap for future investigations.

The case studies discussed above illustrate that digital transformation is not merely a theoretical concept but a tangible force reshaping industries toward sustainability. Companies streamline operations, reduce environmental impact, and align with circular economy principles. However, scaling these digital solutions remains challenging, particularly for small and medium-sized enterprises (SMEs) facing cost and technological barriers (Duan et al., 2025). As digital transformation continues to evolve, future research should focus on policy frameworks, investment strategies, and cross-industry collaborations to ensure that sustainability benefits are widely accessible.

This study highlights the transformative role of digital twins in enabling sustainable e-grocery supply chains. The case studies analysed illustrate that digital twins are not just their theoretical models but also drive measurable improvements in environmental, social, and governance (ESG) performance. E-grocery companies can enhance logistics efficiency, reduce emissions, and ensure sustainability compliance across their supply chains by integrating real-time data, predictive analytics, and AI-driven decision-making.

A key finding is the effectiveness of digital twins in reducing logistics-related carbon footprints. Route optimisation, fleet electrification simulations, and real-time emissions tracking enable companies to lower transportation emissions while improving operational efficiency. For example, the successful deployment of

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micro-fulfilment centres and bicycle couriers demonstrates how digital twins facilitate low-emission urban logistics solutions.

Beyond logistics, digital twins enhance sustainable sourcing and agriculture by providing data-driven insights into pesticide use, water consumption, and soil health. Integrating satellite monitoring with digital twins, as seen in the deforestation-free supply chain case study, fosters transparency and accountability in agricultural sourcing, preventing environmental degradation.

In manufacturing and processing, digital twins improve energy efficiency, automate waste reduction strategies, and enhance workplace safety. AI integration enables proactive risk mitigation by preventing food waste through real-time inventory adjustments and optimising warehouse conditions to improve worker safety. The ability to simulate waste reduction strategies before implementation also supports circular economy initiatives. Additionally, digital twins drive packaging optimisation and waste reduction through material flow simulations and return logistics modelling. Businesses can leverage these tools to transition toward sustainable packaging while ensuring consumer participation. The predictive food donation model exemplifies how digital twins can prevent unnecessary waste while addressing social sustainability challenges.

One of the most promising aspects of digital twins is their ability to support real-time ESG risk assessment and dynamic decision-making. Automated ESG scoring dashboards and AI-driven policy compliance alerts enable businesses to adapt operations to emerging regulations or environmental thresholds. This agility enhances long-term resilience and sustainability performance, shifting ESG management from reactive to proactive.

Despite these benefits, challenges remain in scaling digital twin adoption across the e-grocery sector. High implementation costs, interoperability issues, and the complexity of AI integration pose barriers, particularly for small and medium-sized enterprises (SMEs). Future research should explore cost-effective adoption strategies, such as cloud-based solutions, open-source platforms, and industry collaborations.

Digital twins offer a compelling pathway for advancing ESG goals in the e-grocery supply chain. Companies can optimise efficiency, reduce environmental impact, and strengthen sustainability compliance by leveraging real-time data analytics, AI agents, and scenario modelling. As regulatory frameworks evolve, digital twins will become an increasingly valuable tool for balancing profitability with sustainability commitments. Industry-wide adoption and policy support will be crucial in unlocking their full potential and shaping the future of sustainable supply chains.

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ASSESSMENT OF THE SUSTAINABILITY OF PUBLIC SERVICE QUALITY: A CASE OF LATVIA

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Abstract. One of the United Nations Sustainable Development Goals (SDGs) is good governance and sustainable cities and communities. Sustainable development goals in public administration are relevant worldwide and can only be achieved through collective efforts by using scientific insights. The sustainability of the quality of public administrative services is one of the key objectives in improving the functioning of public administration in Latvia and worldwide. The present study aimed to assess the sustainability of the quality of administrative services provided by public administration institutions in Latvia, comparing its results with a similar study conducted in 2017–2018. The study was based on four public administration institutions and their branches in Latvia. It relied on a sample of public service customers from the largest cities in Latvia – Riga, Daugavpils, Jelgava, Ventspils, and Valmiera. A total of 130 randomly selected customers of public administration institutions participated in the study; they filled out SERVQUAL questionnaires before and after their visit to the institution. The survey questionnaires were collected in 2022-2023. The customer sampling can be characterised as random and administratively territorial, ensuring proportional representation across planning regions. The service quality assessment model – SERVQUAL (Parasuraman et al., 1988) – and SPSS software (22.0) were used for data collection and analysis. Improving the sustainability of the quality of administrative services in Latvia can significantly contribute to enhancing the quality of life in society, achieving its strategic goals, and refining the operations of public administration institutions, thereby improving the economic environment.

Keywords: public administration; public services; sustainability of public service quality

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JEL Classifications: H8, H83

Additional disciplines: quality management

1. Introduction

In 2015, the United Nations General Assembly adopted the resolution "Transforming our World: The 2030 Agenda for Sustainable Development". This resolution outlines 17 Sustainable Development Goals (SDGs) aimed at achieving sustainable global development. The SDGs are balanced across three dimensions: economy, social aspects, and the environment. One of these goals focuses on good administration and sustainable cities and communities (UN 2015).

The Sustainable Development Goals (SDGs) in public administration are relevant worldwide and can only be achieved through collective efforts using scientific findings. For a country aiming to achieve higher development indicators, collaboration with research institutions is essential to help attain global objectives that

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are relevant to society as a whole and future generations, such as the sustainability of public services, accessibility to educational opportunities, and healthcare availability (AlShehail et al., 2022; Sigurjonsson et al., 2024).
To agree on the most effective methods for achieving these goals, leaders of public institutions and policymakers should draw on the expertise of scientists and researchers. Ensuring the sustainability of the quality of public administrative services is one of the key objectives in improving public administration in Latvia and globally (Zikhali et al., 2023; Shava & Vyas-Doorgapersad, 2023).

This article aims to provide insight into assessing the sustainability of administrative service quality in public sector institutions in Latvia, comparing the obtained data with the previous studies. Improving the sustainability of administrative service quality in Latvia can significantly contribute to enhancing the quality of life in society, achieving its strategic goals, optimising the operations of public administration institutions and municipalities, and improving the economic environment.

2. Theoretical Aspects of the Research

Determining a set of sustainable development indicators that is appropriate for the real situation in public administration is a challenging task. To address this issue, it is essential to understand which indicators are the most important and how they impact sustainable development goals. At the same time, the number of representative indicators should be as small as possible.

To systematically analyse the sustainable development of public administration, six key subsystems are to be considered:
- Individual development of society members (civil liberties and human rights, social justice, individual independence and the right to self-determination, health, the right to work, social inclusion and participation in social life, the role determined by gender or social affiliation, level of material welfare, qualification, specialisation, adult education, age, family planning prospects);
- The social system of a society (the population's birth and mortality rates, ethnic composition, distribution of income and class structure, social groups and organisations, social security, healthcare, age-related benefits);
- Political administration (quality of government and public administration, national funds and taxation policy, political participation and the level of democracy, human rights policy, population and immigration policy, legal system, crime control, international cooperation policy, technology development policy);
- Infrastructure (ratio of between urban and rural areas, transport infrastructure and the distribution of industrial enterprises, supply systems (electricity, water, food, manufactured goods, services), waste disposal, healthcare services, communications and media, educational and professional opportunities, science (scientific research));
- Economic system (production and consumption, payment instruments, entrepreneurship and trade, labour force and unemployment rate, income, market);
- Resources and environment (natural environment, natural resources, ecosystems, biological species, depletion of non-renewable resources, regeneration of renewable resources, waste recycling, environmental pollution, environmental degradation).

These six subsystems can be grouped into three larger subsystems: the social system, the economic system, and the environmental management. Specific indicators can characterise the functioning of each subsystem. It is the systemic approach that can be used when selecting indicators for sustainable development in public administration and assessing its sustainability.

The sustainability of public administration can be assessed by using various parameters. The authors have identified the indicators crucial for assessing the sustainability of public administration development in accordance with the sustainable development indicators recommended by the UN (2015). All the indicators are grouped into subsystems: economic, financial, social, and environmental.

The following indicators are proposed for characterising the sustainability of the development of the economic subsystem of public administration: the quality of public administration, the volume index of industrial

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production, the share of unprofitable enterprises, the volume of investments, the unemployment rate, and the inflation rate. A decline in the quality of public administration and a decrease in investment activity can be considered signals of a deterioration in the economic sustainability of public administration. Therefore, the quality of public administration and the index of investment volume could be used as indicators that describe the sustainability of the economic subsystem of public administration.

The sustainability of the financial subsystem is determined by the following indicators: the volume of budget revenues as a percentage compared to the previous year at reference prices; the share of taxes allocated to municipal budgets in total tax revenues; the debt-to-capital ratio; and the ratio of municipal debt servicing expenses to budget expenses. The indicator "volume of budget revenues, % compared to the previous year at reference prices" reflects the share of budget revenues in comparison to the previous year, which allows for the assessment of changes in revenue.

Significant parameters of the sustainability of societal development are indicators that reflect the trends in social processes, the well-being of the population, demographic indicators, and crime rates; they form the social subsystem. The Human Development Index (HDI) is a universal indicator used to analyse the socio-economic situation in individual countries and globally. The use of this index was promoted by the publication of unified socio-demographic statistics. The Human Development Index consists of three components that characterise human development: life expectancy, education, and per capita income.

In implementing the concept of sustainable development, and with the escalation of environmental issues worldwide, the impact of public administration activities on the environment becomes an important indicator of its sustainability. The impact of these activities on the environment can be assessed by the economic damage caused to the environment. The economic damage caused by environmental pollution is an assessment of the harm caused by such pollution. This economic damage increases proportionally with the volume of harmful substances entering the natural environment (in the form of wastewater, emissions, waste) and depends on their toxicity.

The mentioned groups of indicators can be used to analyse the activities of both the public and the private sectors in the environmental, social, and economic spheres (Ball et al., 2009). In the past decade, there has been increasing attention in the scientific literature to the assessment of the sustainability of public administration. The most studied topics include sustainability indicators, public administration organisations' accountability, and the transparency of their operations (Van Dyk 2011; Sánchez et al., 2013; Lynch & Mosbah 2017). However, it appears that the research on the sustainability of the public sector significantly lags behind the research on the private sector in this respect (Dumay et al., 2010; Farneti, Guthrie, 2009; Domingues et al., 2017). It is assumed that it is important to assess the impact of the public sector on the environment and its economic and social contributions. This area of the public sector performance assessment is still in its early stages and remains underdeveloped. Although the public sector has begun to engage more in sustainability assessments by publishing reports and sustainability indicators, this research theme is still in its infancy (Domingues et al., 2017).

Many scholars also examine such aspects as the main drivers of corporate sustainability in the public sector and the levels at which the sustainability of the public sector is measured. Many of these measurement systems have been developed for specific areas or institutional contexts of the public sector (Lundberg, 2013; Ramos et al., 2021). Based on these systems, three measurement methods have been mainly used in public sector research to assess the performance in the environmental and sustainability areas. These include sustainability indicators (Mapar et al., 2017), sustainability reports (Farneti & Guthrie, 2009; Montecalvo et al., 2018; Navarro-Galera et al., 2014), and environmental indicators (Myhre et al., 2013; Alpenberg et al., 2019).

The analysis of the research literature testifies to the fact that currently, there are no unified global standards or guidelines for determining the sustainability of the public sector. It should be concluded that sustainability indicators in the public sector encompass performance related to environmental activities, natural resource conservation, emission levels, employment aspects, occupational health and safety, community relations, and the involvement of stakeholders (Adams et al., 2014).

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There is no unified understanding or definition of terms such as "sustainable development" and "sustainability" in the public sector. Still, they are mainly provided by authors based on the specific characteristics of the industry. This is the most common approach for assessing the sustainability and environmental performance of the public sector (Moreno-Pires & Fidélis, 2012; Schlör et al., 2013; Mapar et al., 2017). In this context, the environment is the primary area of interest, and 50% of authors choose it as a criterion for measuring sustainable activities (Niemann & Hoppe 2018; Mapar et al., 2017; Alpenberg et al., 2019). However, these indicators are mostly created by the authors themselves, using surveys with short yes/no questions (Alpenberg et al., 2019; Mapar et al., 2017), interviews with key report preparers, or content analysis. Authors analyse sustainability using sustainability reports and integrated reports (Park et al., 2021).

Thus far, EU member states have played a leading role in assessing the sustainability of the public sector (Niemann & Hoppe, 2018). In EU countries, legislation is being introduced to address sustainability assessment issues; for example, the Non-Financial Reporting Directive (EU 2014), which amends Directive 2013/34/EU regarding the disclosure of non-financial information (environment, social responsibility, human rights, anti-corruption) and other international standards. One of the latest packages is the proposal for the Corporate Sustainability Reporting Directive (EU 2022), which the European Commission amended in 2022 to expand the scope of the Non-Financial Reporting Directive (EU 2014) in sustainability reporting standards in the areas of environment, social issues, and administration.

In recent years, public authorities have expanded their knowledge about the quality of sustainable services, and sustainability has been adopted as a policy goal and integrated into their service functions and processes. However, there is a limited understanding of how to measure the results related to environmental sustainability (Park et al., 2021). The authors propose determining the sustainability of public services by monitoring the quality of administrative services, using the SERVQUAL service quality assessment model (Parasuraman et al., 1988) for data analysis.

Analysing the scientific literature, the authors have summarised the above-mentioned groups of sustainability indicators in the table below (see Table 1).

Table 1. Indicators for Assessing the Sustainability of Public Administration

Economic Subsystem	Financial Subsystem	Social Subsystem	Ecological Subsystem
Inflation rate %	Volume of budget revenues, % compared to the previous year at reference prices	The ratio between the subsistence minimum and the average wage	Intensity of production waste, % compared to the previous year
Unemployment rate, %	Percentage of regulated taxes allocated to local budgets, %	Natural population growth (decline) per 1,000 people.	Environmental impact assessment
Index of investment volume compared to the previous year (%)	The ratio of borrowed capital to budget revenues, %	Life expectancy index	Manufacturing resource productivity, %
The share of unprofitable enterprises, %	The ratio of municipal debt servicing expenses to budget expenditures, %	Crime rate, number of crimes per 1,000 people.	
Volume index of industrial production, %.			

Source: created by the authors, based on Vazhenina,2010

3. Research Methodology

The study assessed the sustainability of the quality of administrative services provided by Latvian public administrative institutions in 2022-2023, comparing the results with the research conducted in 2017-2018.

The study was based on four public administration institutions and their branches in Latvia. It relied on a sample of public service customers from the largest cities in Latvia – Riga, Daugavpils, Jelgava, Ventspils, and

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Valmiera. The study involved 130 randomly selected customers of public administrative institutions who completed SERVQUAL questionnaires before and after visiting the institutions. The survey questionnaires were collected in 2022-2023. The customer sampling can be described as random and administratively territorial, ensuring proportional representation across the planning regions. The service quality assessment model – SERVQUAL (Parasuraman et al. 1988) – and SPSS software (22.0) were used for data collection and analysis. The survey was conducted at the public service delivery locations. The respondents were introduced to the content and aim of the survey. Anonymity was guaranteed to the respondents before they provided any data. Ethical and legal principles were adhered to in the study to ensure that the personal rights of the research participants were not violated. The questionnaire was developed based on the information elicited from scientific literature sources.

The SERVQUAL questionnaire consisted of two parts. Each part contained 22 statements about service quality, which were grouped into a set of five-dimension criteria. The customers were asked to assess each statement by using a 5-point scale.
Part A – showed the customer's expectations regarding the service quality, as well as the importance of various quality criteria to the customer.
Part B – showed the customer's assessment of the service received.

In both parts of the questionnaire, the object to be assessed was the service quality as a set of five quality dimensions, consisting of 22 criteria, which were:

- Dimension 1 – Tangibles (appearance and physical components);
- Dimension 2 – Reliability (trustworthiness / accurate performance);
- Dimension 3 – Responsiveness (courteousness and helpfulness);
- Dimension 4 – Assurance (attention, reliability);
- Dimension 5 – Empathy (convenient service delivery, good communication, and customer understanding).

Based on the difference between the expected and perceived service, an overall service quality indicator was calculated.

4. Research Results and Discussion

The study assessed the sustainability of the quality of administrative services provided by Latvian public administration institutions in 2022-2023, comparing it to the study conducted in 2017-2018. The results of the 2022-2023 study were then analysed and compared to the results of the study carried out in 2017-2018. The statistical analysis revealed the following results.

The mean of service expected by customers is 4.79. In comparison with the 2017-2018 research data, it can be concluded that the level of customer expectations has increased. The expectation level has risen in specific dimensions as well. It has notably increased in dimensions such as empathy, assurance, and tangibles (see Figure 1).

Customers have rated reliability, assurance, and responsiveness as the most important dimensions in the quality of administrative services in the Latvian public sector in 2022-2023.

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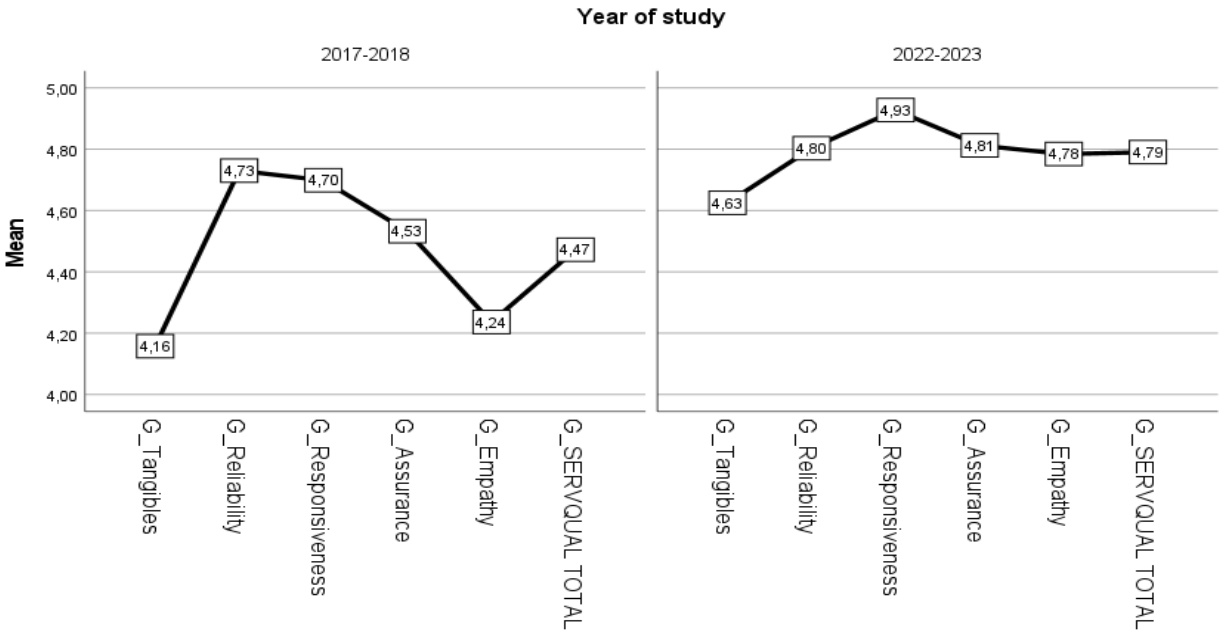


Figure 1. Comparison of the assessment of service expected by customers between 2017-2018 and 2022-2023.

Source: Created by the authors based on Katelo I., Kokina I., Raščevskis V. 2019, statistical analysis of survey data using SPSS 22.00, 2024.

The mean of the perceived service is 4.46. Compared to the data of the 2017-2018 study, the perceived service rating has increased across all quality dimensions. The lowest perceived service rating given by customers in public sector institutions in Latvia was for the quality dimension – tangibles – with an average score of 4.28, while the highest rating was for the reliability quality dimension, with an average score of 4.62 (see Figure 2).

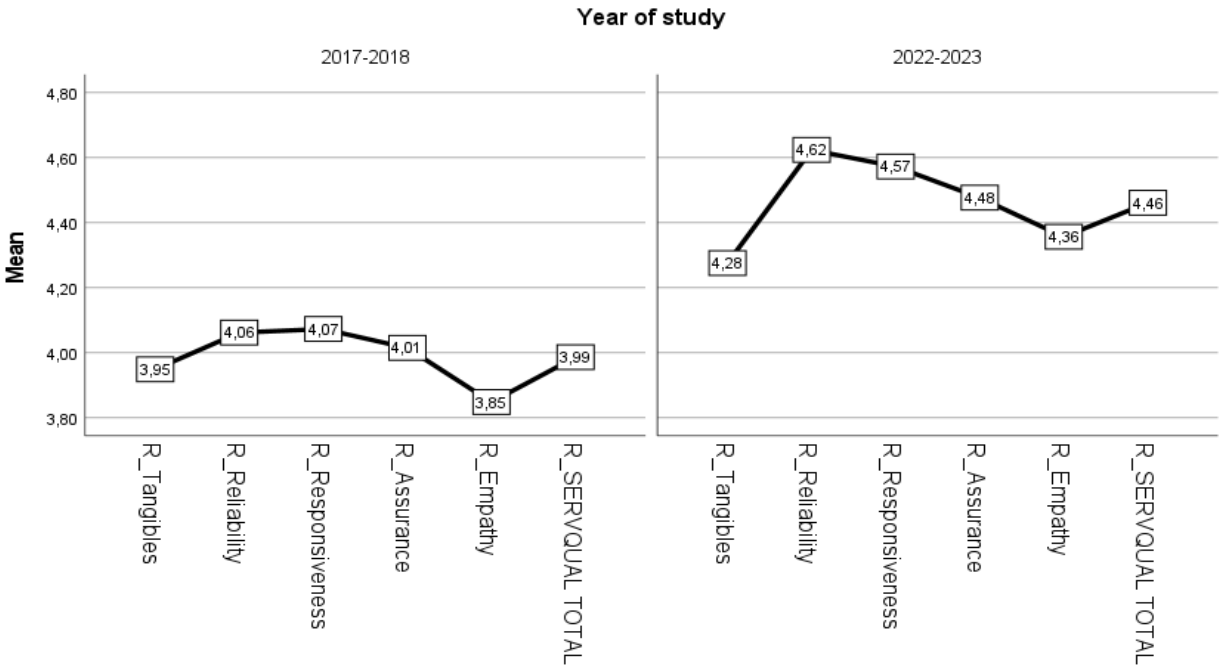


Figure 2. Comparison of the assessment of service perceived by customers between 2017-2018 and 2022-2023.

Source: Created by the authors, based on Katelo I., Kokina I., Raščevskis V. 2019, statistical analysis of survey data using SPSS 22.00, 2024.

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By calculating the difference between the values of the perceived service and the expected service, we obtained the average quality of administrative service delivery, which was rated negatively across all quality dimensions. The lowest-rated aspects of administrative service quality were in the dimensions of tangibles, responsiveness, assurance, and empathy. The least negative quality assessment was observed only in the reliability dimension. However, it is worth noting that the average quality of administrative service delivery in 2022-2023 was rated higher than in 2017-2018 (see Fig. 3).

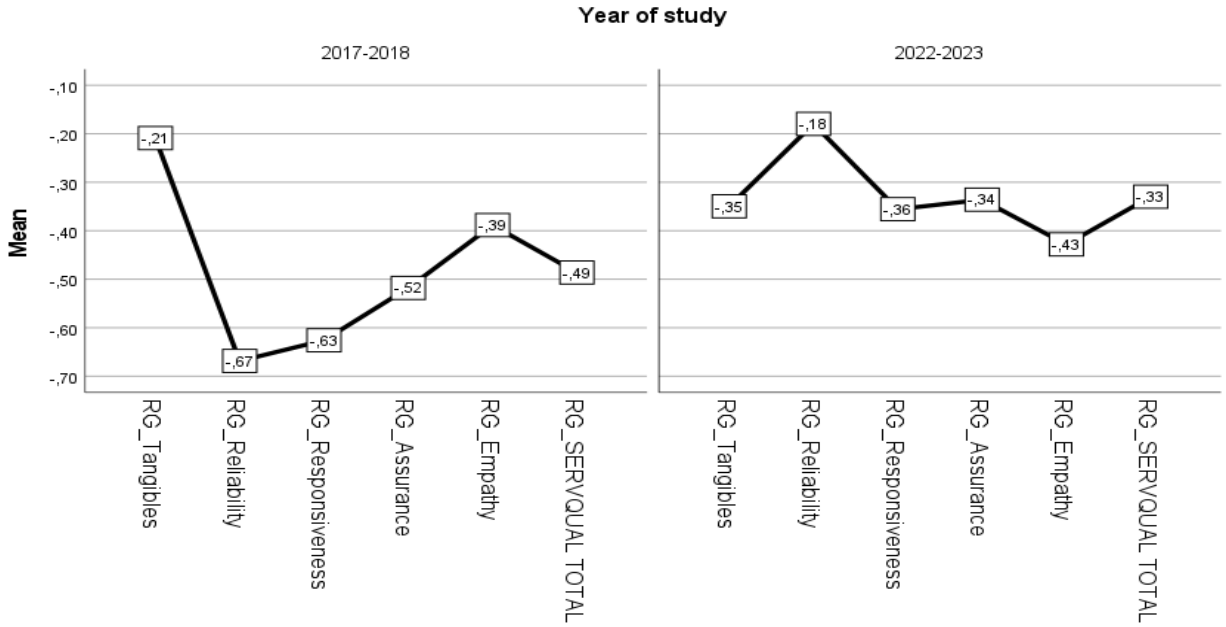


Figure 3. Comparison of the difference between the perceived service assessment and the expected service assessment (P-E) in 2017-2018 and 2023-2024. Quality of administrative services.

Source: created by the author, based on Katelo I., Kokina I., Raščevskis V. 2019, statistical analysis of survey data using SPSS 22.00, 2024

Analysing the customer survey results from the public institutions considered, it has been observed that the quality of administrative services provided by the State Revenue Service (SRS) was rated the most positively (-0.02). Compared to the administrative service quality assessment of 2017-2018, the quality of services provided by SRS has improved in all quality dimensions.

The quality of provided administrative services has slightly improved in the State Social Insurance Agency (SSIA) (-0.25 b.) and the State Employment Agency (SEA) (-0.32 b.).

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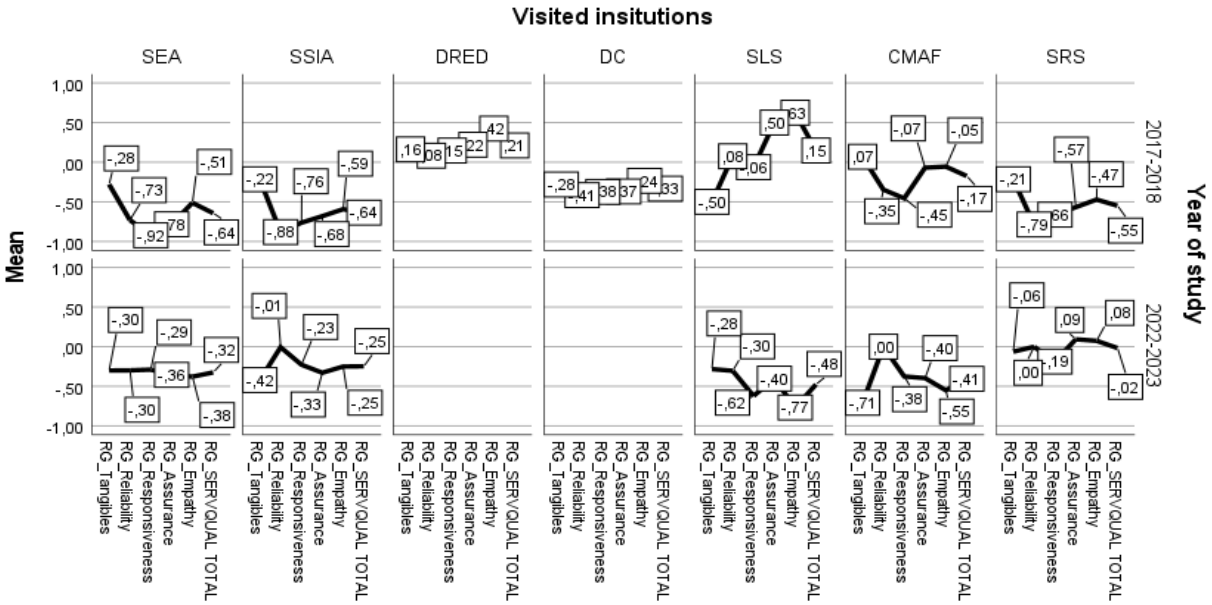


Figure 4. Assessment of administrative service quality in Latvia in 2017-2018 and 2022-2023, across the public institutions considered.

Source: Created by the authors, based on Katelo I., Kokina I., Raščevskis V. 2019, statistical analysis of survey data using SPSS 22.00, 2024.

The most negative assessment was given by the customers of the State Land Service (SLS) (-0.48). Compared to the administrative service quality assessment of 2017-2018, the quality of services provided by SLS has slightly declined in all quality dimensions (see Fig. 4 above).

Conclusions

The study found that customers consider the most important factors in the quality of services provided by public administration institutions to be service reliability, assurance and responsiveness of employees.

In the quality of administrative services in Latvia's public sector, the most important quality dimensions that need improvement are empathy, responsiveness, assurance, and tangibles.

The most positive assessment of the quality of administrative services was given by the customers of the State Revenue Service (SRS) (-0.02), while the most negative assessment was given by the customers of the State Land Service (SLS) (-0.48).

