

FORUM SCIENTIAE OECONOMIA



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Entrepreneurship and Green Economic Development: A Bibliometric Investigation

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Abstract

Climate change and the depletion of natural resources are driving the search for mechanisms to transition to a sustainable economy, where entrepreneurship plays a key role in driving environmental innovation. Research in this area remains fragmented, making it difficult to identify policy and education priorities. The aim of this study is to conduct a bibliometric analysis of the scientific space of entrepreneurship and green economic development, identifying thematic priorities, publication dynamics, leading scientists and institutions, and the trajectories of evolution in research approaches. The study provides a systematic understanding of the current state of scientific developments, identifies conceptual gaps, and determines promising areas for further research. The methodological basis of the study is the application of bibliometric methods to a sample of 4,190 publications indexed in Scopus for the period from 1993 to 2025. The sample was formed in accordance with the PRISMA protocol. The analysis was performed using VOSviewer software to study the co-occurrence of terms, citations, and co-authorship. From more than 14,000 keywords, 1,000 terms with the highest level of connectivity, occurring at least five times, were selected. This made it possible to identify key conceptual nodes and their interrelationships. Seven thematic clusters and the evolution of priorities, from macroeconomic issues in the 1990s to the 2000s, to specific implementation mechanisms in the 2010s to the 2020s, have been identified. These clusters include entrepreneurial intentions, the circular economy, and sustainable business models. A 10-dimensional model was proposed that integrates institutional, technological, financial, educational, and socio-behavioural dimensions and aligns microeconomic activity with the macro goals of sustainable development. The study contributes to green entrepreneurship theory by linking firm-level entrepreneurial activity with macro-level sustainability objectives. In practical terms, the work provides scientifically sound tools for higher education institutions in developing interdisciplinary programmes, for government agencies in setting priorities for supporting green business, for entrepreneurs in identifying niches in the circular economy and sustainable models, and for investors in assessing the success factors of venture projects, thereby accelerating the transition to a low-carbon economy while maintaining economic efficiency.

Key words

green entrepreneurship, sustainable development, green economic development, bibliometric analysis, environmental innovation, circular economy, entrepreneurial intentions.

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Introduction

In contemporary scientific discourse, the issue of interaction between entrepreneurship and green economic development is becoming increasingly complex, as the combination of environmental priorities, technological innovations, and market transformations forms a multidimensional and inconsistent research space. Despite the general desire for sustainable development, there are different, sometimes opposing, positions in scientific literature on how exactly entrepreneurship should contribute to green transformations and which mechanisms ensure the greatest effectiveness.

On the one hand, a number of authors argue that the driving force behind green development is macroeconomic and institutional factors that determine the incentives, constraints, and vectors of national environmental policy. Tarasova (2018) emphasises that the adaptability of economic systems in crisis conditions depends primarily on strategic instruments of state regulation that shape new models of enterprise development. Tkachenko et al. (2019) emphasise the strategic role of state forecasting instruments, which set the trajectory for energy conservation in the construction industry by defining the framework for the implementation of sustainable practices.

On the other hand, representatives of the microeconomic and behavioural paradigm believe that key changes occur at the level of the innovative potential of individual enterprises and the willingness of consumers to support environmentally oriented business models. Tambovceva and Titko (2020) demonstrate that consumer participation in the sharing economy model is shaped by individual values and trust levels, rather than institutional conditions alone. Verina et al. (2021) show that digital transformation in education creates the preconditions for a new generation of entrepreneurs capable of integrating sustainability principles and technological innovations.

Some researchers support the position that entrepreneurship can ensure a rapid breakthrough in the implementation of environmental innovations. Grinevich et al. (2019) outline the potential of green entrepreneurship in the sharing economy, while Dzwigol et al. (2021) consider green logistics to be a tool for optimising resources and minimising the environmental footprint. At the same time, Miskiewicz (2021) points out that the implementation of green business models remains challenging due to technological, regulatory, and financial barriers, especially in sectors where the environmental impact is difficult to measure or commercialise.

Thus, contemporary literature reveals a significant fragmentation of views, manifested in different interpretations of the key factors of green development. Some researchers emphasise the dominance of institutional drivers, while others give preference to technological or behavioural factors. The role of entrepreneurship remains equally controversial, with some studies positioning it as the main catalyst for environmental transformation (Grinevich et al., 2019; Dzwigol et al., 2021), while others see it as a phenomenon that is largely dependent on government policy and the regulatory environment (Tarasova, 2018; Tkachenko et al., 2019). Opinions also differ on digital tools, which some authors (Veckalne et al., 2023; Verina et al., 2021) consider a powerful enhancer of innovation, while others (Miskiewicz, 2021; Kozlov, 2021) see them as a source of new socio-economic inequalities. Additional contradictions arise in the interpretation of the interaction between business and consumers in the process of green transformation: some researchers (Olasiuk & Bhardwaj, 2019; Chygryn et al., 2022) focus on market demand, while others (Tambovceva & Titko, 2020; Santoso, 2024) focus on cultural and social mechanisms of influence.

The existence of these opposing approaches indicates a theoretical gap, as scientific discourse still lacks a comprehensive, coordinated vision of the research area that would integrate macroeconomic, microeconomic, institutional, technological, and behavioural dimensions of entrepreneurship in the context of green economic development. Previous studies (Chygryn & Miskiewicz, 2022; Allen & Malin, 2008; Silajdžić et al., 2015) offer a fragmented coverage of individual aspects of the issue, but do not form a comprehensive understanding of its structural logic, key conceptual nodes, and interdisciplinary links.