Assessing the sustainability of the quality of administrative services provided by Latvian public administrative institutions in 2022-2023, compared to the study conducted in 2017-2018, it has been found that the quality of administrative services has remained at the existing level, it has not significantly deteriorated, and has improved slightly. Therefore, over the past five years, the sustainability of the quality of administrative services provided by Latvia's public administrative institutions has been maintained.

The Sustainable Development Goals in public administration are relevant worldwide and can only be achieved through collective efforts and scientific insights. In pursuit of higher development indicators, the state must collaborate with research institutions to help attain global objectives that are significant for society as a whole and future generations, such as the sustainability of public services. The authors propose that the sustainability of public services is determined by monitoring the quality of administrative services, employing the SERVQUAL model for service quality assessment (Parasuraman et al., 1988) for data analysis.

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CHANGES IN THE VALUE ORIENTATION OF THE WORKFORCE FROM THE PERSPECTIVE OF INTERGENERATIONAL DISPARITIES IN THE CONTEXT OF WORK ATTITUDES AND LOYALTY*

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Abstract. The presented study examines labour market changes caused by generational shifts, specifically focusing on employees' value orientation toward work and changes in loyalty. Due to generational transitions, the labour market is experiencing shifts leading to workforce shortages. Understanding generational value differences is crucial for attracting and retaining the necessary workforce. The study aims to analyze survey data to determine generational attitudes toward employer loyalty and identify differences in perspectives on work activity across generational cohorts. The survey involved 405 respondents active in the Slovak labour market. The representation of generational cohorts in the sample aligns proportionally with their approximate labour market presence. The research focuses on testing several hypotheses aimed at identifying intergenerational differences in: (1) Willingness to work and remain in the labour market, (2) Loyalty to employers, (3) Perceptions of job stability. The primary method used to examine intergenerational differences and test hypotheses is the Kruskal-Wallis test. Results show a clear intergenerational decline in loyalty, with each successive generation spending shorter periods with a single employer. Additionally, the hypotheses reveal generational differences in: (1) Current willingness to change employers, (2) Perceptions of staying with one employer long-term, (3) Attitudes toward early retirement, (4) Views on work itself. These findings support long-term trends indicating that younger generations prioritize flexibility and work-life balance over job stability. As the results highlight emerging generational differences, it is crucial to adapt job designs to the specific values each generation brings.

Keywords: generational disparities; value orientation; loyalty; workforce mobility

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JEL Classifications: J21, J24, J63

1. Introduction

Labour market changes caused by generational transitions represent a complex research topic integrating demographic, economic, and social factors. A generational shift involves the entry of new generations and the exit of older ones, bringing differences in values, skills, preferences, and expectations among cohorts. This

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transition is particularly intense due to the convergence of up to four generational cohorts in the labour market alongside technological progress, innovations, and adverse demographic trends. These demographic shifts will exacerbate labour shortages, making it even more critical to understand generational disparities.

The term "generational cohort" refers to dividing a population based on birth periods, a concept first proposed by Inglehart (1977) to segment populations by generation. A generational cohort typically spans 15–25 years, depending on the average time from birth to parenthood (Lissitsa et al., 2022). The literature identifies key generational cohorts, including the Silent Generation, Boomers, X, Y, Z, and Alpha, with some authors also recognizing intermediary cohorts like Xennials and Zillenials (Kempf Taylor, 2023; Gentry, 2023). Each cohort has unique needs, preferences, and abilities that employers must understand to manage and retain the workforce effectively. The labour market comprises Boomers, X, Y, and Z.

Generational disparities lead to demographic changes characterized by population ageing and labour shortages. Employers face the challenge of attracting and retaining essential workers. Evidence of this generational issue is provided by demographic indicators, which vary depending on the selected generational timeframe. Xiang et al. (2023) studied intergenerational fertility shifts, linking workforce shortages to population ageing driven by declining birth rates and increasing life expectancy. This demographic trend is not confined to developed nations but is becoming a global issue requiring complex solutions (Nagarajan et al., 2021).

Fluctuations in birth rates, mortality, and changes in societal norms and behaviours typically drive demographic transformations caused by generational transitions. Understanding these shifts can help businesses develop strategies to address fluctuating consumer demands, reduce employee turnover, and cultivate talent pools (Redmond, 2024).

Despite forecasts predicting a decline in total population and, consequently, the workforce (Rouzet, 2020; Dougherty et al., 2022), generational replacements bring about conflicts as different generations exhibit diverse characteristics shaped by their unique historical contexts (Egerova et al., 2021; Mahmoud et al., 2021).

Given these generational differences in values, attitudes, skills, and expectations, it is reasonable to assume changes in perceptions of loyalty toward employers. Employee loyalty is critical to team stability, productivity, and organizational efficiency. Generational differences in loyalty perceptions pose challenges for employers, necessitating tailored strategies to attract and retain employees.

2. Theoretical background

The value orientation of different generations significantly influences their workplace behaviour and approach to work. Variations in values among generational cohorts result from socioeconomic and cultural shifts shaping each generation (Balon, 2024; Šesteková, 2023). This analysis focuses exclusively on the four generations present in the labour market—Boomers, Generation X, Millennials (Y), and Generation Z. Understanding intergenerational disparities is significant in a declining workforce. This decline is primarily attributed to changes in attitudes and values related to the labour market and career, as well as transformations in family policies, equality, and the high participation of women in the labour market (Golovina et al., 2024). Generational cohorts respond to various external changes, such as political shifts, economic conditions, labour market dynamics, technological advancements, and internal factors, like the intrinsic beliefs of cohort members. Recognizing and understanding these generational and contextual differences is essential for organizations to maintain a sufficient and motivated workforce (Alaql et al., 2023).

Demographic shifts caused by generational turnover often stem from factors like fluctuations in birth and mortality rates and changes in social norms and behaviours. Understanding these shifts is valuable for businesses in developing strategies to adapt to changing consumer demands, reduce employee turnover, and foster talent development within organizations (Redmond, 2024). Beyond the outlined demographic trends, other factors also impact the labour market, as noted by Andabayeva et al. (2024) and Textor (2024). According to these authors, generative artificial intelligence is increasingly utilized, with its effects primarily concentrated in developed countries due to the structure of their labour markets. These trends and the skills required for

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implementing smart industries are particularly associated with Generation Z and, to a lesser extent, Millennials. Giupponi and Machin (2024) highlight that technological advancements and shifts in skill demand primarily drive inequality and changes in the labour market. However, challenges arise from the relatively low representation of Generation Z in the labour market, their anticipated reduced willingness to work, and issues related to loyalty.

Alferjany and Alias (2020) identified generational differences in work values, including work ethic, respect for authority, work-life balance (WLB), and career development. Baby Boomers prioritize individual values and support from supervisors, while Millennials prefer collaboration and teamwork. Global changes, such as technological advancements and the climate crisis, have shifted younger generations' value orientation, particularly towards achieving a balanced WLB.

Several challenges are associated with Generation Z, including NEET, the Great Resignation, and quiet quitting. NEET (Not in Education, Employment, or Training) has become a critical indicator in discussions about the vulnerability of young people in the labour market. Addressing youth unemployment is increasingly linked to digital technologies and economic digitization, which can offer new opportunities to mitigate this issue (Başol et al., 2023). Another challenge, the Great Resignation, refers to a significant number of young people planning to change employers or leave the workforce altogether. This trend emerged as the global economy began recovering from the pandemic, prompting employees to reassess their work priorities and values. Key factors contributing to the Great Resignation include Changes in work preferences, The need for greater flexibility and work-life balance, Burnout due to working conditions, and A reevaluation of the purpose and meaning of work. For businesses and organizations, this trend presents a challenge. They must adapt to employees' new expectations, provide flexible working options, and improve corporate culture to remain competitive and appealing.

Simultaneously with the Great Resignation, the phenomenon of "Quiet Quitting" is emerging. This term refers to a situation where an employee gradually reduces their work engagement without formally informing their employer. It represents one of the ways employees express dissatisfaction with their work. This process may involve reduced participation in work tasks, limited communication within the team, and diminished work performance. This phenomenon affects all generations but is particularly pronounced among Generations Y and Z (Liu-Lastres, 2023; Lee et al., 2023; Marks, 2023; Formica & Sfodera, 2022).

Generational changes are also analyzed by Deloitte, which conducts regular surveys to identify differences in values and perceptions of the labour market and societal issues. Their research findings indicate that Generations Z and Y are deeply concerned about the state of the world and fear for their future. Due to ongoing crises, younger generations are reassessing their priorities and striving to balance the challenges of their daily lives with their desire to drive societal change. According to Deloitte (2023), the main attitudes and key factors influencing Generations Z and Y include: (1) Concerns about the future; (2) Rising costs of living and housing; (3) The Great Resignation; (4) Flexible work arrangements and an increasing interest in work-life balance (WLB); (5) Climate change; (6) Stress and burnout.

In line with Deloitte's findings and several studies (Harsono & Abdullah, 2023; Nieżurawska-Zając et al., 2023; Alaql et al., 2023), a shift in perceptions and attitudes towards employers frequently arises from a value-based perspective, along with associated loyalty to one's job and organization. Employee loyalty is influenced by various factors that employers can partially control, although external influences also play a role. Commonly cited factors impacting loyalty include job satisfaction, which is tied to the perception that the organization meets employees' needs. Additional factors include satisfaction with management and supervisors, strong workplace relationships, trust, and effective communication (Azzam & Harsono, 2021).

As evident from these studies, the current trends associated with declining loyalty are particularly pronounced in the context of Generation Z. This generation has become the focus of a substantial number of studies. The present study aims to identify generational disparities within Slovakia, specifically within the V4 region. Fuchs-Schündeln and Schündeln (2020) found significant differences between generational cohorts in Western countries and Eastern European nations, stemming from historical and political factors, particularly the

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influence of socialism. As a result, findings from Western studies cannot be directly applied to the Eastern European region, a conclusion supported by Hu et al. (2023). These authors emphasize that generational disparities vary geographically, necessitating region-specific research. Within Slovakia, Yen et al. (2023) demonstrated that the societal evolution in Eastern Europe, shaped by cultural, economic, and social factors, has significant implications for understanding the decision-making processes of different generations. Their research confirmed that regional disparities persist and continue to influence the behaviour of generational cohorts based on region-specific factors.

Given the differences between generations, especially in light of demographic trends, it is essential to shape an appropriate entrepreneurial environment that acknowledges generational nuances in the business ecosystem. This need becomes particularly important in the future, as Gosztonyi (2023) highlights.

4. Research objective and methodology

Employee loyalty is one of the key factors directly influencing the stability and performance of enterprises. In the context of generational disparities and workforce reductions, acquiring and retaining employees in the labour process becomes increasingly critical. Literature analysis has long suggested that newer generations entering the labour market tend to be less loyal compared to older ones. Recent discussions even highlight that the youngest generation in the labour market (Generation Z) is losing interest in work. This intergenerational transformation poses a challenge for employers who aim to meet differing expectations and retain employees across generations.

The primary objective of this study is to analyze the results of a questionnaire survey to assess the attitudes of different generations in the labour market toward employer loyalty and identify generational differences in their attitudes toward work activities.

The study is based on interim findings from a self-designed questionnaire survey focusing on the attitudes of labour market participants in Slovakia, segmented by generational cohorts. The survey was conducted in 2024 using the Survio platform. The target group consisted of employees in the Slovak labour market. The questionnaire covered several areas, each addressing specific aspects of generational disparities. Questions designed to identify attitudes toward work were structured using a 5-point Likert scale (strongly agree, agree, neutral, disagree, strongly disagree). A specific question regarding loyalty or willingness to change employers ("How many employers have you worked for?"), required respondents to provide a numerical response.

A total of 405 respondents participated in the survey. The distribution of generational cohorts was as follows: (1) Baby Boomers (25.20%), (2) Generation X (26.90%), (3) Generation Y (28.40%), and (4) Generation Z (19.50%). This distribution roughly corresponds to the actual representation of these generations in the labour market.

To address the research objective, the following hypotheses were formulated:

H1: Statistically significant differences exist between generations concerning the current labour market situation in the context of willingness to change employers or resign.
H2: Statistically significant differences exist between generations regarding the willingness to remain with a single employer for as long as possible.
H3: Statistically significant differences exist between generations in attitudes toward the use of early retirement options.
H4: Statistically significant differences exist between generations in their views on work activities and job performance.

The formulated hypotheses were tested using the Kruskal-Wallis test, an alternative to analysis of variance (ANOVA). This non-parametric method evaluates whether the medians of groups differ significantly based on the rank order of values. In this study, the Kruskal-Wallis test was employed to examine generational differences across various areas of the questionnaire survey. Only Likert-scale questions were analyzed using this method.

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The test allows the identification of statistically significant differences, with the evaluation and interpretation following Tupá (2024), in line with Hendl (2023).

Hypothesis verification and interpretation of findings utilize the Asymp. Sig. value, ensuring it is at or below the significance level of 0.05. This indicates statistically significant differences between generations. Additionally, the test results for each generation indicate the degree of association with the respective question: the lower the value for a particular group, the stronger the association. This interpretation is consistent with Tupá (2024).

Furthermore, descriptive statistical analyses will be employed to evaluate questions requiring direct numerical responses from respondents. These methods summarize and assess data using basic statistical measures, such as mean, median, and mode.

The chosen methodological approach enables a thorough examination of diverse areas related to loyalty and willingness to work. The results of this study contribute to a deeper understanding of generational disparities in Slovakia, and due to historical and cultural similarities, the findings may also be relevant to the broader V4 region.

5. Results and discussion

The generational shift in the labour market signifies the entry of a new cohort of workers into the workforce. Since each generation is shaped by specific conditions during their formative years, these differences manifest in their behaviour and preferences within the labour market. This divergence is evident in areas such as loyalty to employers, which directly impacts workforce retention and turnover rates.

Table 1. Intergenerational Differences in Loyalty

Gen	n	Min	Max	Mod	Avg.	Total	Avg. number of years on the labour market	Number of years to change employer
Boomers	102	0	13	4	5,40	551	40	**7,40**
X	109	1	20	3	4,33	483	30	**6,92**
Y	115	0	10	3	3,35	390	20	**5,96**
Z	79	0	9	2	2,96	209	10	**3,37**

Source: own processing

Table 1 presents the results of a survey question, "How many employers have you worked for?" Based on the responses, the average frequency of employer changes across generations was calculated, reflecting generational differences in workplace loyalty. The findings suggest significant variations in the duration of employees remaining with a single employer across different generations.

This trend can be partially attributed to fewer total years in the workforce among younger generations and their initial search for an optimal job. However, in a broader context, younger generations demonstrate lower employer loyalty, reflecting shifts in values and preferences within the labour market. For employers, this presents a challenge in adapting strategies to retain younger employees. Key factors include offering career development opportunities, workplace flexibility, attractive benefits, and proximity to the workplace.

In addition to shifts in attitudes, behaviour, and skills, generational differences have also contributed to demographic changes, leading to an ageing workforce and labour shortages. Older generations (Boomers and Generation X), characterized by higher stability and loyalty, are gradually retiring from the labour market. They

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are being replaced by younger, less stable generations. It will be critical for employers to understand how to attract and retain such a workforce (see Table 2).

Table 2. H1 - Kruskal-Wallis Test for the Question – "Do you plan to resign in the near future?"

Validation Tests	**Chi-Square =32,669; df=3; Asymp. Sig. = .000**				
Question/Validation Tests	Generácia	N	Median	Avg.	Mean Rank
I plan to give resignation in the near future	Z	**79**	3	4	**145,06**
	Y	115	5	4	211,03
	X	109	5	4	208,90
	Boomers	102	5	5	232,52
	Total	405	-	-	-

Source: own processing

Significant generational differences (Asymp. Sig. = 0.000) reveal that Generation Z is the least inclined to stay in their current job (Mean Rank = 145.06). This trend underscores the lower loyalty of younger generations and highlights the necessity for employers to implement measures to retain talent, such as offering career development opportunities. In contrast, Baby Boomers exhibit the highest level of loyalty.

Based on the results of the Kruskal-Wallis test, H1 can be accepted, indicating statistically significant differences between generations concerning turnover intentions and workplace departures.

Generation Z is identified as the least loyal cohort, with the highest likelihood of resigning in the near future, while Baby Boomers are the most loyal. Generations X and Y fall within a moderate range of loyalty. The results indicating the lowest loyalty among Generation Z align with findings from studies conducted in other countries and represent a challenge not only for Slovakia but potentially for the V4 region and Europe as a whole (Lindblad, 2024; Rahmani & Groot, 2023; Zudina, 2022).

Table 3. H2 - Kruskal-Wallis Test for the Question – I Consider It Appropriate to Stay with One Employer for as Long as Possible

Validation Tests	**Chi-Square =18,889; df=3; Asymp. Sig. = .000**				
Question/Validation Tests	Generation	**N**	**Median**	**Avg.**	**Mean Rank**
I Consider It Appropriate to Stay with One Employer for as Long as Possible	Z	79	3	3	249,29
	Y	115	2	2	193,41
	X	109	2	2	**201,95**
	Boomers	102	2	2	**179,08**
	Total	405			

Source: own processing

Generation Boomers exhibits the highest mean rank (179.08), which underscores their traditional approach to loyalty and job stability. Conversely, Generation Z, with a mean rank of 249.29, assigns less importance to this value, reflecting their preference for flexibility and career advancement (see Table 3 above). In comparison with other studies, such as those conducted in the United States, Akota (2021) reports that generational differences in employee turnover are less pronounced. However, this finding is not supported by the present results for Slovakia and the V4 region. Moon et al. (2024) conducted a study on intergenerational turnover in South Korea,

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concluding that turnover rates are increasing, thereby threatening the long-term sustainability of the workforce. This turnover is attributed to the divergent professional values brought about by generational shifts. These findings align with previous research.

Table 4. H3 – Kruskal-Wallis test for the question: If possible, I plan to take early retirement

Validation Tests	**Chi-Square =81,853; df=3; Asymp. Sig. = .000**				
Question/Validation Tests	Generation	N	Median	Avg.	Mean Rank
If possible, I plan to take early retirement	**Z**	79	3	3	**167,91**
	Y	115	3	3	**167,19**
	X	109	3	3	184,56
	Boomers	102	5	4	290,26
	Total	405			

Source: own processing

The findings indicate that younger generations, particularly Generations Y and Z, are more inclined to take advantage of early retirement, whereas generations approaching retirement age are less likely to do so (see Table 4). These results may be linked to perceptions of work-life balance (WLB) and financial considerations. Older generations recognize the necessity of remaining in the labour market, while younger generations may have greater confidence in their ability to accumulate sufficient financial resources for early retirement.

Table 5. H4 – Kruskal-Wallis test for the question: If I had sufficient financial resources (personal savings or conditional income), I would not work

Validation Tests	**Chi-Square =22,865; df=3; Asymp. Sig. = .000**				
Question/Validation Tests	Generation	N	Median	Avg.	Mean Rank
If I had sufficient financial resources (personal savings or conditional income), I would not work	**Z**	79	4	3,13	**178,63**
	Y	115	4	3,33	192,11
	X	109	4	3,30	**189,75**
	Boomers	102	4	3,96	248,31
	Total	405			

Source: own processing

Generational differences in response to this question are statistically significant (Chi-Square = 22.865; p = 0.000), supporting hypothesis H4. The Boomer generation exhibits the highest median (4 – "rather disagree") and mean rank (248.31), indicating a lower willingness to leave the labour market even with adequate financial security. Conversely, younger generations, particularly Generations Z and X, display the lowest mean ranks, suggesting a higher propensity to consider a life without employment if financially feasible (see Table 5 above). This result, in conjunction with the preceding question, highlights a generational shift in values, with younger workers placing greater emphasis on personal time, flexibility, and non-work-related activities.

The findings of this study indicate that intergenerational differences exist in values related to loyalty and work itself. Based on these results, it can be inferred that with each successive generation entering the labour market, workforce loyalty declines. Younger generations, such as Generation Y and Generation Z, exhibit higher

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turnover rates and a shorter average tenure with a single employer, reflecting their evolving values, shifting work preferences, and increasing emphasis on flexibility and career opportunities.

Intergenerational disparities present a challenge for the labour market, particularly for employers. To remain competitive, employers must adapt to the trends introduced by each generation while simultaneously considering the expectations of previous generations. This creates a complex situation in which employers must find a combination of generational factors that are attractive to all generational cohorts while ensuring that no cohort perceives any of these factors negatively. Similar findings have been reported by Climek et al. (2024), who emphasize that while common factors exist across generations, each generational cohort also has distinct characteristics. This differentiation suggests that organizations can benefit from implementing retention strategies tailored to the specific needs and values of each generation. Parrish (2024) also explores how generational differences impact job satisfaction, retention, and workplace motivation, highlighting the necessity of tailored retention strategies.

As previously mentioned, the results clearly demonstrate a decline in loyalty across generations. This is reflected in the average number of years that each generational cohort remains with an employer before switching jobs. Some may argue that the varying duration of each generation's presence in the labour market could influence these findings. For younger generations, particularly Generations Y and Z, this period may extend slightly over time. However, from an overall perspective, the intergenerational trend of declining loyalty appears unmistakably clear. The fact that younger generations exhibit lower loyalty levels has also been confirmed by Rueff-Lopes et al. (2024), who investigated turnover rates among Generation Y. These authors concluded that Generation Y experiences the highest turnover rates at the beginning of their careers compared to older generations. Based on this and our findings, it can be assumed that this issue will likely intensify with subsequent generations, including the current Generation Z. Consequently, significant research efforts have been dedicated to younger generations, as Generation Z is often associated with high workforce turnover. According to Marks (2023) and Formicu and Sfoderu (2022), this phenomenon is characterized by mass resignations—whether due to the pursuit of better job opportunities, a general lack of interest in work, or early burnout resulting from the psychological stress that this generation experiences more acutely.

Additionally, Generation Z faces the issue of NEET status (not in employment, education, or training), meaning they neither work, study, nor actively seek employment (Başol et al., 2023). This reluctance to work or prolonged job-seeking behaviour in search of an "ideal" employer is also reflected in our findings concerning the Slovak labour market. Questions related to job resignation, early retirement, and willingness to work reveal similar patterns observed in previous studies of Generation Z.

Regarding potential solutions for employers, adapting to emerging workforce trends—whether through benefits, wages, or other tangible and intangible incentives—appears to be crucial. One particularly important approach could involve intergenerational job personalization. Jäckel and Garai-Fodor (2024) have explored employer selection factors in Hungary and China, highlighting Hungary as a particularly relevant case for regional comparison and policy recommendations. These authors emphasize the importance of a comprehensive employer branding strategy that accounts for the job selection preferences of younger generations. For Generation Z, the employer's stance on socially significant issues, such as environmental sustainability, war, migration, and human rights, plays a critical role. These findings and recommendations align with those of Silva et al. (2023), who examined loyalty in the employer-employee relationship through a generational lens. According to these authors, organizational commitment and the intention to remain with an employer are key determinants of workforce retention. Moreover, factors such as work-life balance (WLB) and organizational culture play a crucial role in shaping employee loyalty. Based on the findings of Silva et al. (2023), implementing these measures could not only help attract and retain employees from specific generational cohorts but also enhance their sense of belonging and engagement within the organization. Similar conclusions have been drawn by Suprayitno et al. (2024), who conducted a literature review on the phenomenon of the "Great Resignation" and found that organizations must respond to the evolving needs and expectations of the workforce. In the context of our research, this means that organizations must identify and adapt to the needs of the generational cohorts entering the labour market.

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5. Conclusions

The present study examined the impact of generational shifts on the labour market, focusing on changes in value orientation in the context of work attitudes and loyalty. Based on a survey conducted in 2024 among 405 respondents active in the labour market, the study explored employees' value orientation concerning work attitudes and loyalty. The identified differences between generations, particularly between Generation Z and older generations (Boomers and Generation X), indicate that the youngest generation demonstrates a greater willingness to change employers and exhibits less interest in long-term career commitment with a single employer. This contrasts with older generations, who display stronger loyalty and a greater preference for employment stability. These generational differences have significant implications for employment practices and pose challenges for employers, who must adapt to differing expectations regarding work flexibility and career progression.

The hypotheses formulated in the study confirmed statistically significant differences between generations, suggesting that generational disparities in attitudes toward work and loyalty are evident in the Slovak labour market. The Kruskal-Wallis test revealed significant differences in attitudes toward loyalty, willingness to change employers, early retirement, and perceptions of work itself. These findings align with long-term trends indicating that younger generations prioritize flexibility and work-life balance over job stability.

From the perspective of the hypotheses, the study confirms that statistically significant differences exist between generations in their approaches to work and its associated benefits. Older generations (Boomers) exhibit a higher willingness to remain in the labour market even when financially secure, whereas younger generations (Z and Y) demonstrate a greater propensity to exit the workforce. This phenomenon highlights a shift in values, where younger employees place greater emphasis on flexibility, work-life balance, and personal time, as well as career opportunities.

Intergenerational disparities present a substantial challenge for employers, who must adapt to the evolving trends and needs introduced by each generation in the labour market. It is crucial for employers to recognize that each generation holds distinct values that influence their decision-making regarding employer selection, career choices, and working conditions. These findings underscore the necessity of intergenerational work personalization, where employers can develop targeted strategies that accommodate the needs and expectations of different generational cohorts.

Additionally, other factors must be considered, such as the increasing job turnover among younger generations (Y and Z), driven by elements such as stress, burnout, and unwillingness to remain in unsatisfactory working conditions. These challenges are particularly relevant for Generation Z, which faces the NEET (Not in Education, Employment, or Training) phenomenon and frequent job resignations. For these reasons, it is evident that employers must adapt their strategies not only to attract new employees but also to retain them within the organization, taking into account the values that are crucial to each generation.

In conclusion, the changing work values and preferences across generations necessitate flexibility and employers' ability to adjust to the evolving demands of the labour market. Retaining employee loyalty amid rising turnover, especially among younger generations, will depend on organizations' capacity to respond flexibly to these shifting needs and implement effective strategies that appeal to all generational cohorts in the labour market.

However, it is important to note that the findings may vary slightly due to the sample size and the regional distribution of respondents. Therefore, for future research, it would be beneficial to examine a larger sample with improved opportunities for regional differentiation. Furthermore, subsequent research could focus on identifying the specific underlying reasons for lower loyalty among younger generations.

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CONTRIBUTIONS OF CULTURAL AND SOCIAL NORMS TO PROJECTS SUCCESS WITHIN THE REAL ESTATE FAMILY BUSINESS IN CHINA

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Abstract. The research question of how could project managers make the Chinese real estate family business projects more sustainable and successful under specific cultural and social norms, is anchored in five-factor groups: the role of cultural and social norms in entrepreneurship; the value-added of an effective project; family business characteristics across different economies; peculiarities of real estate firms, and the growing economic and entrepreneurship power of China. As a pillar of China's economy, the real estate family enterprises are typical project-based enterprises. Driven by the purpose of understanding the views and experiences of project managers in a specific context of cultural and social norms and providing project management improvement recommendations (based on the Chinese real estate family businesses experience), the literature review led to a conceptual model of the role of cultural and social norms on Chinese real estate family business project success. The qualitative analysis, based on the semi-structured experts' interviews, helped verify the conceptual model. The theoretical framework conditions were tested through different angles, such as generation gap, educational background, professional experiences, and nature of the environment (family versus non-family).

Keywords: project success; family business; real estate industry; cultural and social norms; innovation; effectiveness

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1. Introduction

Chinese real estate family companies have gone through multiple development stages, and many failed to grow sustainably due to insufficient support received by family business project managers under specific cultural and social norms, accompanied by the fusion between intergenerational inheritance and innovation. The routes of research on the link between project management and culture could be traced back to the seventies or eighties. Some scholars view culture from a trans-spatial perspective, while others understand culture from a trans-temporal perspective (Kresnawidiansyah et al., 2023; Agit et al., 2024; Pahuja et al., 2024). Such a multi-faceted interpretation opened many opportunities for research related to the culture in family business. The division of ownership, corporate functions, and other family characteristics are influenced by specific cultures. Family business projects in China are deeply influenced by the traditional Chinese culture, while social norms play a significant role in Chinese real estate family business projects.

The Chinese family businesses have rapidly evolved over the last decades, providing a strong impetus to China's economic development. According to Wu and Qi (2020), maintaining inheritance is often considered a prerequisite for the sustainable development of family enterprises, while enhancing innovation capabilities is an engine for the longevity of family enterprises. Given that most real estate family businesses are typical

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project-led enterprises (Produção et al., 2022), the project's success or failure is impacted by the effectiveness of both project management/ leadership quality and innovation processes (Wang et al., 2024b).

In parallel with the evolution of technology, the workplace of modern organisations is evolving (Arefief et al. 2023; Siejca, 2023); representatives of different generations with their specific characteristics and values face different challenges, while project managers in family businesses need to reach higher economic and social value-added under specific cultural and social norms, reshaping social standards for appropriate and inappropriate behaviours, along with individual and organisational behaviour (Lauzikas & Miliute, 2020). In 2003, Wenquan et al. conducted a cross-cultural study on social norms of the citizens of China, the United States, and Japan, which divided social norms into four basic dimensions: adjusting external relations, preventing conflicts, expressing the central values, and sharing gains and costs.