With this in mind, this study aims to conduct a large-scale bibliometric analysis of the scientific discourse at the intersection of entrepreneurship and green economic development. The purpose of

the article is to identify the main thematic clusters and conceptual dominants, trace the interrelations between key categories, identify evolutionary trends in the formation of the research field, and develop an integrated model that combines the economic, institutional, technological, and behavioural aspects of green transformation. The work fills an existing theoretical gap by proposing a new systematisation of scientific approaches and creating a generalised framework for continuing empirical and theoretical research in this field.

The article has a logical structure focused on the step-by-step disclosure of the research. The first section provides an overview of the current literature with an emphasis on key contradictions and theoretical approaches. The second section describes the methodology, including the criteria for selecting publications and the bibliometric tools used. The third section presents the results through thematic clusters, term co-occurrence maps, and evolutionary trends. In the Discussion section, these results are interpreted in the broader context of scientific debate. The conclusions summarise the theoretical and practical contributions of the work and identify directions for future research.

1. Literature review

In contemporary research, increasing attention has been devoted to the interplay between entrepreneurship, innovation, and green economic development, shaping the complex knowledge landscape in this field. One of the earliest attempts to delineate the role of entrepreneurship in an environmental context was the work of Allen and Malin (2008), who examined green entrepreneurship as a practical approach to natural resource management capable of achieving a balanced integration of economic and ecological interests. Subsequent studies have demonstrated that social and behavioural factors significantly influence intentions to develop green entrepreneurship. For example, Alvarez-Risco et al. (2021) analysed the impact of the COVID-19 pandemic on business university students in Ecuador and demonstrated that environmental awareness, innovativeness, and support from the educational environment are key determinants in shaping entrepreneurial orientation.

A separate area of contemporary research focuses on the role of technology, particularly artificial intelligence, in ensuring green economic development. Chang et al. (2023) emphasised that the rational use of natural resources and growth in 'green' total factor productivity can be achieved by introducing digital technologies that create new opportunities for improving management efficiency and sustainable development. Moreover, Chygryn and Miskiewicz (2022), via bibliometric analysis, reported that research in the field of green competitiveness has evolved from the study of individual environmental policy instruments to a comprehensive vision of sustainable development and innovation strategies.

Demirel et al. (2019) emphasised that "green" startups are characterised by distinct management models and economic mechanisms, requiring institutional support for scaling and market entry. In addition, Dzwigol et al. (2021) elucidated the role of green logistics as an organisational-economic mechanism capable of integrating environmental requirements into business processes, thereby contributing to reducing enterprises' carbon footprint. At the micro level, integrating entrepreneurial initiatives with innovative activities is also critical. Specifically, Ebrahimi and Mirbargkar (2017) demonstrated that green innovations, in the context of market turbulence, are crucial factors in the development of SMEs, ensuring their resilience and adaptability.

The understanding of macroeconomic determinants of sustainable development has further expanded. Gherbi et al. (2024) demonstrated that the combination of economic growth, green financing, and the utilisation of renewable energy sources can significantly reduce CO₂ emissions, laying the foundation for environmentally oriented economic transformation. Concurrently, Gibbs and O'Neill (2014) proposed a revaluation of classical approaches to sociotechnical transitions, highlighting that green business in the construction sector can catalyse systemic change and deliver a truly transformative impact. Grinevich et al. (2019) further enrich the perspective on green entrepreneurship, illustrating that it could be successfully integrated into the sharing economy model,

where the multiplicity of institutional logics creates new opportunities for harmonising environmental and economic objectives.

Thus, the landscape of knowledge about entrepreneurship and green economic development is formed at the intersection of several scientific traditions: natural resource management, behavioural economics, innovation research, digital technologies, and macroeconomic policy. The interaction of these areas allows us to gain a deeper understanding of the nature of green entrepreneurship and outline potential trajectories for its development as a tool for achieving economic sustainability.

The formation of the knowledge landscape of entrepreneurship and green economic development has a multidimensional character, covering both microeconomic and macroeconomic levels and integrating approaches to innovative development, environmental policy, and behavioural aspects (Titko et al., 2023b). Researchers pay considerable attention to the relationship between intellectual capital and financial performance with long-term growth. In particular, Lehenchuk et al. (2023) showed that in the ICT sector, intellectual capital is critical in ensuring sustainability and competitiveness, creating preconditions for green economic development.

An important element of the landscape is the role of green markets in supporting entrepreneurial initiatives. Lotfi et al. (2018) reported that the emergence of new 'green' segments creates conditions for developing intellectual companies, which directly contribute to sustainable development. In a broader macroeconomic context, a study by Luukkanen and colleagues using Laos as an example demonstrated that the performance and efficiency indicators of green growth can be assessed through the concept of a 'sustainability window,' which allows for the identification of structural imbalances in green economic policy (Luukkanen et al., 2019).

A significant portion of contemporary research focuses on the orientation of enterprises toward green development and its implications. Makhoulfi et al. (2022) demonstrated that an environmental orientation in entrepreneurship positively impacts ecological outcomes, providing adequate political support and aligning with the resource-based view approach. Similarly, Mondal et al. (2023) identified key factors that facilitate green entrepreneurship development within the circular economy framework, highlighting institutional support, technological innovations, and managerial practices as systemic elements.

Particular attention has been given to the role of financial instruments in developing green startups. Mrkajic et al. (2019) demonstrated that venture capital is increasingly oriented toward ecological innovations, transforming green entrepreneurship into an attractive investment domain. Concurrently, Nikolaou et al. (2011), through SWOT analysis, showed that green entrepreneurship holds significant potential but faces barriers such as insufficient financial resources and underdeveloped institutional support.

Theoretically, O'Neill and Gibbs (2016) emphasised the complexity and dynamism of green economy narratives, noting that green entrepreneurship lacks fixed boundaries and continuously evolves in response to social, political, and economic conditions. In turn, Santoso highlighted that consumer behaviour is increasingly driven by social and environmental responsibility, creating additional demand for green products and services (Santoso, 2024).

In contemporary scientific discourse, entrepreneurship and green economic development are increasingly viewed as interconnected phenomena that shape a new sustainable growth paradigm. In countries with transitional economies, green entrepreneurship often presents a challenge requiring adaptation to institutional weaknesses and financial constraints. This is corroborated by the experiences of Bosnia and Herzegovina, which were analysed by Silajdžić et al. (2015), who reported that ecological initiatives necessitate systemic government support to overcome developmental barriers.

Skordoulis et al. (2022) demonstrated that corporate strategy serves as a mediator between green entrepreneurship, innovation, and competitive advantages, particularly in medium and large enterprises. These ideas are reinforced by Soomro et al., who showed that younger generations exhibit a high propensity for green entrepreneurship, perceiving it as a promising pathway to a green

economy (Soomro et al., 2020). In this context, the development of employee competencies is also critical.

In the realm of consumer behaviour, studies by Taborecka et al. (2023) and Vrablikova et al. (2024) reveal that the attitudes of women across different generations in Slovakia, as well as representatives of Generations X and Y, towards purchasing sustainable clothing are shaped by ecological values, social trends, and trust in sustainable brands. This underscores the growing importance of consumer demand as a driver of green business models. Furthermore, Trapp and Kanbach (2021) proposed a typology of green business models in the technology sector, arguing that archetypes of innovative strategies can serve as a foundation for scaling ecological solutions.

In the broader context of energy policy, Xie et al. (2020) emphasised that coordination between renewable energy sources and green economic development should be based on technological progress that reduces transformation costs.

The contemporary knowledge landscape of entrepreneurship and green economic development unfolds across several key dimensions: the integration of sustainable practices into the operations of small and large enterprises, the increasing role of strategy and innovation in shaping competitive advantages, the growing influence of consumer behaviour and the development of employee competencies, and the institutional and energy-related support for green transformations. These dimensions interact to form a comprehensive scientific framework that elucidates the dynamics and potential of green entrepreneurship in a global context.

2. Methodology

This bibliometric study, which focuses on the landscape of knowledge in entrepreneurship and green economic development, is based on a comprehensive methodology. The Scopus database was used to form a statistical database comprising 4369 scientific publications. The PRISMA guidelines were used to select articles (Fig. 1).

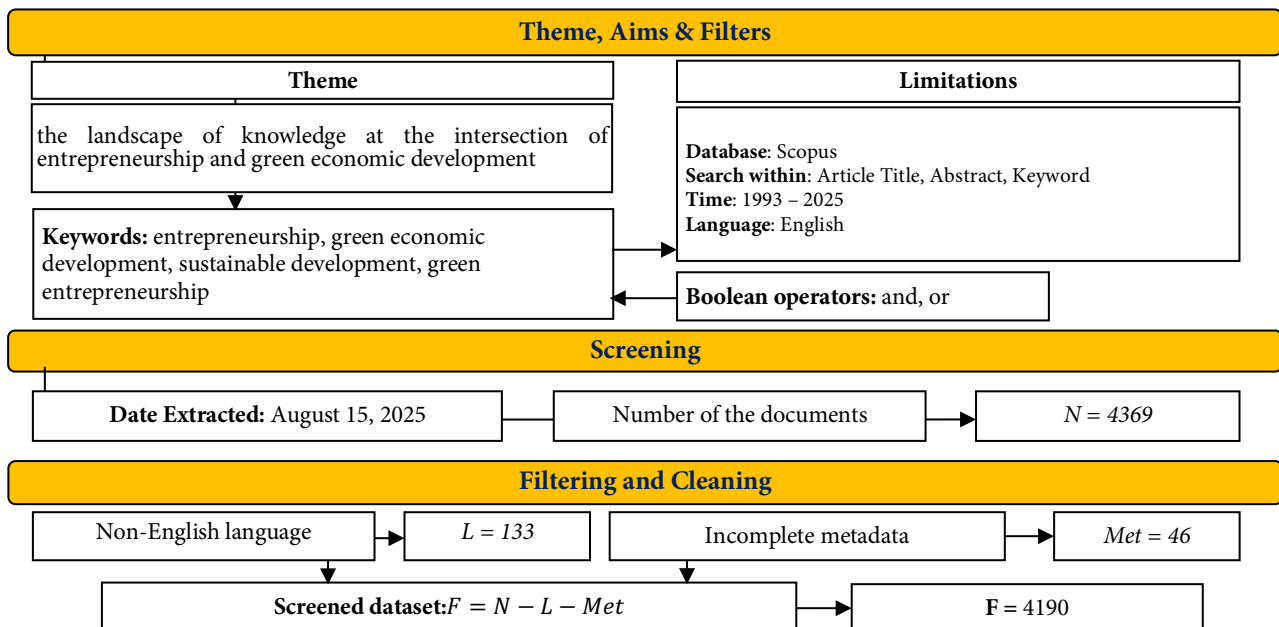


Figure 1. The PRISMA guidelines for meta-analysis of the papers focus on the knowledge landscape of entrepreneurship and green economic development, which are indexed in Scopus.