Over the last years, many scholars (Laužikas & Mačiukaitė-Žvinienė, 2023) linked cultural and social norms to both business sustainability and entrepreneurship opportunities, while the attitude towards business behaviour emerged as a specific cultural environment impacting thoughts of diverse stakeholders, as well as contributing to the entrepreneurship dynamics, public health, social inclusion, citizens'/consumers' needs, etc. (East et al., 2019),

Given the advancement of modern technology, diverse factors (such as the combination of different generations' characteristics - trans-temporal culture, enhancing living conditions, and implementing a well-developed healthcare system) allow people to work beyond their traditional retirement age. Thus, the Chinese real estate family businesses (CREFB) often possess representatives of several generations working together and adapting to evolving cultural and social norms (Wang et al., 2024). Moreover, managers need to acknowledge each generation's expectations, motivation criteria, attitudes, behaviour patterns, and communication styles while acting according to these characteristics and reaching the synergy effects (Gilsing et al., 2022). In today's changing business environment, project management emphasises equal collaboration among employees, while the traditional Chinese culture emphasises hierarchy. Therefore, the project management function should be anchored on information transparency, efficient risk mitigation, and conflict management: the CSNs differences between the East and West should be taken into account and integrated into a strategy by Chinese real estate family businesses (CREFB) while preventing potential project conflicts (Liu, 2018; Liu, 2020).

Since the beginning of the twenty-first century, the real estate industry, which is based on projects in general, has been continuously contributing to China’s economic growth (Zhang, 2022). The economic growth of the real estate industry relied mainly on residents' behaviour in purchasing their real estate, thanks to the increasing purchase power. Relying on the cross-country comparisons, it is found that the higher the level of economic development, the lower the homeownership rate is. However, China's urban housing market shows the coexistence of high house prices and homeownership rates (Lin et al., 2019), which contradicts the findings of cross-country comparisons.

In the long run, traditional cultural values play a dominant role, while the traditional culture is increasingly influencing the home-buying behaviour of individuals. Taking the individual and family factors into account, it is common for Chinese parents to use their own savings to buy a house for their children, which is the manifestation of intergenerational income transfer in the context of 'altruistic' family retirement (Deng et al., 2019, Lai, 2024). From the government's perspective, the government can use the law and regulations of external control norms to structure policies related to homeownership (Wang et al., 2019), such as homeownership incentives, to influence residents' homeownership purchasing behaviour. CSNs influence Chinese residents' home-buying behaviour, individual and family factors, housing factors, real estate development factors, psychological factors, and institutional/ policy factors, which is in line with scholars' findings that culture has a strong influence on home-buying behaviour (Lai, 2024).

CREFB with family characteristics encounter different obstacles at different growth stages, such as the scale of capital, the organisational structure, profitability, etc. (Yang, 2024), calling for the absorption of external social capital, openness and bigger social trust among stakeholders that are not direct representatives of family culture, as well as integration of external talents in organisational operations. Thus, improving the market profitability

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means establishing extensive corporate alliances based on the effective integration of external financial and human capital.

2. Characteristics of family business in China

The dimension of family business is purposefully integrated within the research question because it directly links the culture with business sustainability. Although different scholars reveal a vast spectrum of criteria defining a family business, they agree with the family-centred ownership model: a family business is a business where a family holds the ownership and makes key management decisions. According to the GEM (2024/2025) methodology, the family business concept incorporates four dimensions (ownership, management, employment, and collaboration as a stakeholder), while the level of involvement depends on how many dimensions the chosen career of an individual matches. All in all, a family business could be defined as a family-owned entity, where a family possesses a substantial part of ownership, which is run by the second or further generation, and where the board of directors or executive leadership includes at least one or more family members. Notwithstanding that family businesses are numerous in China, they often face a lack of sustainability, lower technological intensity, and constraints jeopardising sustainable development, smooth transformation, and innovation (Ghafoor et al., 2024).

Such a perspective suggests that family firms in China are currently facing the dual challenges of intergenerational succession and innovation transformation. Achieving effective inheritance is a prerequisite for the sustainable development of family firms while enhancing innovation capabilities is a necessary precondition for the longevity of family firms (Wu & Qi, 2020). In parallel, innovation is largely perceived as both a driver for long-term survival (Shams et al., 2019) and a challenge in terms of the sustainability of family firms (Hernández-Perlines, 2024). Due to the family planning policy, the structure and scale of Chinese families changed. The number of children has decreased, while the younger generation's perception of family has evolved. It is challenging to reach a common understanding of family-based business development among different generations; thus, innovation plays a significant role in the intergenerational development of family businesses (Sanchez-Famoso et al., 2019, Li et al., 2022).

First-generation family firms are considered more entrepreneurial than multi-generational ones. In contrast, how to turn the “rich second generation” into the “entrepreneurial second generation” became a hot topic in Chinese family businesses. This phenomenon indicates that maintaining young generations' innovation and entrepreneurial spirit in family business is both a challenge and an approach to promoting sustainable development across generations. Considering that corporate governance is the main axis of modern enterprises, this strategic goal should be accompanied by the efficient allocation of innovation resources and, consequently, a significant effect on technological innovation (Hernández-Perlines et al., 2024).

Referring to the incompatibility of family goals with the economic goals of a firm, the open innovation system may employ external human resources to influence non-financial goals of the family firm's governance. In contrast, a family firm may secure the achievement of non-financial goals while reshaping its strategic priorities (Wang et al., 2024b). Overall, organisational openness and innovation play an important role in the sustainable development of family businesses. Open innovation in family business is a novel topic; thus, the theoretical model of family business characteristics (see Figure 1) should be further examined while taking into consideration new emerging trends, such as open innovation, new collaboration trends, and the combination of the economic and social value-added.

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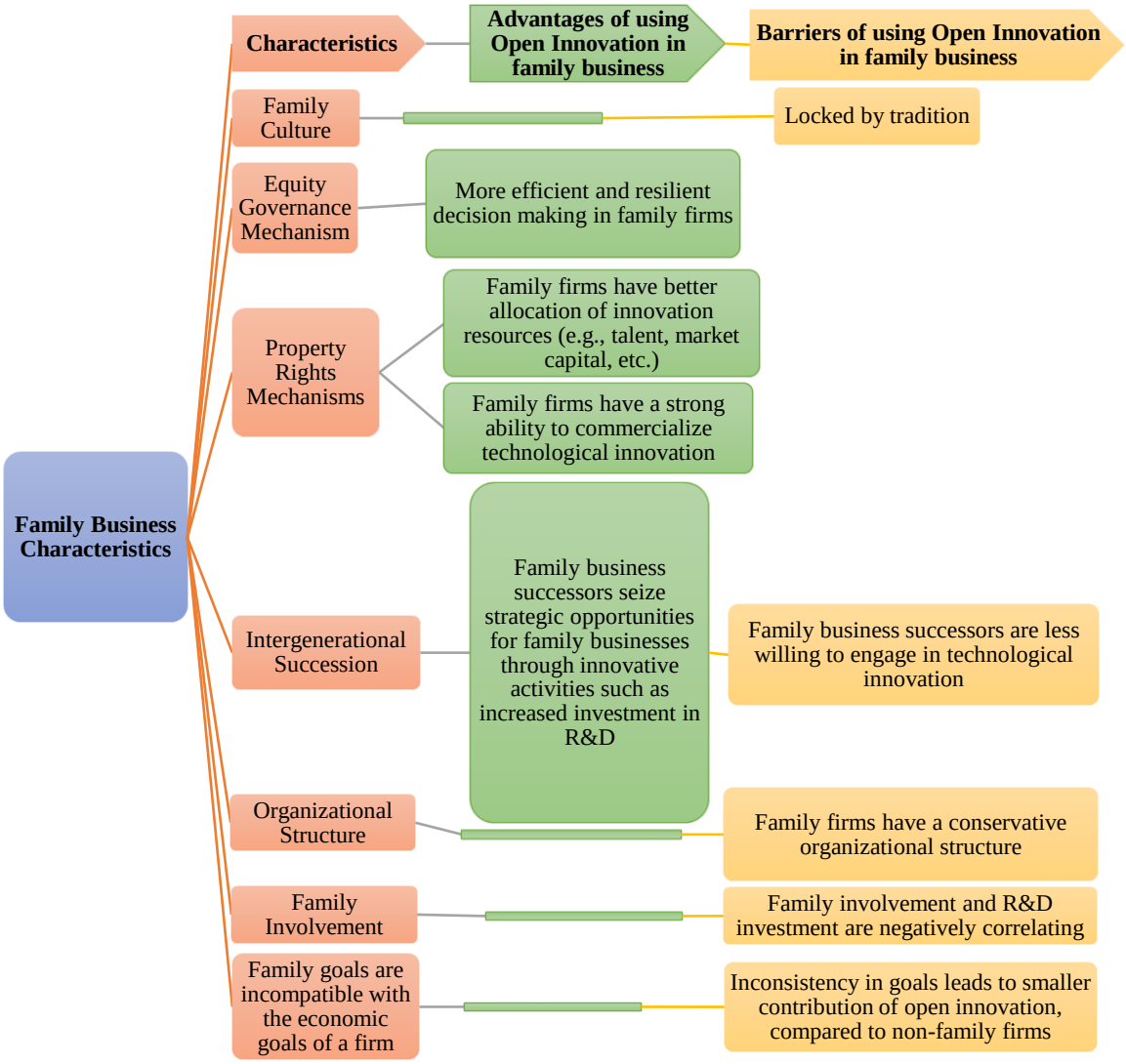


Figure 1. Family business characteristics in China: barriers and advantages of using open innovation

Source: prepared by the paper authors, based on Li et al., 2022; Ghafoor et al., 2024; Calabrò et al., 2019; Letonja and Duh, 2016; Vrontis et al., 2016; Del Vecchio et al., 2019

Given that project success is a key outcome for project practitioners seeking effective commercialisation (along with the economic and social value-added), project managers often monitor and emphasise diverse project activities. The project management approach establishes mechanisms for making decisions around specific tasks across diverse functional departments; thus, diverse effects of cultural and social norms might impact the performance of project managers. To further examine the relationship between project success in Chinese family real estate business and specific cultural and social norms, it is essential to back the theoretical implications of project managers' insights.

3. Methodology: conceptualisation of the role of cultural and social norms

To better understand the effects of cultural and social norms, numerous relevant research methodologies are compared (Table 1), and the conceptual research model is developed while incorporating the main impacts of cultural and social norms on real estate project success in family businesses in China. The developed conceptual model concludes framework conditions as a mosaic of fractions (effects of cultural and social norms), and it is tested via semi-structured qualitative expert interviews.

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The adapted methodological framework model is based on project managers' perceptions of the contributions of cultural and social norms to the competitive advantages of Chinese real estate family business (CREFB). Given the global role of the Chinese economy in terms of the advanced science and technology, examining how Chinese project managers perceive and unlock the contributions of CSNs to project success in CREFB is of significant scientific value to family-based real estate companies across the globe.

The idea of a quantitative survey was abandoned in the present research because of high employee mobility in a competitive real estate industry in China and the difficulty of finding hundreds of CREFB project managers. Such limitations could have jeopardised the research representativeness while diminishing the reliability of the data. Moreover, many project success aspects in Chinese real estate family business are often kept among a narrow group of decision-makers, which calls for strict expert selection criteria. After the ingenious literature review, the diverse methodologies used in similar studies were compared, justifying the suitability of the qualitative research method to answer the research question.

Table 1. Comparison of research methodologies

Author, year	*Research topic*	*Research results*	*Methodology and industry*
The present study	The role of cultural and social norms on real estate family business projects (China)	The role of cultural and social norms on project success; X and Y generations' angles	Qualitative research Semi-structured interviews Via Skype and Wechat online
Masoumeh et al., 2018	Impacts of trust, commitment, and openness on research project performance: case study of a research institute	Trust, openness, and commitment are essential for effective teamwork, shared understanding, commitment.	Semi-structured interviews Non-family business
Ghafoor et al., 2024	To investigate the behaviour of CEOs in family firms within innovation and R&D investment in Chinese family firms.	CEOs with moderate managerial ability show willingness to invest in innovative projects; without ability--- willingness declines.	Chinese A-share listed family firms Ordinary least squares regression Non-family and family CEOs
Chinyamurindi, 2017	Information management in projects: South African construction firms	Conceptual model of project success via information management	Semi-structured interviews Non-family construction business in South Africa
Pasquale et al., 2019	Open innovation in family firms: empirical evidence on internal and external knowledge flows	Family firms execute open innovation strategies, manage knowledge, and create value across generations.	Online survey of 208 Apulian entrepreneurs Research on open innovation in family firms
Guo & Lu, 2023	Competitiveness via data-driven principal component analysis: performance, potential, and process.	Other scholars could use the applied methodology to examine competitiveness across different industries.	A case study of Chinese international construction companies Non-family business
Wang et al., 2020	Research on critical success factors for main contracting model of overseas housing construction projects	Establishes the selection model of project management mode and the success factors system of project management model	Secondary data with the case study Real estate project in Malaysia Family business
Arsić, 2018	Key factors of project success in family small and medium-sized companies	Identification of success factors of projects in family companies	Secondary data Serbia and the EU Family Business

Source: prepared by paper authors, based on Guo & Lu, 2023; Arsić, 2018; Chinyamurindi, 2017; Masoumeh et al., 2018; Pasquale et al., 2019; Wang et al., 2020; Ghafoor et al., 2024

The comparison of research methodologies revealed that only a few studies have examined the impacts of CSNs on the success of family business projects: the scholars are more inclined to use qualitative interviews with experts, presenting specific viewpoints regarding the research object, along with respondents' valuable experience. Although this type of method does not gather knowledge in numerical terms, collecting the data in the form of thoughts, perceptions, insights, and experience enables in-depth conceptualisation and more pertinent recommendations, where various fractals of the systematic/holistic view are explained in conceptual models, maps, theories, and schemes. Such methods help researchers gain deeper information from a specific

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target group of participants who are involved in similar activities and have sufficient expertise and experience with regard to the research question.

The conceptual framework model is anchored on 4 pillars that could be described as research objectives: defining project success and cultural social norms from the theory and project practitioner perspectives; conceptualising and modelling the main effects of cultural and social norms on project success among Chinese real estate family firms; interpreting project managers-experts' perceptions with regards to possible ways to improve CSNs contributions to the project success in Chinese real estate family business; outlining implications and recommendations regarding real estate family business (or any other projects-based industry) improvement in a specific cultural and social context.

Following the ethical (sample exceeds the logical demand/necessity) and scientific (data might be unsaturated) semi-structured expert interview criteria of sample size, it is intended to collect the data until the point of saturation: the sample size reads ten representatives of the leading CREFB with not less than 5 years of project management experience, representing different cities in China, and additional experience outside the family. Most of them completed their studies at home university, except PE 10 expert (with educational background from outside the region), which in the present study is coded as a referee: it helps mitigate the biased approach of our research and check the credibility of answers. Four experts belonged to the X generation, and six belonged to the Y generation (see Table 2 below). The research question, sample size and experts' selection criteria were derived from the literature review and pilot interviews with university professors – experts in the examined area. Confidentiality and privacy were respected via the coding system.

Table 2. Research interviewees

Interviewees	Generation	Education	Experience
Project expert 1 (PE1)	Gen X	College, China	18 years of working experience in a real estate company, more than 10 years as a project manager in a family firm
Project expert 2 (PE2)	Gen X	Bachelor, China	20 years of working experience in a real estate company (10 years in a state-owned enterprise and 10 years in a family business), more than 15 years as a project manager
Project expert 3 (PE3)	Gen Y	Bachelor, China	14 years of working experience in a real estate company and 8 years as a project manager in family business
Project expert 4 (PE4)	Gen Y	Bachelor, China	6 years of working experience in a real estate firm, and 3,5 years as a project manager in a family firm
Project expert 5 (PE5)	Gen X	Bachelor, China	16 years of working experience in a real estate company, and 9 years as a project manager in a family firm
Project expert 6 (PE6)	Gen X	Bachelor, China	16 years of working experience in a real estate company, and 8 years as a project manager in a family firm
Project expert 7 (PE7)	Gen Y	Bachelor, China	5 years of working experience in a real estate company, and 2,5 years as a project manager in a family firm
Project expert 8 (PE8)	Gen Y	Master's, China	6 years of working experience in a real estate company, and 5 years as a project manager in a family firm
Project expert 9 (PE9)	Gen Y	College, China	7,5 years of working experience in a real estate company, and 4,5 years as a project manager in a family firm
Project expert 10 (PE10)	Gen Y	PhD, Abroad	More than 15 years of working experience in a project team

Source: prepared by the authors of the present study

Thus, the present investigation was based on a qualitative database, consisting of the project management experiences of the ten selected CREFB project experts. Considering that project experts working in CREFB may present different interpretations of project success and CSNs and might differently assess the project success factors under specific cultural and social norms, the first four questions were designed to ascertain whether the interviewees met the selection criteria, set in this study. The fifth-tenth questions were designed to clarify project experts' perceptions of project success, CSNs, and project success factors, along with the role of cultural, social normative factors on CREFB project success. The last group of questions attempted to identify how respondents perceived and whether they were capable of improving CREFB project success in the context of certain cultural, social norms to validate the theoretical framework conditions.

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The research problem is interpreted from different angles, such as generational differences, educational background, professional experience, family or non-family environment, etc. This makes the study applicable in any industry (based on projects) and might be useful for experts working in CREFB of different level of experience. The emphasis on how the project managers perceive and are capable of enhancing the Chinese real estate family business project performance is the main research axis, which leads to value-adding recommendations and future research perspectives within this holistic and multi-faceted topic.

To identify the effects of CSNs on success of real estate family business projects in China, it was important to diminish potential biases among family members and accord to the industry's context; thus, 9 project managers from outside the family environment with degree from home universities were selected, while one respondent was a representative of another country with her/his studies completed abroad. Such combination helped examine the Chinese real estate Family Businesses from a more in-depth, objective, and at the same time holistic perspective.

While scrutinising the peculiarities of a specific culture, the characteristics of different generations were addressed: four respondents were representatives of the X generation, and six of them belonged to the Y generation: the liaisons between the project success and cultural social norms in CREFB were tackled mainly from the perspective of X and Y generations, revealing diverse angels, behaviour and perception patterns that correspond to specific age categories, along with other important codes, such as educational background, professional experience, involvement/ engagement level in a family environment.

4. Research implications: towards more sustainable Chinese real estate family business projects

In line with diverging scholars' interpretations of project success, experts' insights were also diverse: eight different definitions of project success were provided by the respondents (see Figure 2). To distinguish the project success characteristics perceived by Gen X and Gen Y, the comparative analysis of the descriptions is illustrated via the web diagram.

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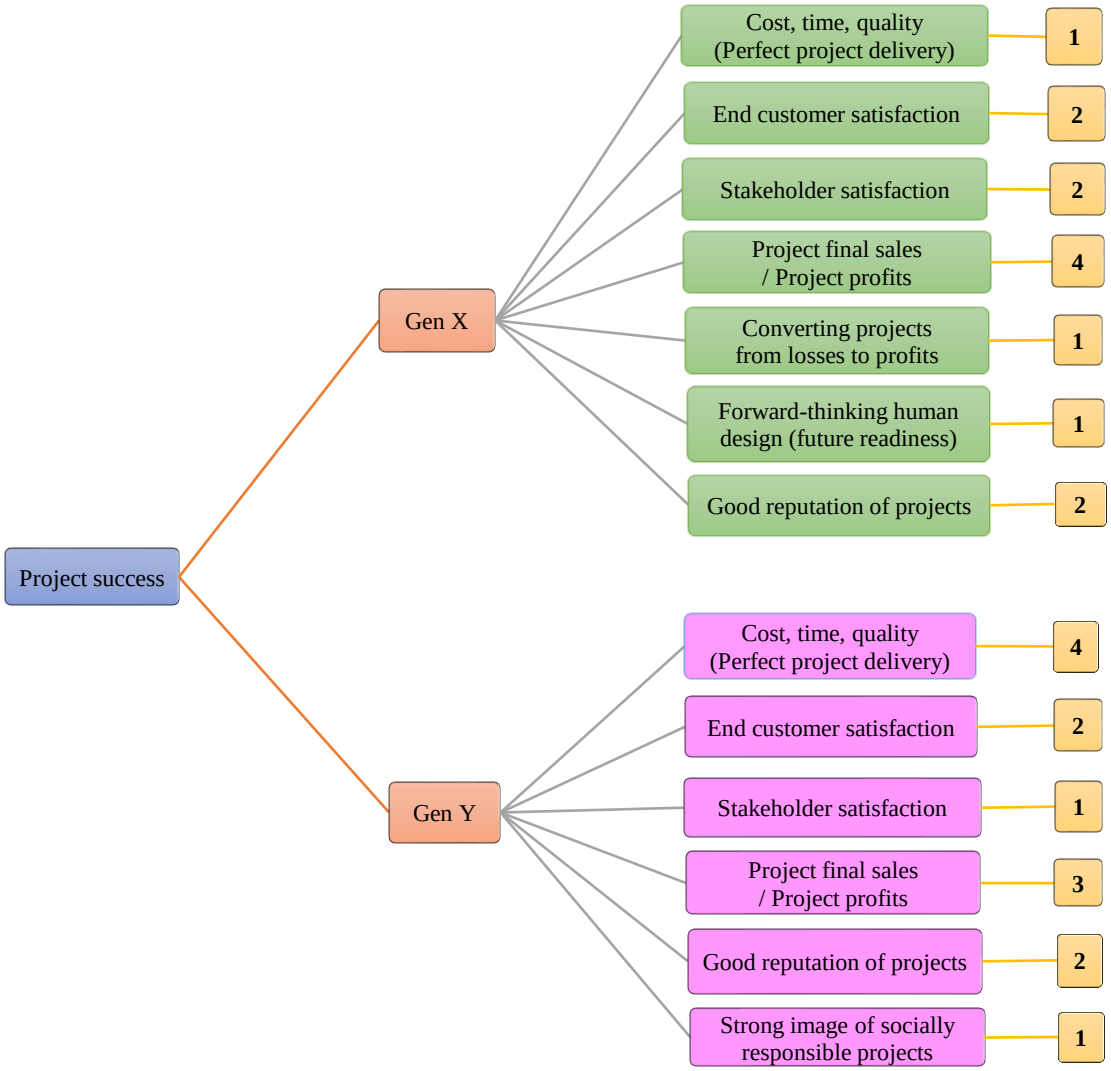


Figure 2. Comparison of project success definitions, X versus Y generations.

Source: developed by the authors of the present study

From the eight project success definitions illustrated above, five of them are mentioned by both Gen X and Gen Y. Having the five project success concepts mentioned by both Gen X and Gen Y analysed more ingeniously, it appears that they all emphasise the achievement of rather tangible improvement in terms of cost, time, and quality; focus on project delivery, end-customer and stakeholder satisfaction, project profit, and reputation. There some significant differences could be identified. For instance, only one representative of Gen X mentioned optimising project delivery as a project success criterion, compared to four of the Gen Y. Moreover, all the Gen X experts mentioned achieving project profit as a project success (compared to half of the Gen Ys). It is also worth noting that of the remaining three project success concepts, two were mentioned only by Gen X, i.e., turnaround and future readiness, while one was mentioned only by Gen Y, i.e., building a strong image of social responsibility.

To continue, Gen X's perception of project success is more inclined to project final sales, while Gen Ys believe that effective project delivery (cost, time, quality) is a more significant indicator of project success. Gen Y's definition of project success seems to be more short-term oriented. In terms of similarity, effective project delivery, end-customer and stakeholder satisfaction, project profit and reputation are the project success concepts that Gen X and Gen Y both emphasise.

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The respondents' perception towards culture and social norms were ambiguous and inconsistent. Eight of the ten participants associated CSNs with the company's culture and five associated CSNs with nepotism. Based on experts' interviews, eight were perceived as the most influential on the success of CREFB projects (four of which were mentioned by both Gen X and Gen Y). Regarding the other four dimensions, Gen X and Gen Y representatives did not reach a consensus. All the Gen Xs linked cultural social norms with a corporate culture based on customer satisfaction, while only four Gen Ys mentioned this dimension. Three Gen Xs emphasised the importance of integrity and the role of interpersonal relations on project success, whereas only two Gen Ys did so. In contrast, Gen Y places more emphasis on the impact of technology and innovation culture on project success (compared to Gen X). Of the remaining four cultural social norms, three were mentioned only by the representatives of Gen Y, such as employee motivation, laws and regulations, organisational openness, social contribution, and social responsibility (see Figure 3).

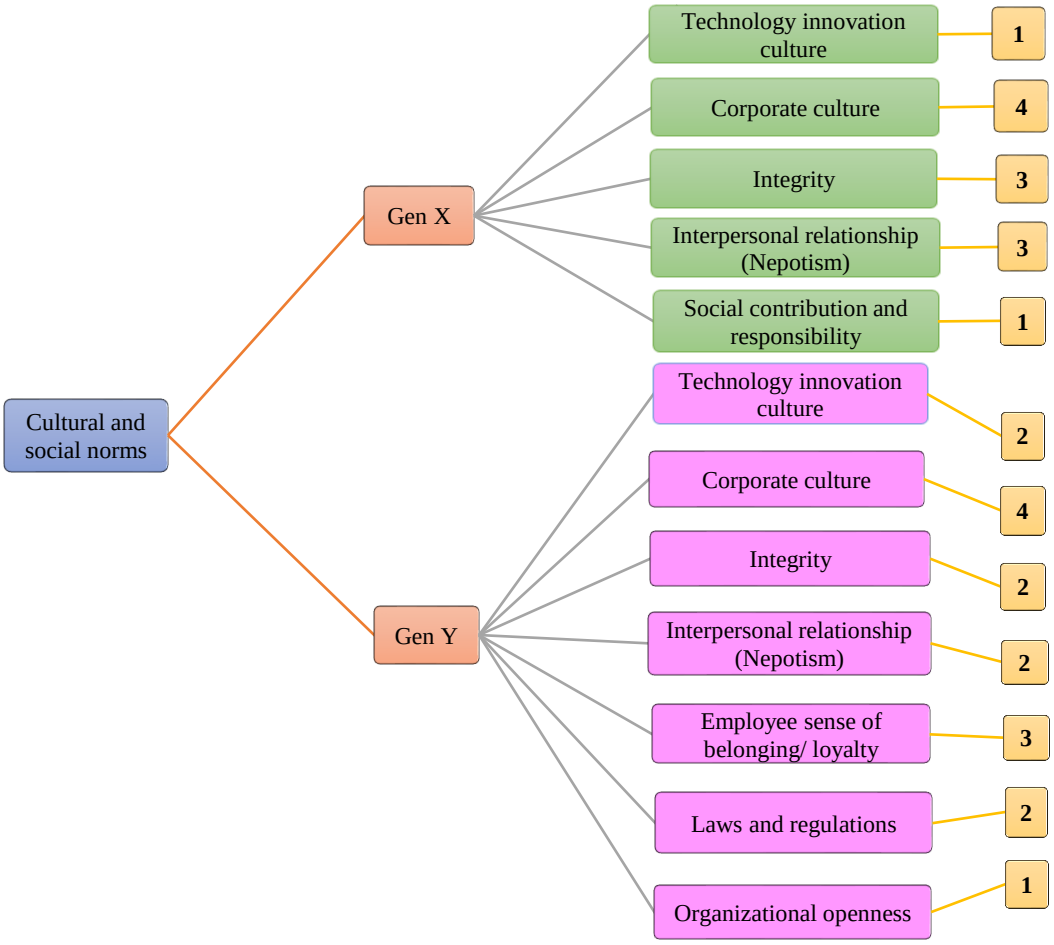


Figure 3. Perception of Cultural and social norms: comparison of X and Y generations.

Source: developed by the authors of the present study

All in all, Gen Xs believe that interpersonal relationships and integrity have a strong impact on project success, while Gen Y believes that cultural and social norms (such as technological innovation, employee loyalty, and laws/ regulations) are more conducive to project success. In terms of similarity, a corporate culture based on customer satisfaction is a cultural and social norm that Gen X and Gen Y jointly emphasise as conducive to achieving project success.

From the theoretical point of view, Z generation is an objective of the present research (for X and Y project managers, Z generation stakeholders are their future customers and clients); However, within the population

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investigated, there were no cases of Z generation representatives in CREFB project managers registered. Moreover, the sustainability of real estate companies is affected by a key factor – housing demand. The Z generation, born after 1994, will be the main group of future home purchasers (some of them have already been customers). If X and Y generation project managers intend to succeed, they must focus on Z generation's mindset. As the PE1 mentioned: 'forward-looking real estate project positioning and project design contribute to the success of a project, and future readiness is an important project success factor, as generations change rapidly'.

Within the next papers of the same series, it is crucial to address questions, such as what representatives of X and Y generations (presently active in real estate project management positions in China) should consider while preparing for the next decades, where Z generation is more powerful in all value creation, strategy development, consumerism, and innovation process commercialisation stages.

Based on five theoretical framework conditions, which substantialise the impacts of CSNs on project success, the present research draws attention to pertinent and value-adding implications of how real estate family firms in China should reshape their business models and strategies to be more sustainable and effective, considering a specific cultural-social context. The research results confirmed that despite the origin of educational background, project managers are more receptive to digital/software-based project management tools, and it is witnessed in terms of their practices or intentions to use project management software introduced in the market. Although only one interrogated project manager had international academic experience, all ten project managers indicated that they use modern project management software in their daily work and would be willing to try out new modern project management software if it was available in the market. This is related to the fact that eight out of ten experts had the first cycle degree completed, and their knowledge with respect to technology innovation culture enabled them to acknowledge the role of high technologies in the efficiency of their operations and corporate performance; therefore, they were more receptive to new technologies.

All the project managers with higher education backgrounds were highly receptive to the application of modern project management tools. This finding is also related to the role of higher education in resource management skills. It was confirmed that experts with higher education backgrounds can allocate and share resources more effectively and smoothly. Eight of ten respondents considered the knowledge and competencies acquired and developed at the university level or outside the family business sufficient to be a professional quality performer in family business projects. On the other hand, a few experts stated that only some university-related knowledge and competencies can be applied in a family business project because family values and philosophy must be considered while joining a family business in China.

Moreover, the diverse perceptions and attitudes towards knowledge and competencies suitable for a family environment make this factor of significant interest: eight respondents were more driven by the concrete, practical techniques and skills, while two experts emphasised both soft (value, culture, philosophy, etc.) and practical project-related competences (knowledge, techniques, skills etc.). In addition, it is significant to note that none of the experts notes resource sharing and allocation as critical for project success, which might be because they are coming from outside the family environment, with less delegation of authority with respect to resource allocation, or they have no sufficient experience abroad (which might diminish the awareness of effective resource sharing via the combination of internal and external resources).

The characteristics of different generations play a significant role in project success because of diverging risk management styles. The present research drew some interesting conclusions regarding the liaison between the average age of project team members and the conservatism of the risk management style. All ten respondents were consistent in their answers with respect to the willingness to be part of a new project that would lead to a more profitable outcome but with a probability of failure or risk. This might be due to their education being oriented to opportunity and challenge, using an effective risk management model. It is interesting to note that the interrogated experts (eight respondents) prefer not to quit a project team in case of enrolment in a large, complex, and unexpected project they might not complete on time. The contradiction of other experts might be related to their lower level of education and limited social responsibility within project teams. Moreover, it could also be related to the fact that an expert is not a family member; thus, does not consider himself/herself

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responsible for the failure of a family project. Another expert outside the family admits that project members need to take risks and responsibility for every project they work on; However, they might quit a project team if they are not paid adequately or treated unfairly.

Notwithstanding that, one expert emphasises the role of strategic partnership in overcoming all minor disadvantages. All in all, experts with higher education seem to be more capable of taking risks and responsibilities than those with a somewhat lower educational level. When they encounter the same problems, those with higher education prefer to find solutions to mitigate risks, while those with lower education tend to avoid responsibilities.

The role of collaboration of team members with project managers was emphasised in the context of a specific hierarchy: the flatter the company's hierarchy, the more efficient the collaboration of team members is. This is related to a way of sharing experience, knowledge, and work progress, along with the working style, combined with the collaboration intensity among the team members and the strategic direction of their supervisors. All ten project managers were eager to share project progress experiences with their team members, partly thanks to a flat hierarchy in their organisations and the information transparency, which in parallel facilitated effective collaboration (it was accentuated, despite experts' education level and their connection to the project experience). For instance, a family member with limited project management experience agreed that there was a need to share information about work progress. At the same time, flat teams were considered a precondition for effective collaboration among team members.

In contrast, the experienced project managers admitted that their team members would make suggestions when they hesitated to make decisions. This might be related to project managers' high level of education: they all emphasised teamwork, knowledge sharing and suggestions. One expert mentioned that "a team cannot be successful, relying only on individual efforts; everyone should be given the right to voice their thoughts equally, and the adoption of reasonable advice is more likely to lead to a successful project".

Project management experience is an essential but insufficient precondition for project management success in the real estate environment in China. The project managers from outside the family environment tend to be more efficient in communication among the team members, which might be related to the nepotistic nature of Chinese society and the specific human relations within the family environment, as emphasised by the experts. One respondent accentuated the dependence between the communication efficiency in family firms and a clear division of job functions and duties among the family members and project managers. If it is disorganised, the family members might consider themselves superior to their colleagues while not obeying the rules.

Management function separation in a family business is critical for project success because the unclear division of job functions among family members in a family firm can affect communication efficiency between family project managers and team members, directly affecting project success. One expert added – that keeping the decision-making power in one person's hands might endanger the strategic effectiveness: some family project managers might have knowledge and skills that do not match the requirements of their position, while communication with other team members (non-family experts) might be inefficient. However, this is rarely the case with the non-family project managers. This might be related to the lack of openness of family businesses while managing family resources (including human and information); a family project manager might also lack trust with other team members.

Having defined project success and cultural and social norms within the literature review, the Chinese real estate family business project managers added interesting new implications for project success under specific cultural and social norms (see Table 3 below). Although the experts' perception was not entirely in line with strategic project success factors/efficiency criteria emphasised by scholars, the research confirmed the role of cultural, social norms on family business project success via two framework conditions: the flatter the company's hierarchy, the more efficient the collaboration of team members with project managers; while the project managers coming from outside family might be more efficient in their communication with their team members.

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Table 3. Summary of findings

	Gen X	Gen Y
Project success definition	● Converting projects from losses to profits. ● Forward-thinking human design (future readiness)	● Strong image of socially responsible projects
	● **Cost, time, quality (Perfect project delivery)** ● **End-customer satisfaction** ● **Stakeholder satisfaction** ● Project final sales/Project profits ● Good reputation of projects	
Cultural social norms which improve project success	● **Social contribution and responsibility**	● Employee sense of belonging/loyalty ● Law and regulations ● **Organisational openness**
	● **Technology innovation culture** ● Corporate culture ● **Integrity** ● **Interpersonal relationship and nepotism**	
Verify theoretical framework from different angles		
The role of cultural, social norms in family business project success	The flatter the company's hierarchy, the more efficient the collaboration of team members with project managers. Project managers from outside families will communicate more efficiently with team members.	

Source: prepared by the authors of the present study

The recommendations from four perspective angles (as shown in Figure 4 below) are prepared to help project managers effectively/ efficiently operate under specific cultural and social norms as well as unlock the potential of family project success. The recommendations are prepared based on the innovation approach of the business model.

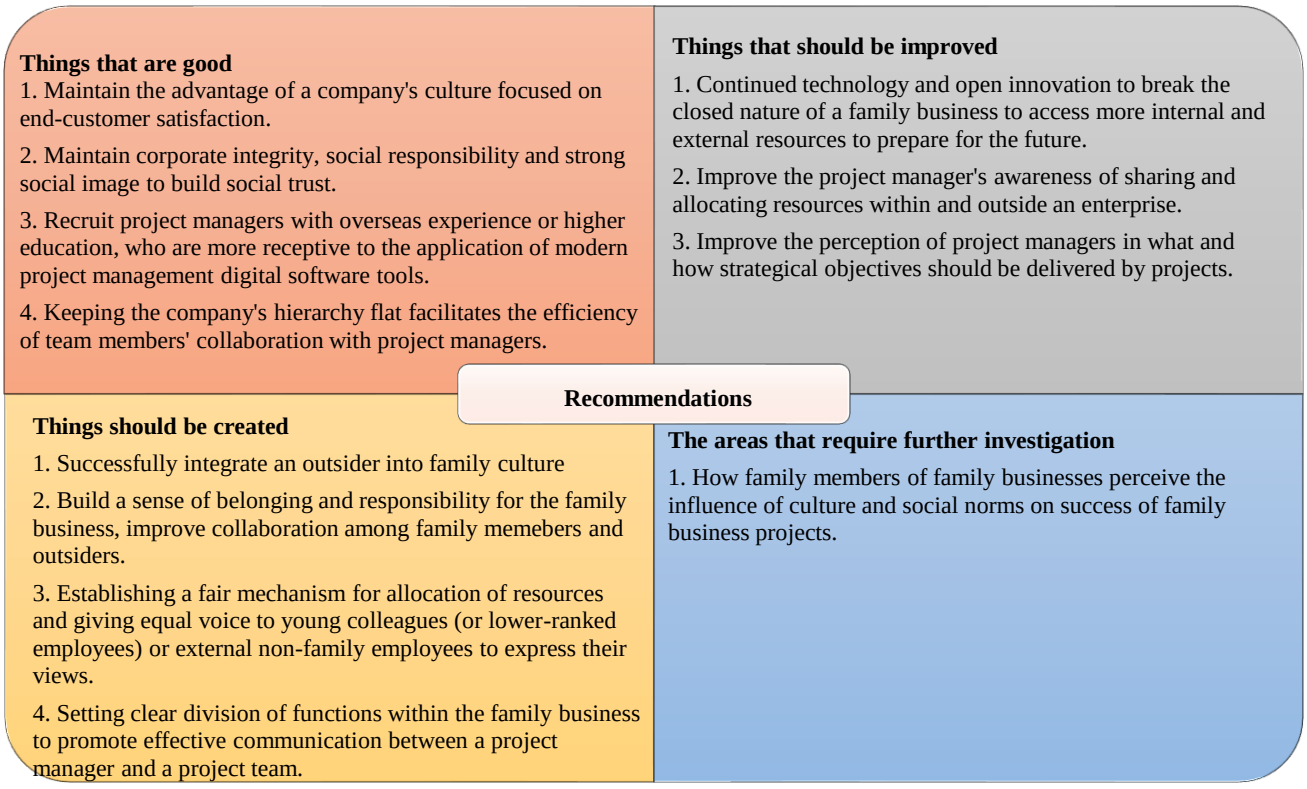


Figure 4. Recommendations for project managers

Source: developed by the authors of the present study

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The present research methodology was centred on qualitative research approach, because of the strict respondents' selection criteria in terms of their job position and experience, as well as due to high employee turnover in Chinese real estate family firms. The combination of qualitative and quantitative research methods might be considered to approach more respondents from 'Z' generation. This study serves as a guide for project managers in real estate family business (or any other industry, based on the project management approach) to unlock the potential for project success in the context of cultural and social norms, and in parallel unlock the potential of the topic for future research covering other industries and economies.

Conclusions

The present study led to the established conceptual framework of the effects of cultural and social norms on Chinese real estate family business project success, which via semi-structured expert interview supported eight definitions of project success as well as eight cultural social norms that the respondents perceived to be most influential in commercialising of CREFB projects; five theoretical framework conditions were tested of which two were in line with actual interview results.

Nowadays, human capital of a family firm is composed of Gen X, Gen Y, and even Gen Z; thus, it could be challenging to align the project management efficiency criteria at the organisational level with diverse characteristics of a specific generation and its representatives' individual characteristics (such as, international studying experience, education level, coming outside or being part of the family environment, etc.) under specific cultural and social norms. The study results are critical for a family business with a geocentric approach to its culture: to be open and capable to create an environment for project managers outside family; allow easily enter an organisation as well as understand and fit the family values and philosophy. The family business experts extensively emphasise the culture, the ethical norms, and rules that are above family interests, making family business transparent outside and inside. The more open the family is, the easier to unleash the potential of the employees coming from outside the family environment, while working on organisational and team project success.

To reach the project success in family business, it is important to successfully integrate the non-family employees into the family culture. Coping with the gap between the family culture and the values of the employees coming from outside, family businesses should take the following suggestions into account. Firstly, a clear communication guide must be created while integrating the modern technology; secondly, clear ethical norms should be set for everyone (each family and non-family member); thirdly, social trust should be reached through leadership. Moreover, hiring employees with the experience abroad or high educational level (both national and foreign) might help family businesses become more open to accept and implement new technologies necessary for real estate family business success in China.

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DEMOGRAPHIC AGEING AND PUBLIC DEBT IN POLAND. IS THE PUBLIC FINANCE SECTOR ABOUT TO COLLAPSE?

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Abstract. The paper addresses the issue of demographic ageing of the Polish population, with particular emphasis on its impact on the functioning of the national economy. Its main objective was to assess the influence of demographic changes on the public finance sector in Poland. To achieve the main objective of assessing the impact of demographic aging on Poland's public finance sector, a study of correlation and periodic change dynamics was conducted, covering the period from 2000 to 2022. Additionally, a regression analysis was performed using the Classical Least Squares Method. In the research part of the paper, changes in the age structure in Poland are characterized, and the impact of this phenomenon on the economic situation of elderly persons is assessed. Using an econometric model, the impact of factors related to demographic changes, such as natural population growth and the demographic dependency ratio on the post-working-age population, on the value of the state's public debt was assessed. Based on the model, an attempt was made to forecast this variable for the years 2023-2026. The analyses revealed that the consequences of demographic ageing threaten the stability of the public finance sector. The study showed that with a 95% probability, a decrease in natural population growth by 1000 individuals leads to an increase in debt by 0.81 billion PLN, and an increase in the demographic dependency ratio on the post-working-age population results in an increase in public debt by 19.71 billion PLN, with other conditions unchanged. Furthermore, the prediction confirmed that, under the conditions of the values of explanatory variables forecasted by the Central Statistical Office, its value in 2026 will increase by 0.38% compared to 2022.

Keywords: demographic ageing; public finance sector; public debt

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JEL Classifications: H63, J10, J11

1. Introduction

The demographic ageing process is one of the most significant challenges facing the economic systems of many countries worldwide, including the capacity of their public finance sector. It is widely known that activities focused on broadly understood pronatalist policy are highly expensive and their effectiveness is often unsatisfactory for public authorities. These factors influence the relatively broad interest of researchers in the problem of the impact of the demographic ageing process on the condition of the public finance sector in individual countries.

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The issue of the impact of the demographic ageing process on public debt has been addressed in many scientific studies. This topic was addressed, among others, by Jensen et al. (1995), Hondroyiannis et al. (2000), Afflatet (2018), Eberstadt & Groth (2010) and Lee et al. (2022).

Popular research directions also concern a slightly more general issue related to the impact of demographic ageing on various components of the public finance sector. Among the key research initiatives, it is worth highlighting the work of Jorgensen et al. (2011), Žokalj (2016), King & Jackson (2000) and Yoshino et al. (2019).

This paper addresses the issue of demographic ageing of the Polish population, with particular emphasis on its impact on the functioning of the national economy. The paper is theoretical-empirical in nature, and its main objective was to assess the influence of demographic changes on the public finance sector in Poland. To achieve the main objective, a study of correlation and periodic change dynamics was conducted, covering the period from 2000 to 2022. Additionally, a regression analysis was performed using the Classical Least Squares Method. Using an econometric model, the impact of factors related to demographic changes, such as natural population growth and the demographic dependency ratio on the post-working-age population, on the value of the state's public debt was assessed. Based on the model, an attempt was made to forecast this variable for the years 2023-2026.

2. Theoretical background

Demographic ageing has been a significant challenge for many countries authorities for years. One of the essential aspects of this phenomenon is the consequences it has for the condition of the public finance sector. The table presents a list of selected publications on this topic along with a brief summary (Table 1).

Table 1. Review of literature

Publication	The main conclusion from the conducted research
Van der Berg (1998)	Van der Berg examines the impact of population ageing on the country's public finances and social security systems. The article highlights the challenges posed by demographic change, including increased demand for pensions and healthcare services. Van der Berg examines the sustainability of the current social security framework in light of these trends, arguing for the need to adapt policies to provide adequate support for older citizens. Overall, the article calls for a comprehensive approach to reform that addresses both the financial sustainability and well-being of older people in South Africa.
King, Jackson (2000)	King and Jackson examine the fiscal challenges of an ageing population. The authors highlight several key areas of concern, including rising costs for health care, pensions, and social services as the proportion of older people increases. They advocate proactive fiscal planning to manage the effects of an ageing population.
Lindh (2003)	Lindh discusses the implications of demographic change, particularly population ageing, for social policy and the public sector. The paper examines how changes in age distribution affect economic and social policy, emphasizing the need for adaptive strategies to cope with these changes. Lindh argues for innovative approaches that incorporate demographic trends into policy planning.
Wolf & Amirkhanyan (2010)	Wolf and Amirkhanyan examine how changing demographic patterns are affecting public sector management and policy. The authors argue that population ageing, changing immigration trends, and changing family structures pose significant challenges to public administration. The article highlights the need for adaptive strategies in public sector organizations to effectively respond to these demographic changes, ensuring that public services remain effective and equitable.
Jorgensen et al. (2011)	Jorgensen, Rocha, and Fruttero examine the multifaceted effects of population ageing in Brazil. The report, published by the World Bank, examines how demographic changes are changing the country's economic landscape and social policies. The authors analyze the implications of population ageing for economic growth, highlighting potential challenges such as a shrinking labor force and increased dependency ratios. They discuss how these demographic changes could exacerbate poverty levels, especially among older people.
Immam (2013)	Imam examines the impact of Japan's ageing population on the stability of its financial sector. The study highlights how demographic changes, characterized by falling birth rates and rising life expectancy, pose significant challenges to economic growth and financial systems. Imam discusses potential risks associated with an ageing population, including a shrinking labor force and rising dependency ratios, which could lead to reduced consumption and investment. The paper emphasizes the importance of addressing the financial implications of an ageing population to maintain stability and promote sustainable economic growth in Japan.

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Kluge (2013)	Kluge examines the economic consequences of demographic change, particularly population ageing, for public finances in Germany. The study highlights the growing pressure on the country's welfare system due to rising costs related to pensions, healthcare and social services for the older demographic group. Kluge discusses potential policy responses, including raising the retirement age, adjusting benefit formulas and increasing labor market participation among older people.
Yoshino et al. (2019)	Yoshino, Kim, and Sirivunnabood examine the impact of population ageing on financial stability. The authors discuss how demographic changes, characterized by rising life expectancy and falling birth rates, pose challenges to government budgets and social welfare systems. The article highlights the need to address these challenges, including adjustments to retirement age, tax policies, and social security frameworks.
Lyons et al. (2018)	In their study, Lyons, Grable, and Joo conduct a cross-country analysis of the relationship between population ageing and financial security. This research examines how different nations adapt to the challenges posed by an ageing population, particularly in terms of economic stability and individual financial well-being. The authors identify key factors affecting older adults' financial security, including pension systems, access to health care, and employment opportunities.
Rouzet et al. (2019)	This article examines the fiscal challenges faced by ageing societies and their implications for inclusive growth. It highlights the growing pressure on public finances due to rising healthcare and pension costs associated with ageing populations. The study highlights the need for reforms in taxation, public expenditure and social protection systems to promote sustainable development and inclusiveness.
Mihajlovic & Miladinov (2024)	Mihajlovic and Miladinov analyze the impact of population ageing on the stability of public finances, highlighting the challenges posed by the increasing old-age dependency ratio. The authors emphasize that this demographic trend places a significant burden on pension systems and social care expenditures, negatively affecting economic growth. The article underscores the necessity of implementing policies that support long-term financial stability, such as investments in human capital, promotion of active ageing, and the extension of working life.
Symeonidis et al. (2021)	Symeonidis, Tinios, and Chouzouris examine the impact of implicit pension debt on the stability of public finances using projections from the Ageing Working Group. The authors highlight that in many countries, implicit pension debt exceeds public debt, posing a significant risk to fiscal budgets. The article emphasizes the need for pension system reforms and responsible budget planning, which should account for explicit public debt and implicit pension liabilities to ensure long-term financial stability.
Temsumrit (2023)	This article analyzes the impact of an ageing population on the level of government expenditures and the structure of the state budget. The study points out that an increasing share of elderly individuals in society leads to higher public spending on healthcare, social care, and the environment. At the same time, the share of expenditures on education declines, which may negatively affect the long-term development of human capital.

Source: compiled by the authors

In this context, in addition to those mentioned in the table, it is worth highlighting the important contributions of Auerbach, and Kotlikoff (1985); Auerbach, and Kotlikoff (1987); Hagemann, R., & Nicoletti, G. (1989); Auerbach et al. (1989); Clements et al. (2018).

A brief review of the literature on the impact of demographic ageing on public debt is presented in Table 2.

Table 1. Review of literature

Publication	**The main conclusion from the conducted research**
Jensen & Nielsen (1995)	Jensen and Nielsen examine the interplay between population ageing and fiscal sustainability. The authors analyze how the growing proportion of older people affects public debt and the ability of governments to maintain sustainable fiscal policies. They emphasize the potential of rising pension and health care costs to create significant fiscal pressures, leading to higher public debt levels.
Eberstadt & Groth (2010)	Eberstadt and Groth examine the long-term implications of demographic trends for the sustainability of public debt. The authors argue that population aging, falling birth rates, and demographic changes in the workforce will significantly exacerbate fiscal challenges for governments, particularly in developed countries. They suggest that these demographic changes could lead to increased public spending on pensions and health care, straining national budgets and raising debt levels.
Afflatet (2018)	Afflatet examines how demographic change, particularly population ageing, affects public debt levels in Europe. The study uses panel data from 18 countries to explore the relationship between demographic ageing and fiscal sustainability. The results indicate that the growing elderly population contributes significantly to the growth of public debt, mainly due to higher spending on pensions and healthcare.

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Lee et al. (2022)	Lee, Mason, and Park examine the relationship between population ageing and debt dynamics in Asia. The authors examine how the growing elderly population affects fiscal policy and public debt levels across the region. They discuss the rising costs of pensions, health care, and social services for ageing populations, which can lead to unsustainable debt burdens.
Aspide et al. (2023)	This article examines the impact of population ageing on public debt and fiscal decision-making. The authors emphasize the growing risk of debt accumulation and highlight the differing preferences of various age groups regarding debt reduction. The publication encourages reflection on the influence of social policy and public finance management strategies on the economic situation in the context of demographic ageing.
Judge (2024)	Judge analyzes the relationship between population ageing and public debt. He discusses how the increasing number of elderly individuals impacts fiscal policy and public debt levels in developed countries. The article also addresses the issue of declining tax revenues, which further complicates public finance management.
André et al. (2024)	The authors highlight the substantial impact of demographic ageing on public debt in OECD countries, underscoring the urgency of pension system reforms. They further explore the challenges of refinancing existing public debt amid increasing global interest rates and rising debt servicing costs.
Basso & Rachedi (2021)	The article emphasizes that demographic changes affect public debt by reducing the ability of government spending to generate economic growth, thereby complicating efforts to reduce budget deficits. The authors conclude that population ageing weakens the effectiveness of fiscal policy as a tool for managing the economy and ensuring its stability.

Source: compiled by the authors

3. Research objective and methodology

The study's main objective was to assess the impact of demographic ageing of the Polish population on the public finance sector. The following specific objectives were formulated:

1. Characterization of demographic trends in Poland in 2000-2022 and assessment of the financial standing of senior citizens.
2. Characterization of the impact of demographic ageing of the Polish population on the labor market and the public finance sector.
3. An attempt to forecast Poland's public debt for 2023-2026 based on the predicted natural increase and the projected dependency ratio of the post-working age population.

The principal premise of this research is to ensure that it is thoroughly representative. This was achieved using detailed macroeconomic statistics based on the official data from Statistics Poland (GUS) and Eurostat.

The following research hypotheses were posited:

1. The advancing ageing of the population contributes to increasing public expenditure on healthcare.
2. The components involved in population ageing, i.e. declining birth rate and increasing dependency ratio of the post-working age population, produce an increase in the national public debt.

This study was concerned with Poland, while the empirical analysis focused on the condition of the public finance sector, taking into account demographic ageing factors which affect the economic situation in the country. As regards the timeframe, the study covered the period from 2000 to 2022.

This study analyzed and interpreted the findings from research on the impact of demographic ageing on the financial situation of older people, the labor market and the public finance sector. The research used secondary data published by Statistics Poland, which was contained in the Local Data Bank, Domain Knowledge Bases, and periodic thematic statistical reports.

The issue in question was investigated using statistical analysis and an econometric model. The former involved a quantitative description of economic and social phenomena, relying on a numerical determination of the average level of the analyzed characteristic and the average degree of differentiation between units. Statistical analysis also encompassed the study of the dynamics of phenomena, which included periodic changes and development trends. Meanwhile, the econometric model developed using Gretl software served to carry out

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regression analysis to demonstrate the linear relationship between the studied parameters and obtain a macroeconomic econometric forecast based on the classical trend model.

The impact of demographic ageing on the Polish economy was analyzed by predicting public debt in 2024-2026 while relying on the following factors: dependency ratio of the post-working age and natural increase in 2010-2022.

The Classical Least Squares method (CLS) was used to estimate the parameters of the linear model. It consists of determining the values of the estimates $\hat{\beta}_0$, $\hat{\beta}_1$, … $\hat{\beta}_t$ of parameters β_0, β_1, … β_t, so that the sum of squares of the deviations between the theoretical values and the empirical values is the smallest, which may be expressed as:

$$\sum_{t=1}^{n} e_t^2 = \sum_{t=1}^{n} (y_t - \hat{y}_t)^2 \rightarrow \min,$$

where:
e_t – absolute error of *ex-post* projection over period t,
y_t – empirical value of the variable projected for period t,
$\hat{y}_t$ – theoretical value of y variable over period t (Nazarko, 2018, p. 14).

Using CLS, the following assumptions were formulated:

1. The model is linear.
2. The anticipated value of the random component equals zero.
3. The random component is not subject to autocorrelation, while its variance is constant over time.
4. Explanatory variables are not random.
5. The random component has a normal distribution (Tatarczuk, 2021, p. 51).

Parameters β_0 i β_1 are estimated using CLS in accordance with the following formulas:

$$\hat{\beta}_1 = \frac{\sum_{t=1}^{n}(t - \bar{t})y_t}{\sum_{t=1}^{n}(t - \bar{t})^2},$$

$$\hat{\beta}_0 = \bar{y} - \hat{\beta}_1 \bar{t},$$

where:
$\hat{\beta}_1$ – estimate value for parameter β_1,
$\hat{\beta}_0$ – estimate value for parameter β_0,
t – time variable,
$\bar{t}$ – arithmetic mean of variable t,
y_t – empirical value of the variable projected for period t,
$\bar{y}$ – arithmetic mean of empirical values of the projected variable (Nazarko, 2018, p. 16).

In order to assess the validity of the estimates, statistical significance was verified using Student's t-test, followed by normality analysis of the distribution of the random component, heteroskedasticity analysis of the distribution of the random component and autocorrelation analysis of the model residuals.

The model was developed based on Statistics Poland data for 2010-2022 and the projected data for 2023-2026. The general econometric model used in this study may be expressed as follows:

$$Y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \xi,$$

where:
Y – explanatory variable (value of state public debt),
x_1 – explanatory variable (natural increase),
x_2 – explanatory variable (dependency ratio of the post-working age population),
ξ – random component.

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The variables Y, x_1, x_2 are known. Their values were obtained from detailed statistical studies conducted by Statistics Poland. The study estimated the structural parameters β_t. The model's consistency with reality was then tested, and the results were presented. The obtained estimates were interpreted and compared with the posited hypotheses.

4. Results and discussion

Population dynamics are mainly reflected by the ratio of the number of live births to the number of deaths, which has significantly deteriorated in Poland in recent years. It is shown in Fig.1.

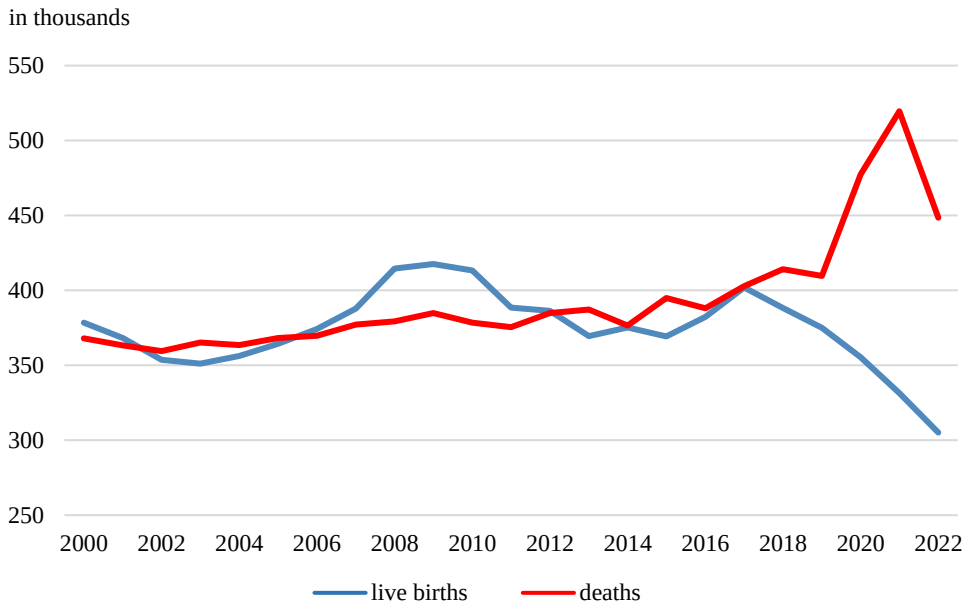


Fig. 1. Number of live births and deaths in Poland in 2000-2022
Source: own elaboration based on data from Statistics Poland

In 2022, approximately 305,000 live births will be recorded, which, compared to 2000 (approximately 378,000), represents an almost 20% decrease. On the other hand, the number of deaths in 2022 reached approximately 448,000, increasing by more than 21% since 2000 (around 368,000). The sudden spike in death rate between 2019 and 2022, as seen in the figure, was undoubtedly due to the COVID-19 pandemic, but it should be noted that the indicator demonstrated an increasing trend throughout the period studied. Another noteworthy element is the small but distinctive increase in the number of births between 2008 and 2010, mainly attributable to the birth of children of persons born during the final stages of the baby boom. Nevertheless, since 2013, Poland has been facing a negative natural increase, which amounted to over 143,000 in 2022.

The changing dynamics of births, deaths and life expectancy have a considerable impact on the Polish pension system, which translates into the quality of life of the senior citizens. Hence, the analysis of the demographic structure provides a foundation for the study of the economic and financial standing of older people, whose livelihood relies chiefly on retirement pay and pensions. Their average level, together with the relation to the average salary in the national economy in 2010-2022, is shown in Fig. 2.