Source: Developed by the authors.

The search strategy was based on a combination of keywords covering the main aspects of the topic, such as 'entrepreneurship', 'green economic development', 'sustainable development', and 'green entrepreneurship'. This allowed us to obtain a representative sample for further analysis.

To select the articles, the following parameters were used:

- Keywords: entrepreneurship, green economic development, sustainable development, green entrepreneurship.
- Boolean operator: AND, OR.
- Timeframe: 1993-2025.
- Language: English.

In the first step, 4369 articles were identified. After the completeness of the language and metadata was verified, non-English publications (133) and documents with incomplete metadata (46) were excluded. As a result, the final dataset comprised 4,190 articles that were included in the analysis.

VOSviewer software was used to process and visualise the collected data. At the first stage of analysis, a minimum threshold for the appearance of a keyword was set at 5 times, allowing rare terms to be filtered out and focusing on the most significant ones. As a result, out of more than 14,000 initial words, 1,200 relevant terms were included in the analysis. From these, the 1,000 keywords with the strongest connections were selected, which ensured clear visualisation and analysis. This study encompasses an analysis of word co-occurrence to identify thematic clusters, a citation analysis to identify influential works, and a coauthorship analysis to examine collaboration networks. This approach offers a comprehensive and nuanced understanding of the structure and dynamics of scientific knowledge in this field.

3. Research results

Forming a holistic view of the knowledge landscape of entrepreneurship and green economic development requires the integration of various scientific approaches and research results that highlight the interrelationships among the economic, social and environmental components of sustainable development. The analysed sources enable us to identify the key determinants of green entrepreneurship development, among which the institutional environment, innovative practices, entrepreneurial orientations, consumer behaviour, and strategic business approaches are decisive. At the intersection of these factors, a framework model is formed (Table 1), which summarises knowledge about the driving forces, barriers and prospects of green transformations in entrepreneurial activity.

Table 1. Framework Model of the Knowledge Landscape of Entrepreneurship and Green Economic Development.

Fields of knowledge	Characteristics
Resource and environmental foundation	Green entrepreneurship as a mechanism for sustainable natural resource management and reduction of environmental impact; operational carriers – green logistics and environmentally optimised supply chains (Allen & Malin, 2008; Dzwigol et al., 2021).
Behavioural intentions and human capital	The propensity of young people and students towards green entrepreneurship, the role of education and values, the development of ‘green’ competencies among employees as a condition for the internal institutionalisation of sustainable practices (Alvarez-Risco et al., 2021; Soomro et al., 2020)
Technological and digital driver	AI and technological progress as enhancers of green productivity; digitisation of waste and energy management systems to support the circular economy (Chang et al., 2023; Mondal et al., 2023; Xie et al., 2020)
Business models, strategy and innovation	Archetypes of green technology business models, company strategy as a mediator between entrepreneurship, innovation and competitive advantages; specifics of SMEs in turbulent times (Ebrahimi & Mirbargkar, 2017; Skordoulis et al., 2022; Trapp & Kanbach, 2021)
Finance and investments	The role of venture capital and green financing in scaling up environmental innovations; market opportunities in new green segments (Gherbi et al., 2024; Lotfi et al., 2018; Mrkajic et al., 2019)
Institutions, policy and regional dimension	The “Green Deal,” renewable energy policy, support for transitional economies, sustainable tourism, and small businesses as factors in regional development (O'Neill & Gibbs, 2016; Silajdžić et al., 2015).
Green growth macroeconomics	Assessment of green growth performance (“window of sustainability”), coordination of RES and growth through technological shifts, tools for forecasting green competitiveness (Luukkanen et al., 2019; Xie et al., 2020)
Market, Consumer, and Brand	Social and environmental responsibility as a driver of demand; consumer behaviour in the sustainable clothing market; promotion of the ‘green brand of the country’ as a reputational asset for entrepreneurship (Santoso, 2024; Taborecka et al., 2023; Vrablikova et al., 2024)
Intellectual capital and resilience of an enterprise	The impact of intellectual capital on financial performance and sustainable growth in knowledge-based industries; vulnerability management as the basis for sustainable strategies (Lehenchuk et al., 2023)

entrepreneurial intention, education, curriculum, higher education institutions. These clusters focus on the educational aspect of training green entrepreneurs. The research here analyses how educational programs and institutions can influence students' intentions to start a business focused on sustainable development.

Cluster 5, 'Environmental Innovation and Technology' (blue), demonstrates the link between entrepreneurship and technological solutions—keywords: innovation, entrepreneur, business, and green innovation. The cluster reflects the role of entrepreneurs in creating and implementing innovative technologies to solve environmental problems. This is the micro level of entrepreneurial activity, where the emphasis is on the development and commercialisation of 'green' products and services.

Clusters 6 and 7, 'Social and Behavioural Aspects' (purple and pink), reflect the human factor in the green economy—key words: social effects, behavioural research, human development, perception, and knowledge-based systems. The clusters focus on consumer behaviour, individual perceptions and the social consequences of the transition to a green economy. This shows that economic and technological solutions alone are not enough for the successful implementation of green initiatives; it is also important to consider the human factor.

This clustering is a logical reflection of global macroeconomic trends. In particular, the growing interest in this topic has been driven by factors such as global warming and increasing climate risks, which require changes in economic models. Policies aimed at decarbonisation and the circular economy have been a driving force for investment in green technologies. The COVID-19 pandemic may also have contributed to the shift in focus, as much research has focused on environmentally conscious economic recovery ('green recovery'). Thus, the clusters reflect academic interests and the scientific community's response to key global challenges and economic transformations in recent decades.

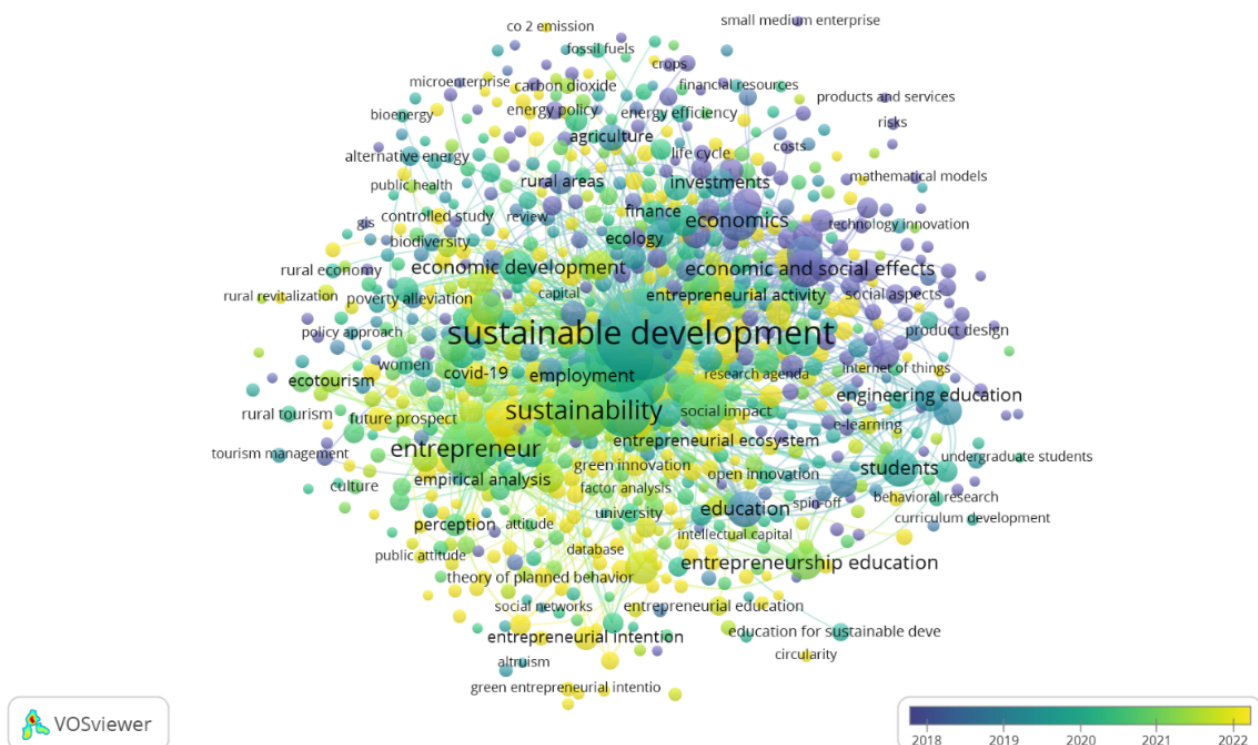


Figure 3. The results of the analysis of the evolution of investigations focused on entrepreneurship and green economic development.

Source: Developed by the authors.

The constructed map visualises the evolution of keywords and allows us to trace how the focus of scientific interest has changed over time for the subject under study.

In the relatively early period (blue/light blue cluster), research focused on general, fundamental concepts such as 'sustainable development,' 'economic development,' 'CO2 emissions,' and 'renewable energy resources.' These basic, macroeconomic studies laid the theoretical foundation for further work.

In the late period (yellow/green cluster) transition, the emphasis shifted to the micro level and practical aspects. Words such as 'entrepreneurship education,' 'entrepreneurial intention,' 'green business,' 'innovation,' and 'circularity' appear and become more significant. This indicates a shift from general discussions about sustainability to specific issues of implementing a green economy through entrepreneurial activity and education.

Key macroeconomic and social factors, including global politics and regulation, have influenced this evolution and clustering. Coordinated actions by governments and international organisations (the Paris Agreement) have increased attention to climate issues. This has stimulated investment in green infrastructure and technologies, which have required scientific justification and the search for new business models.

Technological progress, such as the rapid development of technologies in renewable energy, smart cities and the circular economy, has also created new opportunities for entrepreneurs. This led to the emergence and study of terms related to 'green innovation' and 'product design.'

It is also worth noting social pressure and awareness. The growing environmental awareness of consumers and investors demands greater social responsibility from businesses. Research has begun to focus on behavioural aspects, ecotourism and social effects.

The crisis caused by the COVID-19 pandemic has intensified the debate on 'green recovery'. This has prompted researchers to study how the principles of the green economy can be integrated into crisis recovery strategies.