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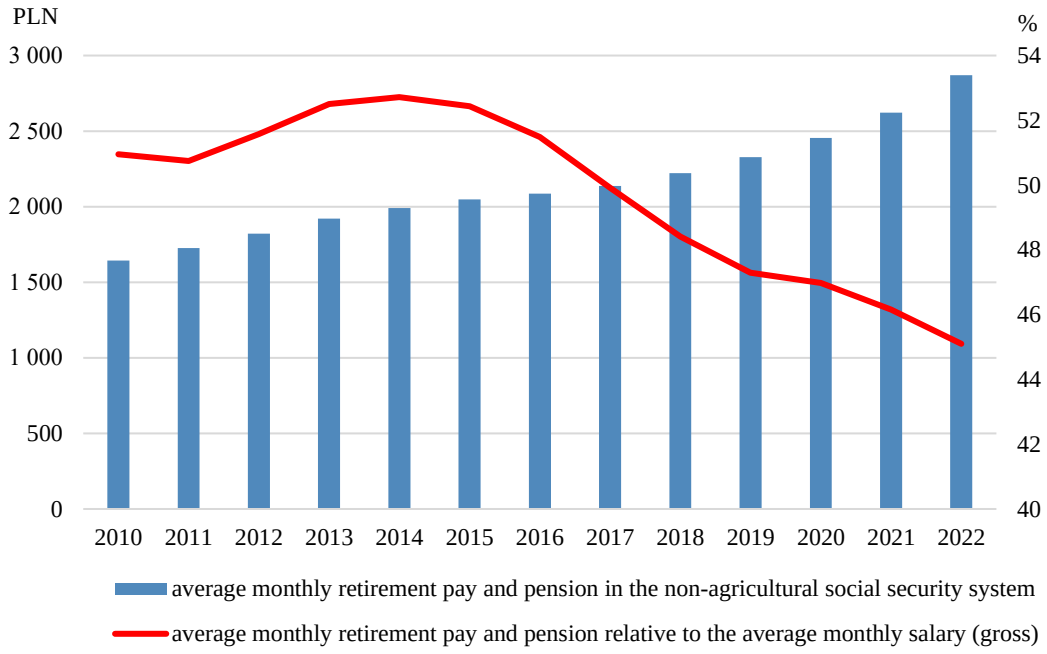


Fig 2. Amounts of gross retirement pay and pensions in the non-agricultural social security system relative to average monthly salary (gross) in Poland in 2010-2022
Source: own elaboration based on data from Statistics Poland

Despite the annual increase in the average monthly gross retirement pay and pensions in the non-agricultural social security system, their relation to the average gross monthly salary in the national economy has seen a significant decline since 2014. In 2022, it reached just over 45%, which, compared to 50-53% in the first half of the studied period, is a worrisome development. The value of average benefits paid by the Social Insurance Institution (ZUS) increased in 2022 by more than 74% compared to 2010, while the value of average salaries in Poland in that period increased by more than 97%. Negative trends may be further illustrated by examining the dynamics of retirement pay and pensions relative to inflation. In 2022, their value increased by 9.4% compared to the previous year. Simultaneously, the prices of consumer goods and services increased by 14.4%, which in practice may mean that the financial standing of older people in Poland worsened.

Moreover, demographic ageing has a significant impact on the labor market. In recent years, the number of people in the post-working age group has considerably increased, and forecasts indicate that this trend will continue in the next decades. At the same time, a decline in the number of people of pre-working age has been observed, heralding a tangible reduction in the labor force's potential. In 2060, the proportion of the post-working-age population is projected to increase by more than 140% compared to 2000, whereas the proportion of working-age persons will fall by almost 20%. In addition, the number of people of pre-working age is expected to drop by approximately 36% in the studied period. When examining the structure of Poland's population by economic age groups, one should also analyze the average annual rate of change, which may be expressed by the following formula:

$$\bar{i}_g = \left(\sqrt[n-1]{i_{\frac{n}{n-1}} * i_{\frac{n-1}{n-2}} * i_{\frac{n-2}{n-3}} * \ldots * i_{\frac{2}{1}} * i_{\frac{1}{0}}} - 1 \right) * 100\%,$$

where:
$i_{\frac{n}{n-1}}$ – last chain index,
$i_{\frac{1}{0}}$ – first chain index,
n – number of studied periods.

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The average annual rate of change in the number of pre-working-age people between 2000 and 2022 was -1.33%. For those of working age, the rate reached -0.22% and 1.94% for the post-working age population. These values indicate a much faster increase in the number of elderly persons accompanied by a fairly rapid decline in the number of young people. Such trends call for an immediate response, posing a significant challenge to the market, which is to adapt to jobs and employment conditions without delay.

Eurostat projections also provide eloquent data concerning the impact of demographic ageing on the labor market in Poland (Tab. 1). According to the projections, by 2070, the population in Poland will drop by approximately 7 million while life expectancy will increase by 6.5 years for women and 8.9 years for men. In addition, changes in the labor market will be prompted by a significant decline in the proportion of the pre-working age population, reaching nearly 20% between 2025 and 2070. Furthermore, it follows from the projections that if the retirement age does not change, economic growth will be substantially hampered in the coming decades as the baby boom generation of the early 1980s will have left the labor market. An evident slowdown in productivity growth is also anticipated due to changes in the employment structure.

Tab. 1. Eurostat projections of change in the labor market in 2025-2070

	Population (in millions)	Total dependency rate	Labor force (in thousands)	Share of the employed aged 55-74 (%)	Productivity growth rate (%)
2025	37.52	69.72	17.21	16.68	3.28
2030	36.96	70.58	16.78	18.27	3.19
2035	36.30	70.50	16.30	20.69	2.59
2040	35.59	72.21	15.59	22.94	2.25
2045	34.82	78.56	14.68	23.82	2.21
2050	34.02	87.74	13.73	23.64	2.07
2055	33.23	95.86	12.97	22.28	1.94
2060	32.44	100.88	12.44	20.97	1.81
2065	31.64	101.17	12.11	21.72	1.67
2070	30.81	99.46	11.80	22.24	1.54

Source: own elaboration based on Eurostat data

In the Eurostat studies, the total dependency ratio was approached as the ratio of the number of people aged 0-19 and 65+ to the number of persons aged 20-64. It is projected to increase by almost 43% over the period analyzed. According to Eurostat forecasts, by 2070 the labor force will have fallen by more than 31%, more than the population (18%). In contrast, the share of those employed aged 55-74 will increase by around 33% in the period under review. Negative trends are expected with respect to productivity growth, which is anticipated to slow down by more than half. This phenomenon is certain to be influenced by the ageing labor force.

Depopulation poses a significant challenge for the public finance sector. Changes in the demographic structure not only reduce income tax revenue but also necessitate increased spending to minimize the negative consequences of the growing share of the elderly in the population. Even so, when considering the trend of the impact of demographic change on public finances, one should also mention areas where reduced budget expenditure may be anticipated. These include education, pre-school care and maternity benefits. As for the overall impact of population ageing, it is crucial to highlight increased outlays on healthcare services (Fig. 3). Statistics show that the elderly and children account for the majority of the National Health Fund (NFZ) patients. Moreover, the highest mean reimbursement values for healthcare services and medications per patient are generated by people in the oldest age groups.

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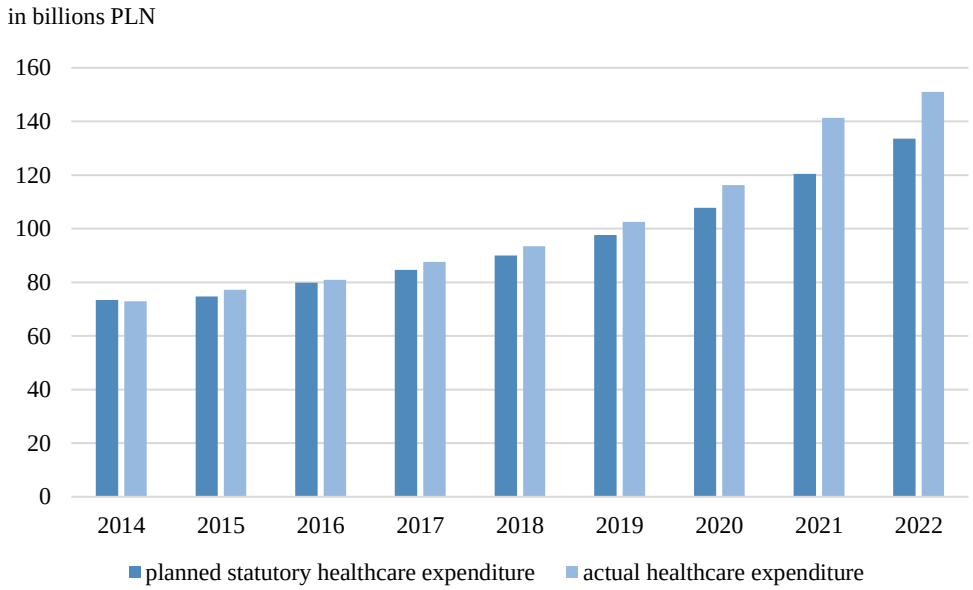


Fig. 3. Planned and actual public expenditure on healthcare in Poland in 2014-2022
Source: own elaboration based on data from Statistics Poland

In 2022, public expenditure on healthcare in Poland amounted to over PLN 133 bn, i.e. 4.9% of the Gross Domestic Product (GDP). This was 107% more than in 2014. A comparison of planned and actual expenditures also yields relevant information about the healthcare system, as only in 2014 was the former greater than the latter. However, the greatest disproportion was observed in the last two years of the studied period, when actual expenditures exceeded planned expenditures by 17% and 13%, respectively. The unfavourable situation faced by the National Health Fund (NHF) may also be inferred from the speed of expenditure growth. Between 2014 and 2022, the medium-term rate of change in public healthcare expenditure was 9.5%, while the rate of change in GDP per capita was 7.9%. The direct impact of population ageing on the public finance sector can be demonstrated by analyzing the Pearson linear correlation coefficient, expressed by the formula:

$$r = \frac{\sum_{i=1}^{n}(x_i - \bar{x})(y_i - \bar{y})}{\sqrt{\sum_{i=1}^{n}(x_i - \bar{x})^2}\sqrt{\sum_{i=1}^{n}(y_i - \bar{y})^2}},$$

where:
x, y – variable values,
$\bar{x}, \bar{y}$ – mean variable values,
n – number of periods.

The linear correlation coefficient between the number of persons aged 70 and over and healthcare expenditure between 2014 and 2022 was almost 96%. This means that as the size of the elderly population increases, public expenditure on healthcare increases as well, which is not surprising given that those are seniors who most frequently use services financed by the National Health Fund.

Inquiries into the demographic ageing of the population must not be limited to the current situation but also consider the threats that the Polish economy will have to confront in the future. Again, Eurostat forecasts provide vital information in this respect (Tab.2), indicating that negative demographic trends and their consequences will affect all European Union (EU) countries in the coming years. The data shows that ageing-related changes will result in increased healthcare expenditure, including long-term care. The projected statistics for Europe also estimate the total cost of ageing as a percentage of GDP, which even more clearly illustrates the scale of the issue in question.

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Tab. 2. Eurostat forecasts concerning changes in expenditure due to demographic ageing in Poland in 2025-2070

	Healthcare expenditure as % GDP	Long-term care expenditure as % GDP	Total ageing cost as % GDP
2025	6.04	0.92	22.14
2030	6.29	1.13	22.22
2035	6.51	1.33	22.14
2040	6.71	1.45	22.19
2045	6.92	1.52	22.45
2050	7.14	1.62	23.00
2055	7.36	1.79	23.68
2060	7.53	2.01	24.14
2065	7.62	2.20	24.18
2070	7.62	2.30	24.09

Source: own elaboration based on Eurostat data

It is estimated that between 2025 and 2070, the share of healthcare expenditure in GDP will increase by more than 26%. Significant changes are also projected for long-term medical care expenditure, which is expected to increase by 150% as a share of GDP. The average EU rates are 12.4% and 58.7% respectively. As for Poland, the total cost of ageing as a percentage of GDP determined by Eurostat will increase by 8.8% by 2070, with a 4.1% increase for the entire EU. These trends reflect the rapid ageing pace in Poland and the extent of costs resulting from such dynamic demographic changes.

Reflection on the changes in the demographic structure in Poland may be concerned with multiple domains, whereby the public finance sector may be considered one of the most important among them. Therefore, an attempt was made to assess the impact of trends related to demographic ageing on Poland's financial condition. Two explanatory variables were included in the econometric model: natural increase and the dependency ratio of the post-working age population. On the other hand, national public debt was adopted as the explained variable. The data in Tab. 3 demonstrates that Polish society is facing the problem of depopulation. However, the study aimed to measure the actual consequences of this phenomenon, expressed as changes in the value of national public debt. For the purposes of the analysis, it was assumed that the aforementioned variables are the only ones that influence its volume. The study considered actual data from 2010-2022 and the Statistics Poland forecast for 2023-2026.

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Tab. 3. Value of national public debt in 2010-2022 and explanatory variables with projection until 2026

	National public debt (in billions PLN)	Natural increase (in thousands)	Dependency ratio of post-working age population
2010	747.90	34.82	26.0
2011	815.35	12.92	26.9
2012	840.48	1.47	27.9
2013	882.29	-17.74	29.0
2014	826.77	-1.31	30.2
2015	877.28	-25.61	31.4
2016	965.20	-5.75	32.7
2017	961.84	-0.87	34.0
2018	984.31	-26.02	35.3
2019	990.95	-34.76	36.5
2020	1111.81	-122.05	37.4
2021	1148.58	-188.01	38.1
2022	1209.50	-143.32	39.0
2023		-123.27	39.9
2024		-128.27	40.7
2025		-132.15	41.4
2026		-139.67	41.9

Source: own elaboration based on data from Statistics Poland

In addition to assessing the impact of the explanatory variables on the explained variable, the analysis also aimed to estimate national public debt in 2023-2026, which is why the table does not include data on its value in the period concerned. As part of the assessment of Poland's demographic situation, it may be worthwhile to consider changes in natural increase, which dropped more than fivefold between 2010 and 2022. At the same time, national public debt rose by more than 60% and the dependency ratio by approximately 50%.

The Classical Least Squares method (CLS) was used to estimate the parameters of the linear model. The formula of the model in question was as follows:

$$Y = 275.26 - 0.81x_1 + 19.71x_2 + \xi,$$

where:
Y – value of the national public debt in billions PLN,
x_1 – natural increase in thousands,
x_2 –dependency ratio of post-working age population,
ξ – random component.

The obtained parameter estimates were interpreted as follows:

1. If the natural increase grows by 1,000 people, national public debt will decrease by an average of PLN 0.81 bn, with a mean error of ± PLN 0.25 bn *ceteris paribus.*
2. If the dependency ratio of the post-working age population increases by one unit, national public debt will increase on average by PLN 19.71 bn with a mean error of ± PLN 3.73 bn *ceteris paribus.*

After evaluating the model, its compatibility with the data was analyzed. It was found that the empirical values of the national public debt deviate from the theoretical values by an average of PLN 33.19 bn, which constitutes 3.49% of the mean of this variable. The determination coefficient was also significant, as it demonstrated that the model accounted for 95.26% of the variability of the national public debt. Based on these statistics, the model should be considered to fit the actual data.

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To assess the validity of the model, the significance of the structural parameter was verified by positing the following hypotheses:

$$H_0: \beta_1 = 0,$$
$$H_1: \beta_1 \neq 0.$$

The null hypothesis assumes that the structural parameter β_1 equals zero, i.e. it is statistically insignificant. The alternative hypothesis, on the other hand, assumes that the parameter is non-zero, i.e. it is statistically significant. Since the absolute value of the Student's t-statistic (3.29) is higher than the critical value (2.23), the null hypothesis was rejected in favour of the alternative hypothesis. It follows that the parameter β_1 is statistically significant, meaning that population growth significantly affects the value of the national public debt.

The significance of the parameter β_2 was verified in the same manner. The following hypotheses were posited:

$$H_0: \beta_2 = 0,$$
$$H_1: \beta_2 \neq 0.$$

The null hypothesis assumes that the structural parameter β_2 The null hypothesis assumes that the structural parameter equals zero, i.e. it is statistically insignificant. In contrast, the alternative hypothesis assumes that the parameter is non-zero, i.e. it is statistically significant. Since the absolute value of the Student's t-statistic (5.29) is higher than the critical value (2.23), the null hypothesis was rejected in favour of the alternative hypothesis. It follows that the parameter β_2 is statistically significant, meaning that the dependency ratio of the post-working-age population significantly affects the value of the national public debt.

The following hypotheses were posited to verify the joint significance of the structural parameters of the model:

$$H_0: \beta_1 = \beta_2 = 0,$$
$$H_1: \beta_1 \neq 0 \vee \beta_2 \neq 0.$$

The null hypothesis assumes that both explanatory variables are equal to zero, i.e. they are statistically insignificant. Conversely, the alternative hypothesis assumes that the parameters are non-zero, i.e. they are statistically significant. Adopting significance at a level of α=0.05, both parameters were considered significant, and the null hypothesis was rejected in favour of the alternative hypothesis, as the significance of the variables was 0.0082 and 0.0004, respectively. The Fisher-Snedecor test showed that the value of the F-statistic (100.4) is higher than the critical value (4.10), which means that natural increase and the dependency ratio of the post-working age population have a jointly significant impact on the value of the national public debt.

Confidence intervals for the structural parameters were also analyzed, with the following results:

$$P = \{-1.36 \leq \beta_1 \leq -0.26\} = 0.95,$$
$$P = \{11.41 \leq \beta_2 \leq 28.02\} = 0.95.$$

This means that with a probability of 1 – α, i.e. 0.95, the actual value of the parameters β_1 and β_2 is within the specified intervals.

As regards the interpretation of the structural parameter estimates, it is crucial to verify the stochastic assumptions that are necessary to assess the degree of fit of the econometric model. Consequently, the normality test of residual distribution was performed with the following hypotheses:

$$H_0: \xi_t \sim N(0, \hat{\sigma}_\xi^2),$$
$$H_1: \xi_t \nsim N(0, \hat{\sigma}_\xi^2).$$

The null hypothesis assumes that the random component has a normal distribution, while the alternative hypothesis is that the random component does not have a normal distribution. This was verified using the Chi-square(2) test statistic, which was 0.45, so at the significance level of α=0.05, it was found to be lower than the critical value (5.99). As a result, since there were no grounds to reject the null hypothesis, the random component was assumed to have a normal distribution. This is corroborated by the visualization of the distribution in Fig. 4.

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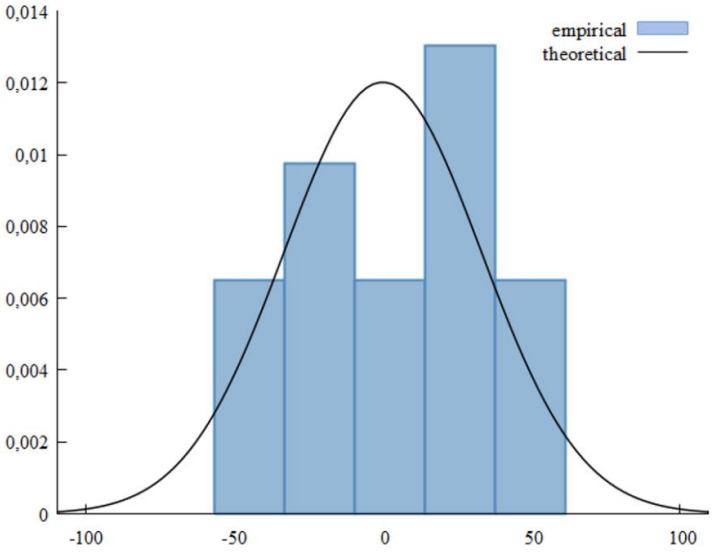


Fig. 4. Results of normality test of residual distribution in Gretl
Source: own elaboration based on data from Statistics Poland

Since the data shown in Fig. 4 indicate that the residuals have a distribution approaching normal distribution, the model should be evaluated positively. The probability of an erroneous verification decision is α=0.05.

The test of heteroskedasticity of the random component may also serve to verify the stochastic assumptions of the model. The following hypotheses were thus posited:

$$H_0 : E(\xi_t^2) = \sigma_\xi^2,$$
$$H_1 : E(\xi_t^2) \neq \sigma_\xi^2.$$

The null hypothesis assumes that heteroskedasticity of the variance does not occur, while the alternative hypothesis is that heteroskedasticity does occur, i.e. the variance of the random component is heterogeneous. White's test was performed to verify these assumptions. The p-value of the Chi-square (5) statistic amounted to 0.44, reaching a higher value than the adopted significance level, i.e. α=0.05. Consequently, there were no grounds to reject the null hypothesis, and the variance of the random component was considered to be homogeneous.

Finally, the validity of the model was analyzed using the Durbin-Watson (DW) test to examine the autocorrelation of the random component. The following hypotheses were put forward:

$$H_0 : \rho = 0,$$
$$H_1 : \rho > 0.$$

The null hypothesis assumes that there is no autocorrelation of the random component, whereas the alternative hypothesis is that there is significant positive autocorrelation. The DW statistic was 1.96, which is higher than the critical values d_L and d_U, which, at the significance level α=0.05 reached 0.86 and 1.56, respectively. This means that there are no grounds for rejecting the null hypothesis, i.e. autocorrelation of the random component does not occur. It should be noted that the closer the DW statistic is to 2, the better the model is. This study closely approached that value, which implies the model's high validity.

All the above tests demonstrate that the developed econometric model is valid and explains the relationship between the studied variables with high probability. The study shows that reduced natural increase and rising dependency ratio of the post-working age population significantly increase the national public debt. The analyses highlight the negative impact of demographic ageing on the stability of the public finance sector in recent years. As part of this inquiry, it may also be worthwhile to consider this process in terms of the corollaries which the Polish economy will face in the coming years.

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To illustrate the scale of these challenges, a forecast of changes in the national public debt 2023-2026 was developed using the econometric model described above. The obtained results are presented in Tab. 4.

Tab. 4. Projected national public debt in 2023-2026

	Projected national public debt (in billions PLN)	*Ex ante* error (in billions PLN)	95% confidence interval (in billions PLN)
2023	1161.46	37.857	1077.11 – 1245.81
2024	1181.28	38.668	1095.12 – 1267.43
2025	1198.21	39.468	1110.27 – 1286.15
2026	1214.14	39.964	1125.10 – 1303.19

Source: own elaboration based on data from Statistics Poland

Assuming that the natural increase and dependency ratio of the post-working age population will reach the levels projected by Statistics Poland while other conditions remain unchanged, the national public debt in 2023 will amount to PLN 1161.46 bn and will continue to increase year on year by an average of 1.5%. The accuracy of the forecast at its formulation stage is expressed by the relative *ex-ante* error, which may be described using the following formula:

$$V_t = \frac{\sqrt{S^2(e) + x_t D^2(a_j) x_t^T}}{y_t^P} * 100,$$

where:
$S^2(e)$ – residual variance,
x_t – value of explanatory variables in the projected period,
$D^2(a_j)$ – variance and covariance matrix for structural parameter estimates,
x_t^T – value vector of the explanatory variable in the projected period,
y_t^P – value of point forecast.

Relative errors of acceptability of the forecast for 2023-2026 ranged between 3.26% and 3.29%, which, with the adopted significance level α=0.05, indicates the validity of the prediction and a slight deviation of the actual value of the phenomenon from the forecast. The accuracy of the estimates is illustrated by the data in Fig. 5.

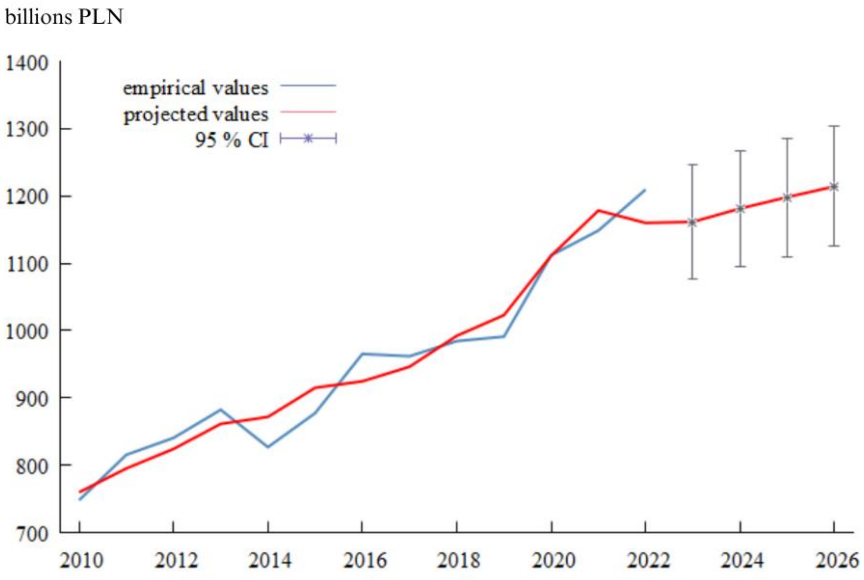


Fig. 5. Projected national public debt in Gretl
Source: own elaboration based on data from Statistics Poland

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In line with the accuracy of the *ex-ante* prediction, the estimated values of the national public debt for 2023-2026 should be considered accurate. The obtained forecast suggests that demographic ageing will significantly affect the future condition of the public finance sector, causing a 0.38% increase in the debt in 2026 compared to 2022.

Conclusions

The demographic ageing of Poland's population should be recognized as a major challenge to the economic system. The advancing demographic changes are a threat to the labor market and the condition of the public finance sector. Negative trends have been confirmed both by archival data and parameters projected by statistical institutions.

As a result of the study, the following conclusions were obtained:

1. The demographic situation in Poland is deteriorating dynamically, while forecasts indicate further negative trends. The number of births between 2000 and 2022 fell by more than 20 %, and the natural increase has been negative since 2013.
2. Between 2000 and 2022, the dependency ratio of the post-working-age population increased by more than half. Projections suggest that after 2055, the ratio of the working-age population to the non-working-age population will be 1:1. The fact that the labor force aged in the period from 2013 to 2022 is shown in the 66% rise in the number of employees aged 60 and over.
3. In 2022, public finance sector expenditure on healthcare more than doubled compared to 2014 and amounted to almost 5% of GDP at that time. During the analyzed period, those outlays grew on average 20% faster than GDP per capita.
4. The increase in the number of elderly people in Poland translates into increased public expenditure on healthcare. Pearson's linear correlation coefficient between these outlays and the number of persons aged 70 and over in 2014-2022 was almost 96%, indicating a very high correlation between the variables in question. This confirms the hypothesis that the progressing ageing of the population causes public expenditure on healthcare to increase.
5. From 2010 – 2022, the natural increase in Poland dropped more than fivefold. Linear regression analysis indicated a significant impact of changes in the natural increase and dependency ratio of the post-working age population on the national public debt, which was corroborated by significance tests on the structural parameters and stochastic assumptions of the econometric model. With a probability of 95%, if the natural increase diminishes by 1,000 people, the debt increases by an average of PLN 0.81 bn, with a mean error of ± PLN 0.25 billion, while a one-unit increase in the dependency ratio will cause the national public debt to rise by PLN 19.71 bn, with an average error of ± PLN 3.73 bn *ceteris paribus*. This supports the hypothesis that the components of population ageing, i.e. reduced natural increase and greater dependency ratio of the post-working age population, contribute to increased national public debt.
6. Taking into account the predictions of Statistics Poland, the changes in natural increase and dependency ratio of the post-working age population will cause the national public debt in 2026 to increase by 0.39% compared to 2022, with a probability of 95%.

This research constitutes a novel contribution by quantitatively demonstrating the strong correlation between demographic changes and public debt using localized data and precise econometric model. Unlike other studies, this analysis provides detailed projections specific to Poland, highlighting its unique demographic dynamics and fiscal implications.

Nonetheless, the findings must be considered in light of certain limitations. For instance, the projections rely on current trends, which may be altered by technological advancements, digitalization, or policies promoting the integration of older adults into the workforce. These factors could potentially mitigate some of the anticipated fiscal challenges and warrant further investigation.

The results of this study are consistent with broader findings in the literature, which also emphasize the significant fiscal challenges posed by demographic ageing. Numerous studies have highlighted the impact of

population ageing on public debt, particularly through rising expenditures on pensions and healthcare. This research builds upon these insights by providing a more detailed, localized perspective focused on Poland, offering specific quantitative results and projections. The alignment of findings with prior research underscores the universality of issues stemming from demographic ageing while emphasizing the distinctive pressures faced by Poland due to its rapid demographic changes.

Future research should explore strategies to address the economic and fiscal consequences of demographic ageing. Promising avenues include promoting active ageing, increasing the retirement age, and enhancing the participation of older individuals in the labor market. Additionally, evaluating the impact of technological innovations and improvements in healthcare delivery on public expenditure could provide valuable insights into mitigating these challenges.

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THE ACTIVITIES OF THE INTERNATIONAL LABOUR ORGANIZATION IN THE CONTEXT OF ACHIEVING THE SUSTAINABLE DEVELOPMENT GOALS*

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Abstract. This study examines the pivotal role of the International Labour Organization (ILO) in advancing the United Nations Sustainable Development Goals (SDGs), with a particular focus on promoting decent work and ensuring safe and secure working conditions. The article explores the mechanisms of international regulation of social and labour relations, highlighting both the historical and contemporary contributions of the ILO to global labour standards. It evaluates the transformative impact of the COVID-19 pandemic on progress toward achieving these goals, emphasising the emergent challenges and the need for innovative measures to enhance occupational safety and health. The study also analyses the ILO's historical legacy, which has shaped the international labour landscape over the past century, and discusses its current initiatives to address modern labour challenges. Special attention is given to the interconnection between economic growth, financial sustainability, and the implementation of international labour standards. By exploring specific strategies for improving workplace conditions and fostering financial resilience, the research presents actionable recommendations for global policymakers, organisations, and stakeholders. The findings underscore the importance of adopting a multidimensional and cooperative approach to resolving global social and labour issues. The study concludes that achieving the SDGs - particularly Goal 8 (Decent Work and Economic Growth) - requires strengthened international collaboration and a shared commitment to aligning labour policies with sustainable development objectives. This comprehensive examination of the ILO's role provides valuable insights into its strategic importance in ensuring equitable and sustainable progress in labour relations worldwide.

Keywords: social and labour relations; sustainable development goals; international labour organisation; occupational safety and health; decent work; international standards; economic growth

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1. Introduction

Global changes in the labour and economic spheres necessitate the creation of effective mechanisms to ensure social and economic balance and development of society. In this context, the Sustainable Development Goals (SDGs), approved by the UN General Assembly in 2015, become the basis for international cooperation to achieve proper working conditions, economic progress and social protection. Of particular importance is SDG 8, which covers the goal of ensuring decent work and productive employment for all in the modern world, where inequality, labour market instability, unemployment and the effects of the COVID-19 pandemic pose significant challenges.

Despite a long history of regulating social and labour relations at the international level, many issues remain unresolved. Insufficient coordination of governments' actions and limited access to innovative approaches and financial resources, especially in low-income countries, make it much more challenging to achieve the set goals. In this context, the activities of the International Labor Organization (ILO) are of particular importance, as this organisation is engaged in developing labour standards, protecting workers' rights and strengthening international social dialogue.

The COVID-19 pandemic has further exacerbated labour inequality and emphasised the need for international cooperation. While economically developed countries have partially recovered, low- and middle-income countries have faced additional challenges that have significantly affected their ability to implement the SDGs. Rising economic inequality, declining employment, and volatile financial markets have highlighted the need for more coordinated action at the global level.

Achieving decent work and economic progress is a complex task encompassing economic, social and environmental dimensions. The ILO's activities are unique, as the organisation develops international labour standards and ensures their practical implementation in different countries. However, despite its extensive experience, there is still a need for a deeper study of its impact on the implementation of the SDGs.

2. Theoretical background

Today, the importance of international aspects of regulating social and labour relations is growing rapidly. In this sense, the SDGs deserve attention, as they have become a benchmark for the global community to develop various spheres of social life. Among the SDG targets, target 8.5 is of particular importance: "Promote safe and secure working conditions for all workers, including through the use of innovative technologies in the field of occupational health and safety," which is part of SDG 8. This target includes a set of tasks to ensure decent work and economic growth. Along with it, it is worth noting the improvement of the socio-economic and financial conditions of enterprises and organisations, which is envisaged by SDG 8.10. It is no coincidence that both tasks are integrated within the same goal.

In such circumstances, the ILO is of great importance, as it has been focusing on developing international labour standards and protecting working people globally for more than a century. The history of research on the topic outlined in the title of this article demonstrates both the chronological process of knowledge accumulation and regulatory development, as well as the focus on new issues, particularly those arising from the COVID-19 pandemic.

The initial research stage on this topic is based on the works of authors such as Hák, Janousková, and Moldan (2016), who substantiated the need for a more precise definition and further detailed the mechanisms for implementing the SDGs. Their work emphasised the importance of developing systematic approaches to assessing progress in achieving these goals.

The COVID-19 pandemic and the crisis in social and labour relations that arose as a result of its consequences have become a kind of milestone in research on this issue. In particular, Naidoo and Fisher (2020) emphasise that UN documents "have become another victim of COVID-19". These and similar statements formed the basis of studies (Meschede, 2020; Swain & Yang-Wallentin, 2020). Even so, most researchers agree that the

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ILO, within its mandate and specialisation, should play a decisive role in achieving some of the goals (Rantanen et al., 2020). Moreover, in our previous works, it has already been noted that in this case, the creation of appropriate conditions for ensuring occupational safety and health should be of fundamental importance (Yarotskiy et al., 2021; Dreval et al., 2021; Sramka et al., 2023).

Thus, systemic regulatory approaches to ensuring proper working conditions are a critical element in the implementation of international standards, but in order to achieve the SDGs, it is also necessary to take into account the innovative potential of the private sector, especially in the context of the use of modern technologies. Some authors (Rayevnyeva et al., 2023; Sidak et al., 2024; and Stryzhak et al., 2024) have examined specific aspects of identifying tools and processes for achieving the goals (measurable indicators) of sustainable development in their research studies.

As noted in the study (Jones et al., 2017), their implementation requires the involvement of governments and the private sector. Information and communication technologies have a significant impact on improving working conditions, overcoming poverty, and other areas of social development. The authors examine the role of companies such as Ericsson and Microsoft, as well as industry organisations such as the GSMA and the Global e-Sustainability Initiative, which demonstrate how innovative solutions can contribute to achieving sustainable development goals.

The conceptual basis for this study is the work “The UN Sustainable Development Goals: A Comparative Mid-Term Review of Research” (Sorooshian, 2024), which provides a comparative analysis of the achievements and difficulties in implementing the SDGs. The author emphasises the importance of an integrated approach that considers the interrelationships between individual tasks, which allows for more effective implementation of global sustainable development initiatives.

Barua (2021) explores the importance of human capital in long-term economic development. Her research demonstrates that a prioritised approach to human resource development is important for national progress, especially in middle-income countries where resources are mainly directed to economic growth rather than social welfare.

In their study, (Grzebyk et al., 2023; Labunska et al., 2023) assess the implementation of SDG 8 in the European Union using multivariate analysis. Their results show that positive changes in labour productivity and social protection vary significantly depending on the economic development of individual countries, and the COVID-19 pandemic in 2020 has had a negative impact on their implementation.

A study by a team of scientists (Boudt et al., 2024) draws attention to research projects funded by the European Union. An analysis of the CORDIS database shows that projects aimed at implementing SDG 8 focus on productivity, entrepreneurship, and economic growth, emphasising the important role of funding in achieving these goals.

Paksi, Nabilazka and Silawa (2024) analyse the implementation of SDG 8 in Indonesia during the pandemic. Using the Voluntary National Review (VNR) reports, the authors conclude that, despite the economic downturn, the country has been able to maintain positive momentum in achieving its targets.

The study of Shabbir (2023) outlines the role of entrepreneurship in implementing SDG 8. The author demonstrates that entrepreneurial activity contributes to the development of social responsibility, creating new jobs, and improving economic performance in different regions.

Pasinovych and Myskiv (2023) studied corporate social responsibility's role in Ukraine, particularly in supporting social initiatives during the Russian aggression. The authors found that business plays a significant role in economic recovery and in promoting the population's welfare. Their main conclusion is that the priority SDG for business after the war will be, first of all, Goal 8 "Decent Work and Economic Growth".

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Bieszk-Stolorz and Dmytrów (2023) focus on comparing the geographical distribution of SDG 8 implementation in the European Union. Using the COPRAS method and cluster analysis, the authors determine the impact of the pandemic on the decline in economic growth and job creation.

Balcerowicz-Szkutnik, Szkutnik, and Szkutnik (2020) examine the impact of social and economic conditions on poverty reduction. Masha and Fihla (2025) analyse specific tools of poverty alleviation by financial associations in South Africa. The authors emphasise that fighting against poverty in low-income economies is important for overall development, including the achievement of labour and employment-related targets.

The literature review demonstrates that ensuring decent working conditions and economic growth are fundamental tasks of modern global development. Given the wide range of scientific research, the choice of the topic of our study is due to the need to highlight the role of the International Labor Organization in the implementation of international labour standards, as well as the importance of these initiatives for the implementation of the SDGs.

The purpose of our study is to analyse the ILO's activities in the context of the SDGs, in particular, to ensure decent work and safe working conditions for employees, as well as to develop proposals for improving international labour standards in the light of current conditions.

3. Research objective and methodology

The study is based on a philosophical understanding of methodology as a complex and multidimensional means of cognition. Moreover, special attention is paid to the concept of "sectoral methodology", i.e., the selection of appropriate starting principles and tools from the general methodological arsenal for conducting a specific research work. For our subject matter, it is the selection of those phenomena and subjects of legal reality from the complex of social and social and labour relations which are directly related to the general principles of realisation of the goals of sustainable development and ensuring labour safety, their interconnection and interactions with the so-called “environment”.

In this regard, considerable attention is paid to the method of system analysis, which is recognised as one of the main directions of the methodology of special scientific knowledge and whose application allows the linking of all the necessary phenomena and processes into a single holistic object. The main factors for applying this method in the context of the task at hand include the scale of the problem under consideration, as well as the emergence of numerous challenges and threats that cannot be adequately addressed without considering various related issues.

The implementation of the tasks is also based on several other methods, namely the structural and functional method (to characterise the significance of the ILO's activities in general and its individual structures in the implementation of the SDGs, to fully disclose the problems of interrelationships between individual goals and indicators, as well as to substantiate the conclusions that, in the aggregate of individual provisions, are important both for the implementation of individual goals and for a complete understanding of the significance of SDG 8 for the development of social relations in general); the method of comparison (thus realising the task of clarifying the essential characteristics of the SDGs and their difference from previous international documents of the relevant direction).

4. Results and discussion

International labour standards are the conceptual and regulatory framework of international labour law, accumulating global experience in social and labour regulation in individual countries and certain international organisations. In this regard, the activities of the International Labor Organization, which has been studying and developing such standards for more than a century, are particularly important.

This organisation already has considerable experience in effectively responding to numerous challenges and threats faced by workers in the world of work (in particular, by developing comprehensive socio-economic

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measures to counteract the Great Economic Depression, protecting workers during numerous military disasters, reducing the negative effects of the global economic crisis of 2008, etc.) Today's activities of this organisation are largely focused on ensuring decent work for people worldwide, regardless of race, gender or other characteristics (Rayevnyeva et al., 2023).

At the beginning of the twenty-first century, the UN Millennium Declaration, adopted in 2000 at the UN Millennium Summit, became relevant, defining a comprehensive framework of values, principles and key factors for development under the three main mandates of the United Nations: peace and security, development and human rights (GA/9758, 2000).

Today, the world community is invited to pay attention to the global transition from the Millennium Development Goals (MDGs) to the Sustainable Development Goals (SDGs), adopted by the UN General Assembly in September 2015, which includes 17 sustainable development goals and 169 targets. The approved goals and targets cover various areas of social relations (social, economic, humanitarian, environmental, security, etc.).

In the context of the subject matter of this article, we should first pay attention to **Goal 8**: Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all. This goal becomes functional in the following targets:
SDG 8.3. Increase the employment rate.
SDG 8.4. Reduce the proportion of unemployed young people, out of school, or not in training or education.
SDG 8.5. Promote safe and secure working conditions for all workers, including through the use of innovative technologies in the field of labour protection and industrial safety
SDG 8.10. Strengthen the capacity of national financial institutions to promote and expand access to banking, insurance and financial services for all.

The above goal and objectives cover a set of interrelated issues traditionally addressed by the ILO: economic growth is not an end in itself, it must be combined with effective social protection and adequate safety of workers (besides, it has been repeatedly proved that the costs of measures on workers' safety and health lead to an acceleration of economic growth rather than slowdown); full and productive employment is the first and core component of social protection; decent work for all is the basis of the Decent Work Program, which was developed in the late 1990s and has become a kind of guideline for improving international labour standards, and which today has become a guideline for improving international labour standards (Labunska et al., 2023).

At the same time, a number of issues related to the implementation of the SDGs and the social protection of employees remain without proper argumentation. The scientific community has not yet adequately responded to the peculiarities of the ILO's current activities related to responding to new challenges and threats. This applies, in particular, to clarifying the place of OSH in the updated agenda of the international community. Moyer and Hedden highlighted this state of affairs quite imaginatively and convincingly, asking the following questions: "Are we on the right track? Or are we already very close to achieving these SDGs, and we just need to make a few important policy decisions to put us on the right track? Or are we unable to achieve the SDGs with only a few options to close the gap between current levels and the targets?" (Moyer & Hedden, 2020).

Over the past twenty years, the concept of decent work has been contained in various variations and substantiated in most documents of programmatic importance, international legal norms and analytical developments of this organisation. This concept has been the subject of intensive research in several thousand articles, monographs and dissertations (Sidak et al., 2024; Stryzhak et al., 2024).

From the point of view of our research, it is advisable to focus on the key points of the development of the GSP, which are given in the basic documents of this organisation. In a systematised form, they are presented in the table "ILO Activities on the Development and Implementation of the GSP" (see Table 1).

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Table 1. ILO activities on elaboration and development of the basic principles of the MEA

Title of the report	The essence and structuring of the basic principles of decent work
Declaration	Fundamental Principles and Rights at Work (FPRW): freedom of association and the right to collective bargaining; elimination of all forms of forced or compulsory labour; elimination of child labour; elimination of discrimination in employment and occupation (International Labour Organization, 1998).
Report	The goal of decent work is defined as ensuring productive work for women and men in conditions of freedom, justice, security and human dignity; ensuring decent work for men and women worldwide is the main goal of the ILO in the current situation. In this regard, it is pointed out that it is necessary to move from several dozen major programs to four strategic objectives, which are given in the 1998 Declaration (International Labour Organization, 1999).
Declaration	Four strategic objectives of the ILO are named and detailed: (1) promoting employment (structured according to three pillars); (2) developing and expanding social protection measures - social security and workers' protection (also structured according to three pillars); (3) promoting social dialogue and tripartism (four tasks in total); (4) respecting, promoting and implementing fundamental (International Labour Organization, 2008)
Declaration	All workers should be guaranteed adequate protection per the GPG, considering the following factors: respect for their fundamental rights, adequate minimum wages, maximum working hours, and occupational safety and health. Safe and healthy working conditions are fundamental to ensuring decent work (International Labour Organization, 2019).

Source: own processing

Naturally, the ILO's current agenda is traditionally compiled taking into account the peculiarities of the development of social and socio-economic relations. With the adoption of the updated World Development Agenda, the lion's share of the organisation's efforts began to be directed precisely at the specification and implementation of the SDGs (primarily in the part that directly relates to employment and social protection, safety and health of workers). The work on fulfilling the ILO's main tasks and the Decent Work Program has also been carried out with due regard to the SDGs.

Formally speaking, the impact of the SDGs began to be reflected in the content of most decisions: declarations, resolutions, current normative acts - conventions and recommendations, etc.

First of all, the ILO reports, which are traditionally prepared for presentation at the sessions of the International Labor Conference (hereinafter - ILC) and cover the most important issues of social and labour relations development, deserve attention. The 2019-2020 period is a watershed in the content of these reports, which led to the beginning of work on defining qualitatively new benchmarks for the development of social and labour relations.

These reports gradually reveal the most important principles of the ILO's participation in the development and implementation of the SDGs year after year (for a description of the most important reports in terms of the subject matter of the study, see Table 2).

Table 2. ILO reports with a thematic basis in the form of development and implementation of the SDGs

Title of the report	The thematic focus of the reports
World Social Protection Report 2017–19	The report is based on a comprehensive assessment and prospects for developing social protection in light of the goals to be achieved by 2030; it analyses the progress and main gaps in this area of relations that need to be addressed (International Labour Organization, 2017).
ILO. Towards 2030	The report is based on a methodological framework that outlines the need to adhere to basic principles and HRBAs in implementing SDGs (International Labour Organization, 2018).
Time to Act for SDG 8	The report focuses on the provision that SDG 8 harmonises sustainable development's economic, social and environmental dimensions. This means that the lack of progress in achieving SDG 8 will not allow progress towards the realisation of other SDG goals (International Labour Organization, 2019).

Source: own processing

In the context of our study, the World Social Protection Report 2017-2019 stands out among other related documents, which links specific SDGs to the existing set of international legal norms and provides guidance on ensuring safe and healthy working conditions (see Figure 1 below for a schematic representation of this).

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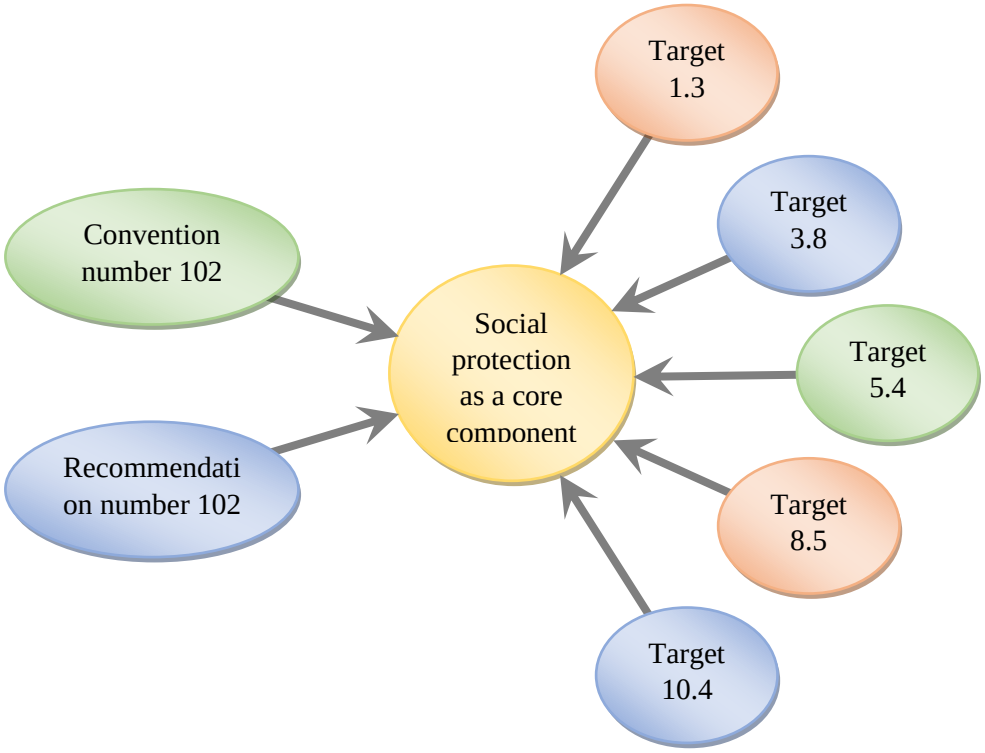


Figure 1. ILO core normative documents and the SDGs in the area of social protection
Source: own processing

The focus of the reports has changed qualitatively due to the spread of the COVID-19 pandemic, which has prompted an intensive search for ways to counteract its destructive power in all social and labour relations areas. At the same time, it should be noted that most of these reports lack a systematic approach to analysing topical issues, as evidenced by the lack of references to the relationship between individual proposals and already-developed international legal norms.

As a single positive example, the report "ILO. 2021. Working from home: From invisibility to decent work" clearly links the solution of modern problems of domestic work to the norms set out in the ILO Domestic Work Convention, 1996, and its corresponding Recommendation, 184 (ILO. Working from home: From invisibility to decent work/International Labour Office. Geneva, 2021). Convention No. 177 emphasises the equality of all forms of labour relations (International Labour Organization, 1996).

In our previous publications, we have further substantiated that the content of fundamental conventions reveals and gives normative value to certain principles and rights in the world of work (Conventions No. 29, 87, 98, 100, 105, 111, 138 and 182).

In 2022, the content and structure of the MWC were qualitatively updated, thanks to the adoption by the 110th session of the ILC of the Resolution on the inclusion of safe and healthy working environments in the fundamental principles and rights at work of the ILO. Therefore, based on the exact position of the relationship of each of these principles to the most important conventions, the fundamental ones should include Convention No. 155 on Occupational Safety and Health and the Working Environment, 1981 and Convention No. 187 on the Fundamentals Promoting Safety and Health at Work, 2006 (International Labour Conference, 2022).

The increased attention of the global community to OSH issues has provided national governments with significant opportunities to improve measures to improve the relevant part of social and labour relations. First of all, it is worth noting the potential inherent in the content of Convention No. 187, particularly regarding the

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inclusion of a national tripartite consultative body or bodies dealing with OSH issues in the national OSH system (International Labour Organization, 2006).

In this case, it is also worth noting that the content of the latest ILO reports contains up-to-date information on the problems of international regulation in the most important areas of social and labour relations. Given the subject matter of the article, the content of the report with the eloquent title "Sustainable Development, Decent Work and Social Justice. Update on progress towards SDG 8" (September 2023). However, progress can only be made formally (based on adopting a particular share of documents with the relevant regulatory scope). Indeed, based on a thorough analysis, this report concludes that "the world is significantly behind schedule in almost two-thirds of the indicators reflecting progress towards the implementation of SDG 8." Thus, according to the ILO, "the international community is almost as far from meeting the SDG 8 targets today as it was in 2015" (International Labour Organization, 2023).

The rapid multiplication of global challenges facing humanity today requires concerted efforts by all global community members. First, it is about overcoming the crisis and restructuring social relations aimed at sustainable development and protecting the vital interests of individuals and society. Indeed, in the face of a difficult situation affecting all spheres of social and socio-economic relations. Therefore, the content of the UN Sustainable Development Goals should become a reliable guide to overcome negative trends and ensure uninterrupted development. This applies, in particular, to providing decent work and economic growth. Moreover, there are many problems and miscalculations about the achievement of SDG 8. In this regard, creating and ensuring safe and healthy working conditions for millions of workers is essential.

Therefore, the activities of the ILO, which has been developing international labour standards for a century, should be of particular importance. The implementation of the declared goals and objectives should be based primarily on the concept of decent work, which was developed long before the adoption of the updated UN Agenda and until recently included four ILO strategic objectives: promoting employment, developing and expanding social protection measures; promoting social dialogue and tripartism; and respecting and implementing fundamental principles and rights at work. Today, a fifth component has been added to them: creating safe and healthy working conditions is not only already defined as a fundamental factor in ensuring decent work but also refers to basic principles and rights at work. These targets provide a solid foundation for many other targets outlined in SDG 8 and many other goals.

5. Conclusions

The essential features of the ILO's current activities in the context of the SDGs implementation include, first of all, the emphasis on decent work as a reliable basis for social protection in various variations and the achievement of specific goals (which is seen in the content of the programmatic documents, as well as in numerous analytical developments of this organisation). To this should be added the provision on the existence of a clear relationship between decent work and safe and healthy working conditions.

The peculiarities of the ILO's activities in the context of these goals are primarily manifested in the clarification of prerogatives or priorities depending on the new challenges and threats facing the world community (the biggest irritant was the COVID-19 pandemic, which caused significant changes in the lives of millions of people around the world, including in social and labour relations and social protection of workers). In this regard, the tone of the ILO's reports has changed qualitatively, as the lion's share of efforts has been directed to additional social protection of workers and the Organization's development prospects in connection with the spread of the COVID-19 pandemic. However, these documents only partially address or ignore the issues of the UN Agenda.

The scientific value of the provisions presented in this article is primarily in defining the essence and features of the ILO's activities in the context of the SDGs, as well as in substantiating specific proposals for the implementation of certain goals based on already developed international labour standards. In particular, it seems appropriate to develop a new ILO document with detailed proposals for implementing individual SDGs in the context of the pandemic. First of all, in our opinion, it should be about making some additions to certain

indicators, namely indicator 8.3, which refers, among other things, to the creation of decent jobs (we propose to add the following: ensuring outstripping job creation relative to the growth of unemployment) and 8.5, which refers, among other things, to ensure full and productive employment and decent work for men and women (our addition: ensuring full social dialogue in the field of labour to create conditions for additional protection of the most vulnerable).

Given the content of SDG 8.10, it is also essential to emphasise the importance of increasing access to financial services to ensure sustainable economic development and social protection. This implies creating conditions for the development of financial literacy, expanding the range of available financial products and services, and ensuring their accessibility to all social groups, including the most vulnerable.

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DIGITAL TRANSFORMATION OF HUMAN RESOURCE MANAGEMENT PROCESSES AND PRACTICES: A STUDY OF SLOVAK ENTERPRISES*

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Abstract. Digital transformation is currently essential for effective human resource (HR) management within organisations. This topic is particularly relevant in the context of the Fourth Industrial Revolution, which introduces new challenges and opportunities for HR processes while also emphasising the responsibility for sustainable development. Implementing digital tools in HR can enhance the efficient use of HR, reduce negative environmental impacts, and promote corporate social responsibility. This research aims to explore the current level of digital transformation in HR processes within Slovak organisations, focusing on the potential of digital technologies to contribute to sustainable and responsible business practices. The study was conducted through a quantitative survey distributed to 743 respondents from Slovak companies. The analysis focused on evaluating the degree of digital tool implementation in areas such as recruitment, training, onboarding, and employee evaluation. The survey results revealed that recruitment and selection processes are the most digitised, emphasising social media and employer branding. In the area of learning and development, online training and employee reskilling are predominant. However, many organisations still rely on basic digital tools, with less frequent implementation of innovative technologies such as AI or gamification. The findings of this study provide valuable insights into the state of HR digital transformation in Slovak organisations and highlight areas requiring further development and investment, particularly with a focus on enhancing sustainability and responsibility in HR management.

Keywords: digital transformation; digitization; human resource management; HR; sustainability

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1. Introduction

Digitisation has become one of the key values for businesses today. Digital technologies significantly influence how companies create and deliver value to customers (Gburova & Matusikova, 2016; Shen et al., 2022). Additionally, businesses must create and transform traditional business models by integrating technologies into their internal organisation, management, processes, and strategies. A central aspect of digital transformation is the rapid development of technologies such as artificial intelligence (Trocin et al., 2021), the Internet of Things (Darbandi et al., 2022), cloud computing (Koman et al., 2024), and Big Data (Almeida, 2022).

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However, within this transformation, companies should not overlook sustainable development, which is becoming an increasingly important aspect of business (Koman & Bubeliny, 2020; Holubčík et al., 2023). The integration of digital technologies can support sustainability by optimising processes, reducing resource consumption, and minimising negative environmental impacts (Lukac & Mihalik, 2018; Gregori & Holzmann, 2020; Juríčková et al., 2020). Technologies like Big Data enable companies to manage resources more effectively, improve energy efficiency, and predict environmental risks, thereby contributing to long-term sustainability (Koman et al., 2022). Beyond environmental benefits, digital innovations can also enhance social sustainability by fostering fairer and more inclusive working conditions, such as through flexible work arrangements and improved access to education (Deloitte, 2018; Baek & Kim, 2021).

In Slovakia, digital transformation has become a priority of state policy and a significant part of strategic plans, such as the Digital Transformation Strategy of Slovakia 2030 (Ministry of Investment, Regional Development and Informatization of the Slovak Republic, 2019), and the Recovery and Resilience Plan. These initiatives emphasise modernising digital infrastructure, enhancing the digital skills of the population, and fostering innovation within businesses. Special attention is given to adapting the workforce to new market conditions, where an increased demand for IT specialists and workers with technological expertise is anticipated.

The business sector in Slovakia is already experiencing a significant shift towards digitalisation. Many companies are implementing smart technologies to enhance the efficiency of production processes, optimise logistics, and improve customer services (Stacho et al., 2023). Digital transformation is also fundamentally changing how human resources (HR) departments operate, impacting all aspects of people management—from recruitment to employee development and talent management (Kucharcikova et al., 2024). Modern technologies such as artificial intelligence (AI), big data, cloud solutions, and automation offer new opportunities to streamline processes, improve decision-making, and increase employee satisfaction (Kucharcikova & Miciak, 2018; Tumova, 2019; Fraij, 2021; Balakrishnan & Parivara, 2023).

2. Review of literature

Digital transformation results from technological advancement and represents a process that drives change across various levels of organisations (Plekhanov et al., 2023). This process not only involves the implementation of digital technologies to optimise existing business processes but also explores new digital innovations that have the potential to transform business models (Correani et al., 2020). Digital innovations are defined as the integration of digital technologies and physical components to create new digital products (Yoo et al., 2010). (Demirkan et al., 2016) expand on the concept of digital transformation, viewing it as an accelerator for transforming business activities, processes, competencies, and models. Its objective is to fully harness the changes and opportunities brought by digital technologies and their strategic impact on society.

Digital people management in the era of Industry 4.0 is characterised by fast, team-oriented, and collaborative leadership focused on innovation (Staffenova et al., 2024). To understand the level of HR digital transformation, a 4-level assessment scale—typology of digital HR in enterprises—was developed (Strohmeier, 2007):

- Analogue Organization (Non-Application): Represents organisations that do not utilise digital technologies, with processes remaining entirely analogue and manual.
- Digital Organization 1 (Operational Application): Includes organisations that use digital technologies to support and improve operational processes, but without a strategic impact.
- Digital Organization 2 (Strategic Alignment): Organisations align digital technologies with their strategic goals, enabling these technologies to support the implementation of business strategies.
- Digital Organization 3 (Strategic Integration): Digital technologies are fully integrated into business strategy development, facilitating the creation of new opportunities and innovations.

One of the key areas of digital HR transformation is recruitment automation. AI and specialised software tools enable the rapid analysis of large volumes of resumes, identification of the most suitable candidates based on predefined criteria, and prediction of their success in each position. Chatbots integrated into the recruitment

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process can answer candidates' questions in real-time, saving HR teams time and enhancing the candidate experience (Alamro et al., 2018; Aljuaid, 2021).

In the area of employee development and training, transformation brings personalised online learning platforms that allow employees to access relevant courses and training tailored to their needs. These platforms often use AI to recommend educational content based on the individual needs and goals of employees. Additionally, virtual and augmented reality (VR/AR) are becoming popular tools for practical training, especially in industries where simulating real-life situations is essential (Derouin et al., 2005; Nof et al., 2015).

Performance and employee satisfaction management is becoming more efficient and transparent through digitalisation. Cloud platforms enable tracking goals and outcomes in real-time, providing managers with insights into team performance. Modern tools for collecting feedback, such as anonymous surveys or mobile apps, help HR departments regularly monitor employee satisfaction and engagement (Rondeau, 2018).