An analysis of the bibliometric map of the evolution of keywords on the subject under study indicates a consistent and logical development of scientific knowledge. The initial stage, focused on macroeconomic and theoretical aspects of sustainable development, has gradually transformed into a more applied and innovative stage, where entrepreneurial initiative plays a key role. This transition from a general concept to specific implementation mechanisms confirms that the scientific community is actively responding to global challenges and macroeconomic trends. The evolution from terms related to politics and ecology to words describing entrepreneurs' education, intentions and behaviour reflects the realisation that the transition to a green economy is impossible without the active involvement of innovative potential at the micro level and the formation of a new generation of entrepreneurs. Thus, the map is not just visualisation but also empirical evidence of the maturity and dynamism of a research field that is constantly adapting to the demands of the times and changing economic realities.

4. Discussion

The results of the bibliometric analysis demonstrate that the research space combining entrepreneurship and green economic development is becoming increasingly interdisciplinary and conceptually profound. The key clusters identified are consistent with the trends described in contemporary scientific works (Allen & Malin, 2008; Chygryn & Miskiewicz, 2022; Demirel et al., 2019; Grinevich et al., 2019; Mondal et al., 2023; Silajdžić et al., 2015), confirming the validity of the conclusions and their connection to the broader context of sustainable development.

First, the results of the study emphasise the growing role of environmental innovation as a driver of business model transformation. This finding is consistent with the results of Shaukat et al. (2023), who emphasise that eco-innovation, combined with market uncertainty, stimulates the formation of a green marketing orientation and has the potential to improve business performance. Similarly, Wagan et al. (2025) reported that market and management factors significantly influence the

effectiveness of green innovations, confirming the importance of integrating innovative practices into strategic management.

The second important area is green consumer demand and behavioural determinants, which are reflected in our clusters related to social behaviour and brand. Olasiuk and Bhardwaj (2019) demonstrated that consumer decisions regarding green brands depend on awareness and trust, which directly correlate with the increasing frequency of the terms "green brand," "awareness," and "trust." Similar conclusions are presented in Santoso (2024), where the author emphasises the need to consider social and environmental aspects of consumer behaviour as key drivers of the market transition to sustainability. Additionally, the results of Chygryn et al. (2022) show that green brands and energy-efficient consumption are becoming important parts of the communication system, shaping new market logics and advantages.

The third key area is human capital, competencies and social aspects of entrepreneurship, which emphasise a shift in research towards behavioural and educational determinants. Gobniece and Titko (2024) emphasise that digital transformation requires the development of new competencies that support environmentally oriented business models simultaneously. The development of staff competencies is also reinforced by green HR practices, as demonstrated by a study by Surya et al. (2024), which shows that innovations in human resource management contribute to achieving sustainable development goals.

The gender aspect, identified in our analysis as one of the areas of behavioural research, is consistent with the findings of Tovmasyan (2022). In particular, female entrepreneurship in tourism contributes to strengthening the sustainability of regional development, and the gender characteristics of entrepreneurial behaviour have a direct effect on the innovative potential of countries.

The fourth dimension concerns institutional and financial support for green transformations, as confirmed by our conclusions regarding the centrality of institutional and political factors. Research by Khalatur and Dubovych (2022) demonstrates that financial engineering in the field of green finance is crucial to the development of an effective system of support for environmental innovation. Similar results were obtained by Alagpuria (2021), who confirmed the existence of financial gaps in the development of sustainable entrepreneurship, especially among SMEs. Moreover, Gavkalova et al. (2022) demonstrated that the development of renewable energy, even in times of crisis, has a positive effect on the environment and can support green entrepreneurship, provided that there is political stability and investment.

The fifth trend emerging from our analysis is digitalisation, smart technologies and circular models, which have become among the key elements in the evolution of scientific approaches. Veckalne et al. (2023) reported that digital services, such as mobile applications, promote sustainable consumption patterns in urban ecosystems. These findings correlate with a global shift from studying purely environmental aspects to exploring the synergy between digitalisation and circularity. Chygryn and Miskiewicz (2022) also confirmed the evolutionary nature of green competitiveness development, which is reflected in the growing importance of the terms competitiveness, transformation, and innovation in our study.

A comparison of our results with those of Kozlov (2021) and Tarasova (2018) reveals that managing negative externalities, adaptability, and strategic flexibility remain fundamental factors in the sustainability of enterprises. In the context of the circular economy, the problem of managing enterprise vulnerability is particularly important, as transformations require systemic changes in operational and strategic processes.

The results confirm the strengthening of the integrative role of culture and social norms in shaping the green economy. Research by Titko et al. (2023a) demonstrates that a country's cultural development significantly influences its ability to achieve the Sustainable Development Goals and that students' attitudes towards sustainable entrepreneurship are shaped in relation to their level of

education, values, and trust. This is fully consistent with the increasing frequency of the terms awareness, attitude, and intention in our evolutionary map.

Thus, the results of the discussion indicate that green economic development is shaped by the interaction of technological, behavioural, institutional, and financial factors. Our data complement existing research findings and demonstrate that contemporary scientific discourse is moving towards deepening interdisciplinary links, focusing on the integration of eco-innovation, social behaviour, digital technologies and strategic management.

Conclusions

The bibliometric analysis revealed that the scientific space at the intersection of entrepreneurship and green economic development is multidimensional, dynamic, and characterised by steady growth in interest over the past decades. The categories of sustainable development and economic sustainability, which integrate innovative, entrepreneurial, environmental, sociobehavioural and educational aspects, occupy a central place in the structure of this space. Mapping key terms and their connections has made it possible to identify seven main clusters that reflect the main directions of development in the field, among which 'Sustainable Development and Economics' and 'Entrepreneurship and Education' dominate. This confirms that the formation of a green economy takes place simultaneously at the macro level through institutions, politics, finance and energy transformations and at the micro level through the development of innovation, entrepreneurial orientation, the educational environment and behavioural changes.