Digital transformation also plays a significant role in personnel administration. Electronic signatures, cloud-based document management systems, and automated payroll processes minimise bureaucracy and eliminate errors. Digitalisation thus reduces administrative burdens, allowing HR specialists to focus on more strategic tasks (Gecíková & Papcunová, 2014; Alkhodary, 2021; Kusnirova et al., 2024).

However, digital transformation also brings challenges. Implementing new technologies requires investment, employee adaptation to new systems, and ensuring cybersecurity to protect sensitive data (Kim & Pae, 2007; Özsungur, 2021; Mohammed & Ahmad, 2025).

The success of this transformation depends on the ability of HR departments not only to adopt new technologies but also to use them in a way that aligns with the company's culture and strategy. Therefore, digital transformation in HR is not just about technology; it is also about changing the approach to working with people and creating an environment that fosters innovation, flexibility, and employee satisfaction.

3. Methodology

This study aims to examine the current level of digital transformation in HR processes within Slovak organisations. Based on this objective and theoretical background, two research questions were defined:

- Q_1: What is the current level of digital transformation of HR processes in Slovak organisations?
- Q_2: Which HR practices in Slovak organisations are currently most supported by digital technologies?

To answer these research questions, a quantitative data collection method was used, which allows for statistically evaluating respondents' answers and identifying patterns, trends, and relationships between variables. Specifically, a questionnaire survey technique was employed, which is one of the most used methods in social and behavioural sciences, as well as in commercial research.

A purposive sampling technique was used to gather data from a specific target group defined by criteria. This technique was chosen for several reasons related to the nature and objectives of the research:

- The goal was to obtain qualified responses that provided valuable and practically applicable insights. Random sampling could have resulted in including respondents who lack the necessary knowledge or experience to answer the research questions effectively.
- Due to time and financial constraints, it was more efficient to directly approach relevant respondents rather than relying on a broad distribution, which might include an irrelevant sample.
- The research required data from a specific group of people, making purposive selection a logical step in achieving precise and useful outcomes.

As part of the research, a questionnaire was designed and distributed to a total of 743 respondents. The data collection took place from January 2024 to March 2024. The distribution was carried out electronically via Google Forms. After the data collection was completed, a total of 245 responses were received, representing a

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gross response rate of approximately 33%. This value was calculated as the ratio of the total number of responses (245) to the total number of respondents approached (743):

$$\text{Response Rate} = \frac{\text{Number of Responses}}{\text{Number of Respondents Contacted}} \times 100 = \frac{245}{743} \times 100 \approx 33\%$$

After processing the responses, we proceeded with a thorough review and data cleaning. During this process, the following were identified and excluded:

- Incomplete responses – questionnaires containing missing key data necessary for analysis.
- Duplicates – responses that were repeated by the same respondent, likely due to multiple submissions of the form.

After excluding 7 invalid responses, the final number of relevant responses was 238. This step was crucial to ensure data quality and minimise bias in the results.

4. Results

For basic respondent characterisation, their job position within the organisation was surveyed, with only HR department representatives or HR department directors being considered relevant. Based on the collected data, it can be stated that 83% of respondents belonged to the category of HR department employees, while HR department directors represented 17%.

The level of education attained by the respondents was also analysed. A master's degree was reported by 68% of respondents, while 13% held a bachelor's degree, and 15% had a high school education. The smallest group consisted of respondents with a doctoral degree, representing 4%.

The study also examined whether the focus of the respondents' education was related to the HR field. The results indicated that more than half of the respondents (64%) did not have an education linked to the HR field, while 36% indicated that their education was focused on this area.

In the analysis, the number of employees in companies was assessed, and based on this, companies were classified according to the European Commission Recommendation No. 2003/361/EC into micro-enterprises, small enterprises, medium-sized enterprises, and large enterprises. The largest group was made up of large enterprises, accounting for 40%, followed by medium-sized enterprises at nearly 40%. Small enterprises represented 21%, and micro-enterprises made up 4%, which classifies them as the least represented entities.

Regarding the sector of activity, businesses were categorised into manufacturing, service-providing companies, organisations and associations, and others. The largest share of respondents (40%) came from service-providing companies, followed by manufacturing businesses at 31%. The "other" category represented 26%, while organisations and associations made up only 3% of the respondents.

The level of HR digital transformation

The questionnaire focused on the degree of digitisation in HR management, analysing the stages of digital transformation in HR based on the model presented by (Strohmeier, 2007). Respondents were asked to select one of the four levels of digital transformation: 1) Analogue organisation (no use of technologies), 2) Digital organisation 1 (operational use of technologies), 3) Digital organisation 2 (strategic alignment of technologies), 4) Digital organisation 3 (strategic integration of technologies).

The results showed that 13% of respondents reported working with analogue data without using digital technologies in their HR department. 34% of organisations indicated that they had implemented digital technologies at the operational level in HR, corresponding to Digital Organization 1. Similarly, 34% of businesses reported reaching Digital Organization 2, which involves integrating digital technologies into the creation and execution of HR strategy. The highest level, Digital Organization 3, where digital technologies are

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strategically integrated into the formulation and implementation of HR strategy, was chosen by 19% of companies.

The next part of the survey focused on analysing HR practices in the context of digital HR transformation. The goal was to explore how digital technologies impact various aspects of HR management and what innovations are being implemented at the operational, strategic, and integrative levels. Respondents were asked about the use of digital tools in the following areas: 1) recruitment and employee selection, 2) employee onboarding, 3) employee training and development, and 4) employee evaluation and compensation.

Recruitment and Employee Selection

Table 1 provides an overview of the practices used in recruitment and employee selection within the context of digital transformation. It considers various ways digital tools and technologies are applied in the recruitment process. The practices are organised according to their overall ranking, with the average values and mode displayed to reflect the preferences of the respondents.

Table 1. Recruitment and Employee Selection in the Context of Digital Transformation

Rank	Practice Name	Average Value	Mode
1	Use of social media for candidate search	2.94	4
2	Employer branding	2.83	3
3	Use of visual elements to attract candidates	2.61	2
4	Referral programs	2.59	4
5	Interviews conducted via online platforms	2.54	2
6	Automated CV screening	1.76	1
7	Use of innovative technologies with AI elements	1.74	1
8	Use of gamification elements	1.51	1
9	Recording online interviews	1.33	1

Source: Own processing, 2024

The table shows that the most used practice is the use of social media for candidate search, which received the highest average rating. This is followed by employer branding, which is considered an important tool for attracting candidates. Other practices, such as the use of visual elements and referral programs, also rank highly. In contrast, practices like automated CV screening, the use of innovative technologies with AI elements, gamification, and recording online interviews are less frequently utilised by the respondents.

Employee Onboarding

Table 2 provides an overview of the practices used in employee onboarding within the context of digital transformation. It focuses on different approaches to utilising digital technologies and tools during the employee onboarding process. The practices are ranked in order, and the average values along with the mode give an overview of the respondents' preferences in these processes.

Table 2. Employee Onboarding in the Context of Digital Transformation

Rank	Practice Name	Average Value	Mode
1	Online introductory training	2.48	2
2	Individual and team introduction of the new employee online	2.37	1
3	Presentation of company videos online	2.31	2
4	Use of innovative technologies with AI elements	1.63	1
5	Use of gamification elements	1.50	1
6	Virtual workplace tour	1.47	1

Source: Own processing, 2024

The table shows that the most used practice in employee onboarding is online introductory training, which received the highest average rating. This is followed by the individual and team introduction of the new employee online, an important tool for integrating new employees into the company culture. Other practices,

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such as the presentation of company videos online, also rank highly. In contrast, practices like the use of innovative technologies with AI elements, gamification, and virtual workplace tours are less frequently utilised by the respondents.

Employee Training and Development

Table 3 provides an overview of the practices used in employee training and development within the context of digital transformation. It considers various ways digital tools and technologies are applied in the process of employee training and development. The practices are ranked according to their overall position, with average values and modes reflecting the respondents' preferences in these processes.

Table 3. Employee Training and Development in the Context of Digital Transformation

Rank	Practice Name	Average Value	Mode
1	Reskilling and upskilling employees	2.97	3
2	Supporting continuous employee education	2.89	3
3	Online training sessions	2.89	3
4	Personalised employee learning	2.82	3
5	Providing coaching	2.32	2
6	Providing mentoring programs	2.26	2
7	Using digital technologies for talent management	2.11	1
8	Using innovative technologies with AI elements	1.61	1
9	Using gamification elements	1.59	1

Source: Own processing, 2024

The table shows that the most used practices in employee training and development are reskilling and upskilling employees, supporting continuous education, and online training sessions. These practices received the highest average ratings and are considered key for ensuring employee growth in the context of digital transformation. Other highly ranked practices include personalised employee learning, coaching, and mentoring programs. In contrast, practices such as the use of digital technologies for talent management, innovative technologies with AI elements, and gamification are less frequently utilised.

Employee Evaluation and Compensation

Table 4 provides an overview of the practices used in employee evaluation and compensation within the context of digital transformation. It examines various approaches to implementing digital tools and technologies in employee evaluation and compensation processes. The practices are ranked according to their overall position, with average values and modes reflecting the respondents' preferences in these processes.

Table 4. Employee Evaluation and Compensation in the Context of Digital Transformation

Rank	Practice Name	Average Value	Mode
1	Performance-based employee compensation	2.91	3
2	Providing immediate feedback during the evaluation	2.75	3
3	Differentiated (personalised) compensation	2.68	2
4	Employee participation in the total compensation structure	2.40	2
5	Online monitoring mechanisms for performance tracking	2.13	1
6	Use of innovative technologies with AI elements	1.55	1

Source: Own processing, 2024

The table shows that the most used practices in employee evaluation and compensation are performance-based compensation and providing immediate feedback during evaluation. These practices received the highest average ratings and are considered key to employee motivation. Other practices include personalised (differentiated) compensation and employee participation in the overall compensation structure. Less frequently used practices are online monitoring mechanisms for performance tracking and the use of innovative technologies with AI elements.

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In addition to identifying the most used practices in various HR processes, respondents also provided feedback on the effectiveness of these processes. The results of these evaluations are shown in Figure 1.

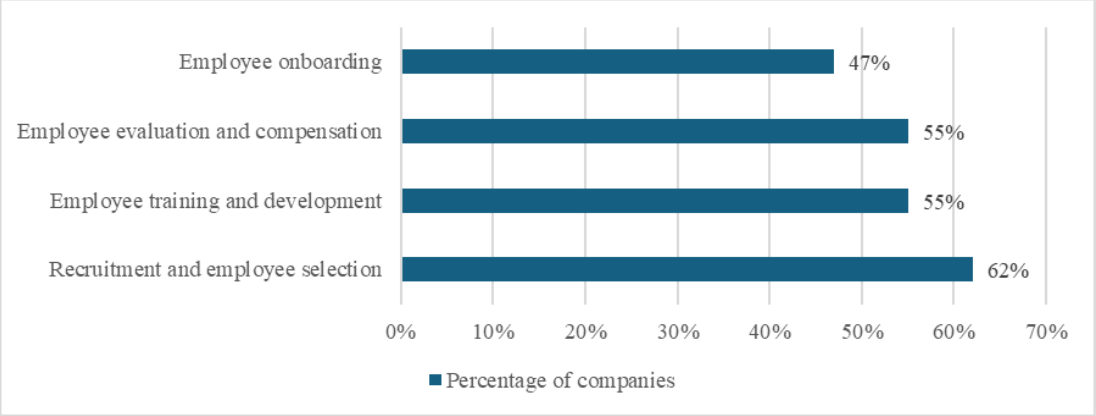


Figure 1. Measuring the Effectiveness of HR Functions Performance

Source: Own processing, 2024

The results indicate that the greatest focus was placed on measuring the effectiveness of recruitment and employee selection, followed by employee training and development, as well as employee evaluation and compensation processes. In contrast, the measurement of effectiveness in employee onboarding is less frequently conducted. These findings reflect the varying priorities of organisations in optimising their HR processes.

5. Discussion

Various international surveys in recent years have focused on the digitalisation of HR management processes and their impact on the effectiveness and sustainable development of organisations. In addition to research conducted in Slovakia (Staffenova et al., 2024), studies in countries such as Germany, Russia, and Bangladesh have shown that the digitalisation of HR processes, especially in areas such as employee evaluation and development, plays a critical role in increasing productivity and competitiveness.

A survey focusing on German businesses (Chugunova & Danilov, 2023) reveals that most surveyed companies have already digitalised their core HR processes and store data digitally, which is a prerequisite for implementing advanced technologies. Respondents positively assessed the benefits of digital tools in HR management, particularly in terms of increased speed, efficiency, and the facilitation of talent acquisition. These technologies also contribute to sustainability, for example, by reducing paper consumption and improving the transparency of decision-making processes, which can decrease an organisation's ecological footprint. The main barriers include the lack of HR professionals with IT skills, high costs, and concerns about employee monitoring. Despite these challenges, there is strong optimism that companies will continue to expand the use of digital tools in HR, provided barriers to adoption are removed.

A similar study was conducted in Russia (Fedorova et al., 2019), where it was found that digitalisation of HR processes enables the elimination of routine tasks, reduces the risk of human error, and frees up HR professionals' time to focus on more strategic issues, thereby increasing effectiveness in addressing business challenges. In large Russian organisations, digital technologies are actively used to build HR branding, though information about employers is mainly obtained through social networks and personal recommendations rather than through digital applications and career websites. Digitalisation of work also has a positive impact on employee motivation, supporting their efforts to improve performance and gain professional recognition. In the context of sustainable development, digitalisation can promote inclusivity and equality of opportunity within organisations, contributing to the creation of a fairer work environment.

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An interesting survey from Bangladesh (Haque & Nishat, 2022) highlights that digitalised HRM practices, such as e-compensation management and e-career management, have a positive impact on employee performance beyond basic job duties. On the other hand, e-performance evaluation had a significant positive effect on fulfilling core job tasks. Other digitalised practices, such as e-recruitment, e-training, and e-communication, did not show a significant impact on employee performance. These findings suggest that the implementation of selected digitalised HRM practices can contribute to improving the overall performance of employees and organisations while also supporting sustainable and responsible approaches to HR management.

6. Conclusions

The findings of this article provide a detailed view of the current state of digital transformation in HR management processes in Slovak organisations. Respondents, primarily HR department representatives, show significant interest in the implementation of digital tools and technologies. In the analysis of individual HR practices, technologies are most frequently used in recruitment and selection, where tools such as the use of social media and employer branding are preferred. On the other hand, advanced technologies like automated CV screening or the use of AI elements are less widespread among respondents, which may indicate still-existing barriers to the adoption of these tools.

In the area of employee adaptation, online onboarding training and online employee introductions dominate, suggesting a positive trend in the implementation of digital solutions in this process. A similar trend is observed around employee education and development, where practices such as reskilling and online training are most preferred. These results highlight a growing interest in continuous employee education, which is crucial for adapting to the digital environment. This aspect is inseparable from sustainable development because organisations that invest in their employees' development contribute not only to the long-term sustainability of their businesses but also to the broader economic and social environment.

Digitalising education not only enables flexibility and more efficient processes but also provides access to real-time learning, thus reducing the need for physical training sessions, which leads to lower resource consumption and a reduced environmental footprint.

In the field of employee evaluation and remuneration, the most used practices are performance-based compensation and providing immediate feedback, reflecting the need for quick responses and motivation in the digital age. Based on the results of this study, it can be concluded that Slovak organisations are at various stages of digital transformation in their HR processes, with most respondents being at the operational level of technology use or the level of strategic alignment.

Progress in adopting digital tools is evident, but there are still areas where further improvements are needed, particularly in the adoption of advanced technologies such as AI or automation. It is expected that, in the future, when barriers such as the lack of expertise or high costs are overcome, organisations will continue to expand their digital transformation efforts, contributing to higher efficiency and competitiveness in the market.

The research provides new insights into the state of digital transformation in Slovak enterprises, focusing on specific companies selected based on predefined criteria. The findings reveal that digital technologies are most widely adopted in HR practices, such as recruitment, onboarding, and employee training, while the implementation of advanced tools like AI and automation remains limited. These insights serve as a foundation for future research and practical recommendations for Slovak businesses aiming to enhance their digital strategies.

However, certain limitations must be acknowledged. Since the study is based on data collected from a selected group of Slovak enterprises, the findings may not be fully representative of all organisations in the country. Additionally, the reliance on self-reported data carries the risk of subjective responses, as participants may interpret questions differently or provide answers influenced by personal perceptions. Despite these constraints,

the results offer a valuable perspective on the current trends and challenges of digital transformation in HR practices within Slovak companies.

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THE IMPACT OF OIL PRICE VOLATILITY ON FINANCIAL PERFORMANCE OF SAUDI FIRMS

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Abstract. The research examines the effects of oil price volatility on the financial performance of oil corporations and focuses on financial metrics: Return on Assets (ROA), Net Profit Margin (NPM), and Gross Profit Margin (GPM). This work employs a panel data regression analysis from 2016 to 2023 to examine the effect of oil price fluctuations on these indicators during the pre-pandemic, pandemic, and post-pandemic phases. The research furthermore examines the impact of fluctuations in oil prices on firms within the oil and various non-oil industries. The initial research indicates a positive correlation between the increases in oil prices and the enhancements in ROA, NPM, and GPM. The declines in oil prices are inversely correlated with these numbers, especially in the short term. The pandemic period exposed peculiarities due to fluctuations in oil demand and prices, which impacted the overall financial status of enterprises throughout their respective sectors and demonstrated the efficacy of risk management methods. Firms in the oil sector demonstrated greater fluctuations in performance compared to those in other industries, attributable to changes in oil prices. The document identifies risk management issues, emphasizes optimal hedging and cost control practices, and highlights the significance of adapting to environmental and geopolitical changes for enterprises. These insights are beneficial for corporations and policymakers, as they emphasize the necessity of implementing sound financial management techniques to plan for swings in oil prices and broader economic shocks.

Keywords: financial performance; oil price; pandemic impact; volatility

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JEL Classifications: F65, G2, M41

1. Introduction

Fluctuations in oil prices significantly impact both global and national economies, particularly in oil-dependent nations like Saudi Arabia, a prominent oil exporter, whose financial performance is inherently connected to global oil price trends (Elneel & AlMulhim, 2022). Price fluctuations can impact the financial stability of corporations, government income, and the overall economic landscape (Guo et al., 2024). This study aims to analyze the impacts of price fluctuations on Saudi businesses' financial activities by evaluating the 114 highest enterprises based on their market capitalization within the Saudi exchange (Tadawul). It also seeks to explore how COVID-19 has changed the effect of oil price volatility on corporate performance and whether oil-dependent firms are more affected by these fluctuations than diversified firms. Oil has also been the pillar of the economy of Saudi Arabia, responsible for the salient portion of its GDP and governmental income (Alley et al., 2014).

Fluctuations in oil prices can cause drastic fluctuations in the financial indicators of all firms in the industry, especially in oil-exporting countries (Moshiri, 2015). The impacts may vary according to a firm's exposure to

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the oil market, diversification strategy, and ability to respond to changing economic circumstances. A decline in oil prices typically leads to lower revenues, reduced profitability, and an increased risk of financial distress (Shu et al., 2018). Firms with divergent investments are less likely to be affected by oil price shocks, as their revenues stream is not fully dependent on oil prices (Chen et al., 2017). The objective of this study is to explore these questions by analyzing the performance of these two types of businesses and how they respond to changes in global oil prices. The country's reliance on oil makes its financial market and businesses highly vulnerable to fluctuations in oil prices. High oil prices lead to increased government revenues for Saudi Arabia, which in turn boosts public sector spending and investment. However, in periods of falling oil prices, the economy suffers from budget deficits, reduced public spending and slowed growth (Shu et al., 2018).

Scholars have also studied the link between oil price fluctuations and financial performance in several contexts. Shu et al. (2018) studied the responsiveness of stock markets of Saudi Arabia and other oil-exporting countries in response to changes in oil prices. Their analysis reveals an inverse relation between changes in oil prices and stock-market performance in those economies. Cashin et al. (2016) used a Global Vector Auto-Regressive (GVAR) approach to demonstrate how fluctuations in oil prices affected the MENA region, with specificity for Saudi Arabia , given its reliance on oil exports. These studies underscore the sensitivity of oil-exporting economies like Saudi Arabia as they make it blameless to fluctuations in global oil prices.

Changes in oil prices also have direct impacts on enterprises and have an indirect influence on enterprises, from the adjustment of operational costs, production costs, and enterprise stability (Guo et al., 2024). In Saudi Arabia, many enterprises are dependent on oil; hence, changes in oil prices may affect oil-related as well as other sectors of the economy (Jawadi & Ftiti, 2019). For example, increased oil prices will lead to higher profitability for firms operating in the energy sector while simultaneously benefiting non-oil firms as the entire economy expands (Elneel & AlMulhim, 2022). However, in the face of dropping oil prices, firms face higher production costs, lower demand for oil products, and potential technical challenges (Kilian et al., 2009). This dynamic creates an environment where financial performances are interlocked with oil price volatility.

It led to an added layer of difficulty to the association between oil prices and business performance, complicating the relationship during the COVID-19 pandemic. Lockdowns, travel restrictions, and significantly weakened global demand led to unprecedented drops in oil prices in 2020, including a dramatic slide into negative territory for West Texas Intermediate (WTI) crude oil in April 2020 (Gharib et al., 2021). The price collapse was exacerbated by geopolitical tensions, notably the failure of discussions between Russia and OPEC. The pandemic disrupted global supply lines and resulted in a substantial decline in oil consumption, particularly affecting oil-exporting economies such as Saudi Arabia. These interruptions resulted in significant economic and financial consequences for both the public and commercial sectors (Yu et al., 2022). Nonetheless, the pandemic underscored the resilience of certain firms, especially those that had diversified their activities beyond reliance on oil.

As a significant oil exporter, Saudi Arabia and its firms' financial success is closely linked to fluctuations in international oil prices (Khamis et al., 2018). Nonetheless, the ways through which these movements affect business financial consequences and how these linkages may evolve due to recent global disruptions such as COVID-19 remain inadequately studied. While fluctuating prices have been linked to economic variations, the effect on Saudi firms remains an ambiguous subject of investigation, particularly prior to and during the coronavirus pandemic. Moreover, the effects of these volatility changes on mutually exclusive portfolios of oil-dependent and diverse enterprises have not been thoroughly analyzed, creating another substantial study gap. This study contributes to knowledge by identifying the risks facing Saudi firms owing to prospective fluctuations in global oil prices and the strategies they might implement to mitigate these risks. The study's recommendations are beneficial for investors seeking to assess the susceptibility of Saudi enterprises to volatile oil prices.

Current research seeks to substantially enhance the literature about deviations in oil prices and financial performance, particularly for Saudi Arabia. This study will enhance comprehension of the effects of oil price fluctuations on various firm types in Saudi Arabia by solving existing research gaps. The study encompasses the following objectives:

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1. To examine the impact of global oil price fluctuations on the financial performance of the top 114 corporations ranked by market capitalization on the Saudi stock market.
2. To examine the fluctuations in the impact of oil price volatility on the firm's performance before and after the COVID-19 pandemic.
3. To analyze the effects of fluctuations in oil prices on oil-dependent vs diversified firms.

2. Literature Review

Over time, the oil industry has played a noteworthy role in the global financial boom. Scholars have been drawn to explore the implications of oil prices since they represent the most critical risk variables influencing alterations in a nation's economic framework (Gharib et al., 2021; Almasria et al., 2024). A multitude of studies have investigated the factors associated with oil charge fluctuations, which significantly influence macroeconomic indicators such as GDP growth rate, investment, stock market trends, and inflation, among others (Shu et al., 2018). The capital asset pricing model helps this phenomenon by proving a high-quality connection by establishing a robust correlation between risk, oil fluctuations, and impacts inside the financial system (Shu et al., 2018). Volatile oil prices, particularly during economic concerns, impact the firm's financial performance. Narayan and Narayan (2007) conducted an empirical investigation of the impact of oil price fluctuations on enterprises within the oil-dependent industry. It was determined that fluctuations in oil prices significantly impact firm profitability, as measured by Return on Assets (ROA) and Net Profit Margin (NPM), due to elevated and unpredictable operational costs. Zainal Abidin and Haseeb (2018) examined the adverse relationship between fluctuations and stock market returns using leveraged regression methods to illustrate the correlation.

Fluctuations in oil prices significantly affect enterprises, especially in oil-dependent countries, such as Saudi Arabia, due to their influence on production costs, operational expenses, and overall stability (Shu et al., 2018; Elneel & AlMulhim, 2022). Lee and Chang (2015) established that oil price shocks significantly impact oil-exporting nations' financial stability and profitability. In Saudi Arabia, where dependency on oil revenue is significant, fluctuations in its price affect corporate profitability. Nonetheless, volatility can generate risks that affect the overall economic landscape and market circumstances, particularly impacting enterprises in non-oil sectors (Lee & Chang, 2015). The oil-dependent economies are susceptible to external influences that impact price volatility, resulting in an uncertain business environment. Consequently, reducing dependence on oil was one of the most significant objectives of Saudi Arabia's Vision 2030.

A multitude of experts have investigated the intricate relationship between oil prices and the diverse economic factors influencing corporate operations. Ghalayini (2011) demonstrates that fluctuations in oil prices substantially impact a nation's GDP. The study's findings indicated non-linear and threshold effects of oil price fluctuations on economic growth (Elneel & AlMulhim, 2022). An increase in oil prices temporarily enhances a firm's profitability; nevertheless, the volatility of oil prices might diminish long-term profitability due to elevated operating expenses and risks. Firms reliant on oil are adversely affected by fluctuations in oil prices. Alaali (2020) suggested in his study that implementing risk management measures to mitigate or hedge against pricing risks can prevent these consequences.

The worldwide monetary disruption caused by the COVID-19 pandemic is the primary factor behind the severe impacts on oil prices and markets. Su et al. (2021) observed that the pandemic increased unemployment, a decline in stock market prices, and a significant decrease in oil prices. The volatility induced by the pandemic presented substantial challenges for policymakers and investors worldwide, impacting oil-exporting nations (Narayan, 2020; Yu et al., 2022). Yarovaya et al. (2021) have examined the relationship between oil price fluctuations and financial performance amidst the COVID-19 pandemic, focusing on the effects of market volatility on equity funds and the overall economic environment. They found a strong correlation suggesting that oil price volatility impacts macroeconomic performance through changes in production costs and subsequent consumer behaviour (Narayan, 2020).

Patel et al. (2021) highlighted the need for innovative approaches to protect vital sectors of the economy that depend on oil. COVID-19 reduced oil prices to historic lows in the oil markets. Producers had to pay buyers to

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take excess oil, turning crude oil prices negative on April 21, 2020, leading to negative crude oil prices (Gharib et al., 2021). Ma et al. The collapse in negotiations between Russia and OPEC regarding the reduction of daily oil production is, indeed, an unusual and exceptional event (2021). In addition, as the pandemic caused a decline in oil consumption and its derivatives, the oil and petroleum products export-dependent Saudi economy was also affected by this business decline. On the contrary, the implications of COVID-19 highlighted the importance of corporate resilience, especially in the countries exporting oil, to adapt to unanticipated situations that might lead to economic turmoil. A study conducted by Yu, Guo and Chang (2022) showed that the pandemic increased oil price volatility and, therefore, increased financial pressure on corporations, especially those in the energy sector. Their study showed how firms with high operating risk associated with oil price uncertainty experienced serious erosion in financial performance, particularly in profitability (Yu et al., 2022). This was particularly evident in enterprises located in Saudi Arabia, as the nation depended significantly on oil sales, hence exacerbating the financial repercussions of the pandemic.

Although considerable research has examined the effects of oil price volatility on corporate performance in Saudi Arabia, several significant areas and elements remain unexplored (Shu et al. 2018; Narayan, 2020). A limited number of studies have investigated the correlation between oil price volatility and financial performance, while the bulk have focused on the relationship between oil prices and stock markets. One main reason for this is that most of the early studies did not differentiate between oil-dependent and diversified firms when discussing oil price volatility (Shu et al., 2018). Therefore, there is a great need for extensive research to study the financial performance of all firms that are affected by oil price fluctuations.

The literature review discussed this point in detail, and as a conclusion, let us summarize it by saying that higher oil prices may benefit oil-producing parties, but the volatility of oil prices constitutes major risks. The cash flow strains could increase during uncertain events such as COVID-19, subsequently affecting revenue outlooks further. Corporate financial performance is moderated by government budgeting and fiscal measures concerning oil price volatility. Recent literature suggests that economic diversity protects for the detrimental effects of oil price variation on financial performance. Thus, the dip in oil prices harms oil production firms, while the rise benefits them in the short term. However, for long-term financial stability, firms need to implement effective risk management and business diversification to maintain consistent financial stability.

3. Methodology

The current study investigates the financial performance of 114 leading business entities listed on the Saudi Stock Exchange (Tadawul) ranked by their market capitalization. Data as of 2016-2023 is used to evaluate financial performance across several years of different business and economic conditions, including the COVID-19 crisis. This study's secondary data is collected from several websites including the Tadawul Website, IMF, SAMA, EIA, and World Bank.

3.1 Variables

A comprehensive set of variables was utilized to assess the impact of oil price deviations on Saudi Arabian firms. These variables provide a broader overview of the economy — both in terms of the macroeconomic variables as well as the variables pertaining to specific segments of the economy. Table 1 provides a general overview of each variable.

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Table 1. Description of Variables

Variable Names	Description
ROA	Profitability is assessed in relation to total assets in the dependent variable.
NPM	The dependent variable denotes the proportion of revenue that is converted into profit.
GPM (Gross Profit Margin)	The dependent variable represents the proportion of revenue that exceeds the cost of products sold.
OP (Oil Prices)	The crude oil price during the study years is represented by the independent variable.
Volatility	The independent variable captures the fluctuations in crude oil prices over time.
DV1 (Pre-, Post- or Pandemic Period)	The dummy variable represents the three COVID phases: Pre-, During, and Post-COVID.
DV2 (Sector Type)	The dummy variable represents whether the firm is in the oil sector (1) or non-oil sector (0).
OP × DV1	The interaction term quantifies the impact of fluctuations in oil prices across various stages of the COVID-19 pandemic.
OP × DV2	The interaction term quantifies the impact of oil price fluctuations on sectors (oil-reliant versus non-oil).

Current research includes “ROA”, “NPM”, and “GPM”, which are important measures to determine the financial performance of Saudi Arabian firms. These variables were chosen to reflect various dimensions of a firm’s profitability and productivity, which are susceptible to changes in oil prices, particularly in Saudi Arabia, which is an oil-exporting country.

ROA signifies how asset-efficiently a firm generates profit. ROA illustrates how effectively the firm uses its asset base to drive earnings. Previously, research has shown drastic changes in oil prices affecting ROA in oil-exporting countries. Ali and Shaik (2022) state that the fluctuations in ROA are relatively high in the case of firms within the Saudi oil sector, indicating how much oil price changes affect firms' profitability.

An essential financial performance measure is the Net Profit Margin (NPM), which shows relatively how much profit from sales remains after subtracting all costs. Filis (2010) elaborated on how oil price shocks can influence operating profit margins to leave high and fluctuating rates for those firms which are dependent on oil. The knowledge and understanding of how much sales change due to oil price changes affect the firms' viability, be they oil or non-oil firms in Saudi Arabia, is gained from NPM.

GPM is an important ratio that indicates, in general, the profitability of a firm and how efficiently it earns gross profit from its sales. GPM would develop valuable conclusions as to how price changes in oil can be reflected in the cost structure of production in firms. As Papapetrou (2001) states, the price of oil is a key factor that impacts the gross margin ratio of firms in oil-dependent economies, as it determines the production costs for many firms in such economies.

The current research is basically about annual average prices of "West Texas Intermediate (WTI)," considered as a global rustic structure for oil pricing. That's why changes in oil prices will reflect naturally on revenues, costs, and profits of firms, especially those falling within the oil industry itself. For a wholesome perspective regarding Saudi Arabia's economy, viewing WTI price as an independent variable is needed to understand how global oil price changes would critically affect firms in this economy. Former studies like Kilian (2009) and Ali and Shaik (2022) have arrived at similar conclusions about oil prices directly affecting firm performance, especially in oil-dependent economies. The trend of oil prices from 2016 to 2023 is illustrated in Figure 1 below. The fluctuations in oil prices across this period reflect key economic and geopolitical events.

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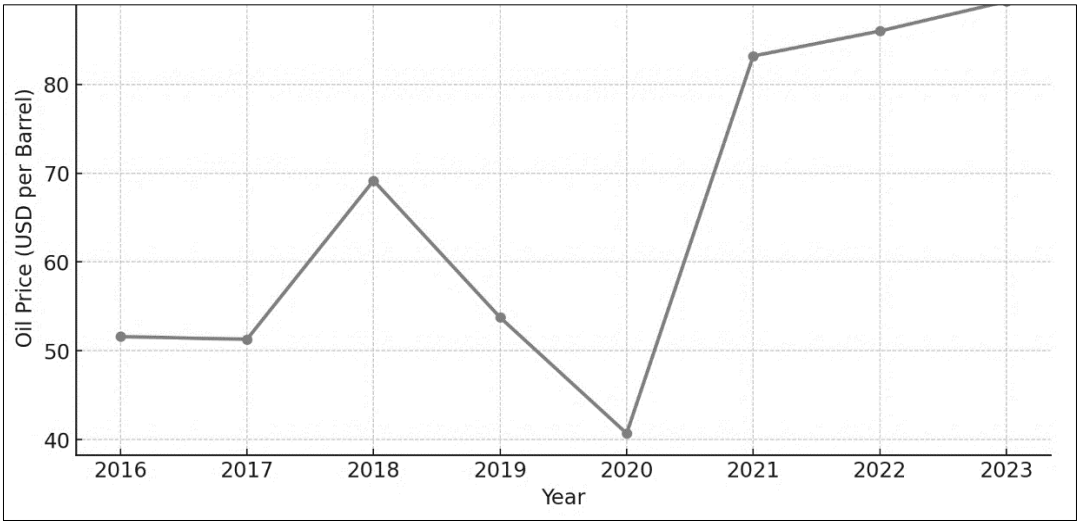


Figure 1. Trend of Oil Prices from 2016 to 2023

The examination also introduces COVID-19 period dummy variable (DV1) for the assessment of a pandemic like COVID-19 towards financial performance. This variable is categorized into three stages: Pre-COVID, During COVID, and Post-COVID. The utmost importance is attached to the inclusion of this dummy variable in order to assess the impact that COVID-19 had on the oil market since it redefined oil prices as it came about by suddenly collapsing in demand and supply. Sheng et al. (2023) discussed the significance of inflation and financial distress during times of cataclysm, such as in the case of the COVID-19 pandemic, in relation to financial markets, oil, and other such sectors. It becomes necessary to include this variable as it allows the last assessment to be more sophisticated in terms of the various stages of the pandemic reflections phase-by-phase, as shown in the title of this study.

A dummy variable is used to differentiate firms based on their sector for sector-specific oil price analysis such that '0' represents the oil industry and '1' identifies the non-oil sector. The oil industry's revenue and profits are closely tied to oil prices, making it more vulnerable to price fluctuations. These price changes have asymmetric impacts on oil and non-oil sectors, indicated by the research conducted by Hamilton (2009), whereby oil-sensitive firms are more reactive relative to these changes.

The term, which comes from the multiplication of OPit by DV1, assesses the impact during the COVID-19 period. It assesses whether fluctuations in oil price volatility have had more or less impact on different phases of the pandemic on firm's financial performance. To illustrate, it is likely that oil price reduction in early COVID-19 hits oil-dependent firms more than those in the non-oil sector. Conversely, during the post-COVID period, rising oil prices would probably have a lesser effect on the oil sector due to uncertainty in the economy. This term captures the phenomena of the pandemic and oil prices together, making the economy more complex during the period under investigation. The research by Filis (2010) and Kilian (2009) states that the synergy between oil price shocks and industries is important for understanding their compounded effects through the pandemic and the volatility of oil prices.

The other interaction term, Oil Prices × DV2, assesses the impact of oil price fluctuations on firms in oil and non-oil industries differently. This term helps determine whether oil price variation has a relatively clearer effect on oil sector firms than on others, where effects could be more ambiguous. The literature usually states that revenue generally increases in oil firms when prices rise; for non-oil firms, revenues may decline because of higher production costs or demand for their products or services, as cited by other studies earlier.

The last volatile element is the volatility of oil prices, which is a key factor in determining market risk and uncertainty. Through oil price volatility, instability in the oil markets eventually leads to the financial instability of the organization. As studied by Chen et al. (2017), oil price volatilities impact firm financial resilience, which

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finds that increased volatility escalates financial risk, especially relevant to oil-dependent economies like Saudi Arabia.

3.2 Pre- Diagnostic test

This is the first step used to test the panel data and determine whether they are stationary or non-stationary with unit roots. Fisher's unit root test is often employed for its ability to assess the variability within panel data. Unlike other tests that assume each panel has a single unit root, the Fisher test acknowledges that each panel may have distinct characteristics. This test incorporates the Augmented Dickey-Fuller (ADF) test. The null hypothesis of the Fisher test assumes that each panel has a unit root, implying non-stationarity. If the probability value is less than 0.05, the test rejects the null hypothesis (H0), indicating that the panel data is stationary (Maddala & Wu, 1999).

This study utilizes correlation analysis and the Variance Inflation Factor (VIF) to identify and address multicollinearity, which occurs when two or more predictors are highly correlated in a regression model. Extreme multicollinearity can obscure the ability to assess the impact of individual independent variables in the model. Typically, a VIF value greater than 10 suggests significant multicollinearity, meaning that certain variables may need to be removed or the model adjusted. VIF values range from one to higher values, with values above five indicating substantial multicollinearity. If the VIF exceeds 10, corrective measures should be taken to ensure the regression results remain meaningful (O'Brien, 2007; Kennedy, 2008).

$$VIF = \frac{1}{1 - R_i^2}$$

3.3 Research Design

The research uses random effects regression models to analyze the fluctuations in oil prices and their impact on Saudi Arabian firms. The study utilizes panel data from 2016 to 2023, focusing on the 114 largest firms listed on the Saudi Stock Exchange, Tadawul. Two models, consisting of three equations, represent different dimensions of financial performance: "ROA," "NPM," and "GPM." The first regression model assesses the effect of oil price volatility on the financial growth of these firms during the pre-COVID and post-COVID periods, particularly within the context of the pandemic. The second model explores the impact of the oil and non-oil sectors on firms' financial performance, providing a detailed view of how the pandemic influenced firms in both sectors. Both models incorporate random effects to capture unobserved heterogeneity among the firms, facilitating a thorough investigation of how deviations in oil prices impact the financial behaviour of firms across various sectors and time periods.

The following hypotheses have been formulated to examine the impact of oil price fluctuations on the financial stability of major firms in Saudi Arabia:
H1: Oil price fluctuations significantly affect the financial performance of leading firms in Saudi Arabia.
H2: The impact of oil price fluctuations on financial performance varies significantly between the pre-COVID, COVID-19, and post-COVID-19 periods.
H3: The effect of oil price fluctuations on financial performance differs significantly between oil-dependent and diversified firms.

3.4 Regression Model

The analysis utilizes a random effects regression model to evaluate the impact of oil price fluctuations on the performance of Saudi Arabian firms. Annual data spanning from 2016 to 2023 for 114 firms listed on the Saudi Stock Exchange is used to explore the directional and proportional effects on key financial metrics. The random effects model is well-suited for panel data analysis as it captures both the cross-sectional and temporal elements of the data while addressing unobserved variation among individual firms (Baltagi, 2008).

The model assumes that individual effects are stochastic and uncorrelated with the explanatory variables, which is critical when examining multiple firms across a series of years in a panel dataset (Wooldridge, 2010). This

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approach is advantageous because it leverages both intra-firm and inter-firm variation to generate more reliable estimates. This framework is particularly valuable as it enables the researcher to control for unobservable firm-specific characteristics, such as management quality or corporate governance, that could influence financial performance. It is especially useful when assessing the financial outcomes of firms in the oil and non-oil sectors. By using the random effects model, this study provides a comprehensive analysis of the relationship between oil price volatility and financial performance, offering insight into how fluctuations in oil prices impact Saudi firms that are either dependent on or independent of oil.
The general equation for the random effects model in this study is as follows:

$$Y_{it} = \alpha_{\circ} + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \mu_i + \varepsilon_{it}$$

Where:
• Y_{it} represents the financial performance indicators (ROA, NPM, or GPM) of the firm.
• X_1, X_2, X_3, X_4 represents the independent variables.
• μ_i is the unobserved random effect (firm-specific component),
• ε_{it} is the error term.

4. Results and Discussion

The descriptive statistics provide a summarized overview of the dataset, focusing on variables such as ROA, GPM, NPM, Volatility, and OP. The average ROA is 2%, with a standard deviation of 0.07, indicating moderate variation across firms. The ROA ranges from -14% to 14%, showing a broad spectrum of performance. GPM has an average of 19.8% but a wide standard deviation of 21.98%, indicating significant variability in profitability, with some firms showing losses while others achieve up to 65.5% profitability. Similarly, Net Profit Margin (NPM) averages 4.5%, with a range from -52.8% to 44.2%, revealing substantial differences in profitability. Volatility averages 27.02%, with values ranging from 12.6% to 45.8%, reflecting notable fluctuations in performance. Operating Profit (OP) has an average of 232.17 units, with a standard deviation of 64.41, indicating significant variation, ranging from 147.41 to 354.12 units (see Table 2). Overall, the dataset highlights considerable disparities in financial performance, with notable variability in profitability, volatility, and operating profits among the firms.

Table 2. Results of Descriptive Statistics

Variable	Obs.	Mean	Std. Dev.	Min	Max
ROA	919	0.02	0.07	-0.14	0.14
GPM	864	19.77	21.98	-24.49	65.52
NPM	912	4.47	21.83	-52.81	44.17
Volatility	920	27.02	10.88	12.63	45.76
OP	920	232.17	64.41	147.41	354.12

The unit root test results show that the data is stationary, as the p-value is below 5%, leading to the rejection of the null hypothesis. The full results of the unit root test are presented in Table 3.

Table 3. Unit Root Results

Variables	z-statistic	p-value
ROA	-6.2007	0.000*
NPM	-5.3142	0.000*
GPM	-4.3506	0.000*
OP	-8.18	0.000*
Volatility	-11.17	0.000*

Note: * indicate the level of significance at a 5% confidence interval.

The correlation matrix shows the interrelationships among the financial variables, including "ROA," "NPM," "GPM," and "Oil Price." The correlation between ROA and GPM is moderate (0.5008), suggesting that firms with higher GPM tend to have better asset utilization. The correlation between ROA and NPM is stronger (0.7519), implying that firms with efficient asset utilization also exhibit higher net profit margins. The

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correlation between ROA and Volatility (0.0772) is weakly positive, suggesting a slight increase in volatility as asset returns rise, though the relationship is marginal. The correlation between ROA and OP is weakly negative (-0.0568), indicating a very slight inverse relationship. GPM and NPM are strongly positively correlated (0.6753), implying that higher gross margins tend to coincide with better net margins. The correlation between Volatility and OP is moderate (0.3248), indicating a positive relationship (see Table 4). Overall, these correlations suggest moderate to weak associations among the variables, with no significant concerns regarding multicollinearity.

Table 4. Correlation Matrix

Correlation Matrix	ROA	GPM	NPM	Volatility	OP
ROA	1				
GPM	0.5008*	1			
NPM	0.7519*	0.6753*	1		
Volatility	0.0772*	-0.0562	-0.06*	1	
OP	-0.0568	0.0141	-0.024	0.3248*	1

A VIF of 1 indicates minimal multicollinearity, and values between 1 and 5 are generally acceptable, while values exceeding 5 or 10 may indicate potential multicollinearity, especially if the VIF surpasses 10 (O'Brien, 2007). The lack of strong correlations among the independent variables is favourable for the stability and reliability of the model. The mean VIF of 1.48 suggests that the model is appropriately specified, and multicollinearity is not a significant issue (see Table 5).

Table 5. VIF and VIF of 1

Variable	VIF	1/VIF
NPM	1.84	0.542149
GPM	1.84	0.542545
Volatility	1.12	0.89288
OP	1.12	0.895272
Mean VIF	1.48	

In 1978, Hausman developed the Hausman specification test to distinguish between panel data models that use fixed effects and those using random effects. This test assumes there are no substantial differences between the estimators of the fixed and random-effect models. The formula for the Hausman test statistics is as follows:

$$H = (\beta_{RE} - \beta_{FE}) \sum -1 \ (\beta_{RE} - \beta_{FE}) \sim \chi^{2\,(k)}$$

The following hypotheses for this test are presented below:
H0: *The Random effect model is appropriate.*

$$Cov\ (\mu_i, x_{it}) = 0$$

H1: *The Fixed effect model is appropriate.*

$$Cov\ (\mu_i, x_{it}) \neq 0$$

H0 is rejected if the p-value is less than 0.05; otherwise, it is accepted. The random effect model is appropriate in our situation, as the "p-value" is plainly greater than 0.05, indicating that H0 is accepted.

4.1 Models

In the Random Effects model, financial performance is assessed using the dependent variables “ROA,” “NPM,” and “GPM.” The independent variables include oil price, volatility, a dummy variable (DV1) indicating the pre-pandemic, during, or post-pandemic period, a dummy variable (DV2) distinguishing between the oil and non-oil sectors, and the interaction term between oil prices and the dummy variables. A random effects regression model is applied to the panel dataset. Model 1 consists of three equations to analyze the impact of oil price fluctuations on corporate financial performance, using ROA, NPM, and GPM as the performance indicators.

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The subsequent equations are employed in Model 1:

$$ROA_{it} = \alpha + \beta_1 \text{OP} + \beta_2 \text{Volatility}_{it} + \beta_3 DV1_{it} + \beta_4 DV1 * OP_{it} + \mu_i + \varepsilon_{it} \ldots\ldots\ldots 1$$

$$NPM_{it} = \alpha + \beta_1 \text{OP} + \beta_2 \text{Volatility}_{it} + \beta_3 DV1_{it} + \beta_4 DV1 * OP_{it} + \mu_i + \varepsilon_{it} \ldots\ldots\ldots 2$$

$$GPM_{it} = \alpha + \beta_1 \text{OP} + \beta_2 \text{Volatility}_{it} + \beta_3 DV1_{it} + \beta_4 DV1 * OP_{it} + \mu_i + \varepsilon_{it} \ldots\ldots\ldots 3$$

The results from the random effects model equation 1, shown in Table 6 below, support Hypothesis *H1: Oil price fluctuations significantly affect the financial performance of leading firms in Saudi Arabia and* Hypothesis *H2: The impact of oil price fluctuations on financial performance varies significantly between the pre-COVID, COVID-19, and post-COVID-19 periods.* These findings align with the study by Wattanatorn and Kanchanapoom (2012), which illustrates that oil prices have a significant influence on accounting performance measures like ROA, particularly within the energy sector. The p-value of 0.001 and a coefficient of -0.0002 for oil price (OP) suggest a negative relationship between oil price and ROA. This indicates that for every unit increase in oil price, ROA decreases by 0.0002 units, highlighting the negative impact on financial performance as measured by ROA. Volatility has a coefficient of -0.0004, with a p-value of 0.023, indicating that volatility negatively affects ROA. The coefficient for the interaction term between oil price and DV1 is 0.0002, with a significant p-value of 0.00, suggesting a positive relationship between oil price fluctuations and financial performance. The model's overall significance is confirmed by a Prob>chi^2 value of 0.000.

Table 6. Random Effect Model Equation 1 Results

ROA	Coef.	Robust Std. Err.	Z	P>|z|
OP	-0.0002	0.000	-3.41	0.001***
Volatility	-0.0004	0.000	-2.27	0.023***
DV1	-0.0535	0.009	-6	0.000***
OPDV1	0.0002	0.000	5.14	0.00***
_cons	0.0756	0.014	5.6	0.00***
sigma_u	0.0471			
sigma_e	0.0458			
Rho	0.5139			
Wald chi^2	53.42			
Prob>chi^2	0.000***			

Note: *** specifies a significance level at a 1% confidence interval

The Random Effects model for equation 2 uses Net Profit Margin (NPM) as the dependent variable to assess financial performance. The independent variables include oil price, volatility, a Dummy Variable (DV1) indicating the pre-pandemic, during, or post-pandemic period, and the interaction term between oil prices and the dummy variable. The regression results for Equation 2 are presented in Table 7 below. The coefficient for oil price (OP) is -0.0421 with a p-value of 0.07, suggesting a negative relationship between oil price fluctuations and NPM, though the relationship is not statistically significant at the 5% level. Volatility, with a coefficient of -0.126 and a p-value of 0.014, is statistically significant at the 5% level, indicating that volatility negatively impacts NPM. The variable DV1 has a coefficient of -13.66 with a p-value of 0.001, indicating a significant negative effect on NPM. The interaction term OPDV1 has a coefficient of 0.0471 and a p-value of 0.003, showing a significant moderating effect and a positive impact on financial performance due to the interaction between DV1 and oil price fluctuations. The overall model's statistical significance is confirmed by a Prob>chi^2 value of 0.000.

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Table 7. Random Effect Model Equation 2 Results

NPM	Coef.	Robust Std. Err.	Z	P>|z|
OP	-0.0421	0.023	-1.81	0.07*
Volatility	-0.1260	0.051	-2.45	0.014**
DV1	-13.662	4.026	-3.39	0.001***
OPDV1	0.0471	0.016	2.93	0.003***
_cons	18.309	5.270	3.47	0.001***
sigma_u	15.480			
sigma_e	14.910			
Rho	0.518			
Wald chi^2	33.40			
Prob>chi^2	0.000***			

Note: ***, **, * indicates a significance level at a 1%, 5% and 10% confidence interval respectively

The results for equation 3 from the random effects model are shown in Table 8 below, illustrating the relationship between oil price fluctuations and the financial performance (GPM) of major Saudi Arabian firms. The coefficient for OP is -0.029 with a p-value of 0.182, suggesting that GPM decreases by 0.029 units for each unit increase in oil price. Volatility has a negative impact on GPM, with a coefficient of -0.141 and a p-value of 0.005, both statistically significant at the 5% level. DV1 negatively impacts financial performance, with a coefficient of -9.135 and a p-value of 0.016. The coefficient for the interaction term between oil price and DV1 (OPDV1) is 0.0356 with a p-value of 0.023, indicating that oil price fluctuations positively impact GPM. The constant term (cons) is significant with a p-value of 0.000, and the overall model's statistical significance is confirmed by a Prob>chi^2 value of 0.000.

Table 8. Random Effect Model Equation 3 Results

GPM	Coef.	Robust Std. Err.	Z	P>|z|
OP	-0.0295	0.0221	-1.33	0.182
Volatility	-0.14198	0.0501	-2.83	0.005***
DV1	-9.135	3.7979	-2.41	0.016**
OPDV1	0.0356	0.0157	2.27	0.023**
_cons	29.399	4.774	6.16	0.000***
sigma_u	17.761			
sigma_e	13.451			
Rho	0.6354			
Wald chi^2	17.02			
Prob>chi^2	0.000			

Note: ***,**,* indicates a significance level at a 1%, 5% and 10% confidence interval respectively

Model 2 comprises three equations to observe the impact of oil prices on financial performance. The dependent variables of the equations are ROA, NPM, and GPM, which are the performance indicators of the firms, and the independent variables are oil price, volatility, dummy variable DV2, which shows the oil and non-oil sectors, and the interaction term of OP and dummy variable. Prior studies have also elucidated that oil-reliant firms are prone to financial difficulties because of fluctuations in oil prices. For instance, Shaeri, Adaoglu, and Katircioglu (2016) explored how oil price hikes act differently for firms based on their sectors. They also found that oil-dependent firms, especially in the energy sector, are more sensitive to oil price changes, while non-oil diversified firms are less affected by these fluctuations, describing a significant difference in financial performance between the oil and non-oil sectors. This corresponds well to our hypothesis that the sensitivities of oil price fluctuations to financial performance vary dramatically across oil-dependent and diversified firms. Thus, the model viably explains the *H3: The effect of oil price fluctuations on financial performance differs significantly between oil-dependent and diversified firms.*

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The following are the equations mentioned below:

$$ROA_{it} = \alpha + \beta_1 \text{OP} + \beta_2 \text{Volatility}_{it} + \beta_3 DV2_{it} + \beta_4 DV2 * OP_{it} + \mu_i + \varepsilon_{it} \ldots\ldots\ldots 4$$

$$NPM_{it} = \alpha + \beta_1 \text{OP} + \beta_2 \text{Volatility}_{it} + \beta_3 DV2_{it} + \beta_4 DV2 * OP_{it} + \mu_i + \varepsilon_{it} \ldots\ldots\ldots 5$$

$$GPM_{it} = \alpha + \beta_1 \text{OP} + \beta_2 \text{Volatility}_{it} + \beta_3 DV1_{it} + \beta_4 DV2 * OP_{it} + \mu_i + \varepsilon_{it} \ldots\ldots\ldots 6$$

The random effects regression results reveal the relationships between the financial performance (ROA) and several explanatory variables, including oil prices (OP), volatility, and firm diversification (DV2), as well as their interaction (OPDV2). The coefficient for oil prices (OP) is -0.0002, and statistically meaningful at the 5% level (p = 0.001), representing that oil price fluctuations adversely impact ROA. Similarly, volatility has a negative coefficient of -0.0003, with a p-value of 0.023, suggesting that volatility also significantly reduces ROA. The coefficient for DV2 (firm diversification) is -0.0535, with a p-value of 0.00, showing an adverse relationship with ROA. The interaction term, OPDV2, has a positive coefficient of 0.0002, and is statistically significant (p = 0.00), suggesting that it mitigates the negative impact on ROA. The constant term (_cons) coefficient is 0.07564, with a p-value of 0.000, indicating statistical significance at the 1% level. The Prob>chi^2 is 0.000, indicating the significance of the overall model (see Table 9).

Table 9. Random Effect Model Equation 4 Results

ROA	Coef.	Robust Std. Err.	Z	P>|z|
OP	-0.0002	0.0001	-3.41	0.001***
Volatility	-0.0003	0.0002	-2.27	0.023**
DV2	-0.0535	0.0089	-6	0.000***
OPDV2	0.0001	0.0000	5.14	0.000***
_cons	0.0756	0.0135	5.6	0.000***
sigma_u	0.0471			
sigma_e	0.0458			
Rho	0.5139			
Wald-chi^2	20.03			
Prob> chi^2	0.000*8*			

Note: ***, **, * indicates a significance level at a 1%, 5% and 10% confidence interval respectively

Table 10 shows the relationships between various variables and their impact on Net Profit Margin (NPM), which serves as a measure of financial performance in this research. The coefficient for OP (oil price fluctuations) is 0.063, and a p-value of 0.142 suggests that oil price fluctuations have an insignificant direct relationship with NPM. Volatility, however, shows a significant negative relationship with NPM, with a coefficient of -0.137, and a p-value of 0.01, demonstrating that higher volatility is linked with a lower NPM. Similarly, the interaction term OPDV2 has a coefficient of -0.069 and a p-value of 0.113, suggesting that the combined effect of oil prices and the dummy variable on NPM is negatively insignificant. The model's constant term (_cons) is negative and has an insignificant p-value. The overall model's significance is evident by Prob>chi^2 = 0.000.

Table 10. Random Effect Model Equation 5 Results

NPM	Coef.	Robust Std. Err.	Z	P>|z|
OP	0.063	0.0427	1.47	0.142
Voltality	-0.137	0.0532	-2.58	0.01***
DV2	10.545	14.321	0.74	0.462
OPDV2	-0.069	0.0436	-1.58	0.113
_cons	-1.477	14.0940	-0.1	0.917
sigma_u	15.487			
sigma_e	15.088			
Rho	0.513			
Wald-chi^2	14.65			
Prob>chi^2	0.000***			

Note: ***, **, * indicates a significance level at a 1%, 5% and 10% confidence interval respectively

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Only volatility is of statistical importance in the model, according to Table 11's results. With a coefficient of -0.1251 and a p-value of 0.013, volatility and GPM have a significant negative relationship, suggesting that increased volatility in the oil price lowers GPM. With a p-value of 0.648 and a positive coefficient of 0.015, the interaction term OPDV2 suggests a negligible inverse relationship with GPM. There is statistical significance in the entire model.

Table 11. Random Effect Model Equation 6 Results

GPM	Coef.	Robust Std. Err.	Z	P>|z|
OP	-0.003	0.0327	-0.11	0.913
Volatility	-0.125	0.0503	-2.48	0.013**
DV2	-14.42	10.143	-1.42	0.155
OPDV2	0.0153	0.0335	0.46	0.648
_cons	33.606	9.884	3.4	0.001***
sigma_u	17.732			
sigma_e	13.518			
Rho	0.6324			
Wald-chi^2	10.79			
Prob-chi^2	0.000***			

5. Research Limitations

Despite the durability of the analysis done for the study, there are certain limitations. First, the database is only for publicly traded firms on the Tadawul (Saudi Stock Exchange), thus neglecting the financial performance of private entities or multinational corporations operating in Saudi Arabia. Second, some external macroeconomic factors, such as inflation and interest rates, may influence financial performance, but they were not controlled for in the model. Tackling these limitations would further clarify how oil price volatility impacts financial performance in future studies.

6. Conclusion

Fluctuations in oil prices significantly influence financial performance, especially in oil-exporting nations like Saudi Arabia. The study indicates a strong correlation between oil price volatility and key performance metrics (ROA, NPM, and GPM), with oil-dependent firms experiencing a more apparent negative impact. Random effects models confirm that profitability diminishes with oil price fluctuations, emphasizing the sensitivity of oil-centric enterprises.

The results support Hypothesis *H1*, demonstrating a significant negative effect of oil prices on financial performance, particularly during the COVID-19 period (Hypothesis *H2*). Diversification emerges as a relieving factor, as diversified firms are better equipped to manage oil price volatility (Hypothesis *H3*). Furthermore, fluctuations in oil prices disturb investor confidence, markets stability, and negatively affect profitability.

The study contributes novel insights into the impact of oil price volatility on Saudi firms in different sectors, and analyzing the effects pre, during, and post the COVID-19 pandemic. Unlike existing literature focusing more on stock reactions to oil price changes, this study further assesses firm-level performance indicators alongside the diversified nature of operations of the firms studied. The study results corroborate those of Shu et al. (2018) and Elneel & AlMulhim (2022), which state that oil price volatility and financial performance have a strong correlation; however, this study takes it a step further and demonstrates that diversified firms tend to be more immune to oil price shocks than oil-dependent firms. These findings are especially pertinent for investors and policymakers concerned with the financial implications of oil price volatility.

Ultimately, fluctuations in oil prices should be regarded as a significant determinant for oil-dependent Saudi enterprises. The volatility in oil prices presents issues related to uncertainty and ambiguity, particularly impacting organizations that are largely dependent on oil. Consequently, understanding these dynamics is essential for firms in oil-rich nations like Saudi Arabia to endure an economy characterized by volatile oil prices, a shifting global economy, and diversification initiatives.

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