The ten-dimensional knowledge model proposed by the authors systematises key conceptual directions and demonstrates the consistency between institutional, technological, financial, educational and behavioural determinants of green transformations. Visualisation of the evolution of key terms has revealed a shift in focus from general macroeconomic issues of sustainability to issues of practical implementation, particularly entrepreneurial intentions, digitalisation, innovative business models and circular practices. This confirms the gradual maturation of the field under study and the strengthening of interdisciplinary links.

The results of this study have significant theoretical and practical value. Theoretically, this work clarifies the structure of scientific approaches in the field and offers a comprehensive view of the relationships among economic, technological, and sociobehavioural factors in the development of green entrepreneurship. The practical significance lies in the possibility of using the results to improve educational programmes, identify areas of support for green business, search for innovative niches in the circular economy, and strengthen the role of entrepreneurship in achieving sustainable development goals.

From a policy perspective, the research results emphasise the importance of creating institutional conditions that stimulate the development of innovative and environmentally oriented entrepreneurial practices. The identified clusters demonstrate that effective public policy must cover environmental regulation, education development, innovation support, the creation of financial mechanisms, and the promotion of circular models simultaneously. The identified strengthening of the role of educational and behavioural aspects also indicates the need to support programmes for the development of entrepreneurial competencies and environmental awareness.

This study has certain limitations related to the specifics of the bibliometric method. The use of only the Scopus database and a minimum threshold for the appearance of keywords limits the inclusion of less represented but potentially important studies. Bibliometric tools allow us to identify the structure and dynamics of the scientific field, but they do not allow us to assess the causal relationships between individual factors of green development or the depth of conceptual discussions.

Further research may focus on empirical verification of the proposed model, in-depth analysis of individual clusters, study of regional characteristics of green ecosystem formation, and investigation of how digitalisation and behavioural changes are transforming traditional business models. The expanded use of mixed and qualitative methods will allow for a deeper understanding of the

mechanisms of interaction between entrepreneurship and green development, strengthening the theoretical and practical basis for further research.

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Reference

1. Alagpuria, M. (2021). Sustainable Financing for the Entrepreneurship Continual Growth: A Gap Analysis on Small and Medium Enterprises in India. *Virtual Economics*, 4(2), 105–119. [https://doi.org/10.34021/ve.2021.04.02\(6\)](https://doi.org/10.34021/ve.2021.04.02(6)).
2. Allen, J. C., & Malin, S. (2008). Green entrepreneurship: a method for managing natural resources?. *Society and natural resources*, 21(9), 828–844. <https://doi.org/10.1080/08941920701612917>.
3. Alvarez-Risco, A., Mlodzianowska, S., García-Ibarra, V., Rosen, M. A., & Del-Aguila-Arcentales, S. (2021). Factors affecting green entrepreneurship intentions in business university students in COVID-19 pandemic times: Case of Ecuador. *Sustainability*, 13(11), Article 6447. <https://doi.org/10.3390/su13116447>.
4. Chang, L., Taghizadeh-Hesary, F., & Mohsin, M. (2023). Role of artificial intelligence on green economic development: Joint determinates of natural resources and green total factor productivity. *Resources Policy*, 82, Article 103508. <https://doi.org/10.1016/j.resourpol.2023.103508>.
5. Chygryn, O., & Miskiewicz, R. (2022). New Trends and Patterns in Green Competitiveness: A Bibliometric Analysis of Evolution. *Virtual Economics*, 5(2), 24–42. [https://doi.org/10.34021/ve.2022.05.02\(2\)](https://doi.org/10.34021/ve.2022.05.02(2)).
6. Chygryn, O., Kuzior, A., Olefirenko, O., & Uzik, J. (2022). Green Brand as a New Pattern of Energy-Efficient Consumption. *Marketing and Management of Innovations*, 3, 78–87. <https://doi.org/10.21272/mmi.2022.3-07>.
7. Demirel, P., Li, Q. C., Rentocchini, F., & Tamvada, J. P. (2019). Born to be green: new insights into the economics and management of green entrepreneurship. *Small business economics*, 52(4), 759–771. <https://doi.org/10.1007/s11187-017-9933-z>.
8. Dzwigol, H., Trushkina, N., & Kwilinski, A. (2021). The Organisational and Economic Mechanism of Implementing the Concept of Green Logistics. *Virtual Economics*, 4(2), 41–75. [https://doi.org/10.34021/ve.2021.04.02\(3\)](https://doi.org/10.34021/ve.2021.04.02(3)).
9. Ebrahimi, P., & Mirbargkar, S. M. (2017). Green entrepreneurship and green innovation for SME development in market turbulence. *Eurasian Business Review*, 7(2), 203–228. <https://doi.org/10.1007/s40821-017-0073-9>.

10. Gavkalova, N., Lola, Y., Prokopovych, S., Akimov, O., Smalskys, V., & Akimova, L. (2022). Innovative Development of Renewable Energy During the Crisis Period and Its Impact on the Environment. *Virtual Economics*, 5(1), 65–77. [https://doi.org/10.34021/ve.2022.05.01\(4\)](https://doi.org/10.34021/ve.2022.05.01(4)).
11. Gherbi, E. A. H., Khalifa, G. S. A., & Kwilinski, A. (2024). Mitigating CO2 Emissions through Economic Growth, Green Finance, and Renewable Energy: Evidence from an ARDL Analysis. *Forum Scientiae Oeconomia*, 12(4), 99–121. https://doi.org/10.23762/FSO_VOL12_NO4_6.
12. Gibbs, D., & O'Neill, K. (2014). Rethinking sociotechnical transitions and green entrepreneurship: the potential for transformative change in the green building sector. *Environment and Planning A*, 46(5), 1088–1107. <https://doi.org/10.1068/a46259>.
13. Gobniece, Z., & Titko, J. (2024). Staff Competencies for Digital Transformation: Results of Bibliometric Analysis. *Virtual Economics*, 7(1), 25–46. [https://doi.org/10.34021/ve.2024.7.01\(2\)](https://doi.org/10.34021/ve.2024.7.01(2)).
14. Grinevich, V., Huber, F., Karataş-Özkan, M., & Yavuz, Ç. (2019). Green entrepreneurship in the sharing economy: Utilising multiplicity of institutional logics. *Small Business Economics*, 52(4), 859–876. <https://doi.org/10.1007/s11187-017-9935-x>.
15. Khalatur, S., & Dubovych, O. (2022). Financial Engineering of Green Finance as an Element of Environmental Innovation Management. *Marketing and Management of Innovations*, 1, 232–246. <http://doi.org/10.21272/mmi.2022.1-17>.
16. Kozlov, D. (2021). The Strategies of Internalising the Negative Externalities in the Company's Sustainable Development. *Virtual Economics*, 4(3), 7–19. [https://doi.org/10.34021/ve.2021.04.03\(1\)](https://doi.org/10.34021/ve.2021.04.03(1)).
17. Lehenchuk, S., Zeytinoglu, E., Hrabchuk, I., Zhalinska, I., & Oleksich, Z. (2023). Nexus Between Intellectual Capital, Financial Performance and Sustainable Growth: Evidence from the Turkish ICT Industry. *Marketing and Management of Innovations*, 2, 152–162. <https://doi.org/10.21272/mmi.2023.2-14>.
18. Lotfi, M., Yousefi, A., & Jafari, S. (2018). The effect of emerging green market on green entrepreneurship and sustainable development in knowledge-based companies. *Sustainability*, 10(7), Article 2308. <https://doi.org/10.3390/su10072308>.
19. Luukkanen, J., Kaivo-oja, J., Vähäkari, N., O'Mahony, T., Korkeakoski, M., Panula-Ontto, J., Phonhalath, K., Nanthavong, K., Reincke, K., Vehmas, J., & Hogarth, N. (2019). Green economic development in Lao PDR: A sustainability window analysis of Green Growth Productivity and the Efficiency Gap. *Journal of cleaner production*, 211, 818–829. <https://doi.org/10.1016/j.jclepro.2018.11.149>.
20. Makhouloufi, L., Laghouag, A. A., Meirun, T., & Belaid, F. (2022). Impact of green entrepreneurship orientation on environmental performance: The natural resource-based view and environmental policy perspective. *Business Strategy and the Environment*, 31(1), 425–444. <https://doi.org/10.1002/bse.2902>.
21. Mondal, S., Singh, S., & Gupta, H. (2023). Assessing enablers of green entrepreneurship in circular economy: An integrated approach. *Journal of Cleaner Production*, 388, Article 135999. <https://doi.org/10.1016/j.jclepro.2023.135999>.
22. Mrkajic, B., Murtinu, S., & Scalera, V. G. (2019). Is green the new gold? Venture capital and green entrepreneurship. *Small business economics*, 52(4), 929–950. <https://doi.org/10.1007/s11187-017-9943-x>.
23. Nikolaou, E. I., Ierapetritis, D., & Tsagarakis, K. P. (2011). An evaluation of the prospects of green entrepreneurship development using a SWOT analysis. *International Journal of Sustainable Development & World Ecology*, 18(1), 1–16. <https://doi.org/10.1080/13504509.2011.543565>.
24. Olasiuk, H., & Bhardwaj, U. (2019). An Exploration of Issues Affecting Consumer Purchase Decisions Towards Eco-friendly Brands. *Marketing and Management of Innovations*, 2, 173–184. <http://doi.org/10.21272/mmi.2019.2-15>.

25. O'Neill, K., & Gibbs, D. (2016). Rethinking green entrepreneurship–Fluid narratives of the green economy. *Environment and Planning A: Economy and Space*, 48(9), 1727–1749. <https://doi.org/10.1177/0308518X166504>.
26. Santoso, S. (2024). Consumer Behaviour: Impact of Social and Environmental Sustainability. *Marketing and Management of Innovations*, 15(1), 229–240. <https://doi.org/10.21272/mmi.2024.1-17>.
27. Shaukat, F., Zaman, H. M. F., Nguyen, T. T. N., & Souvanhxay, P. (2023). The Interplay of EcoInnovation and Market Uncertainty on Green Marketing Orientation and Business Performance. *Marketing and Management of Innovations*, 14(4), 48–68. <https://doi.org/10.21272/mmi.2023.4-04>.
28. Silajdžić, I., Kurtagić, S. M., & Vučijak, B. (2015). Green entrepreneurship in transition economies: a case study of Bosnia and Herzegovina. *Journal of cleaner production*, 88, 376–384. <https://doi.org/10.1016/j.jclepro.2014.07.004>.
29. Skordoulis, M., Kyriakopoulos, G., Ntanos, S., Galatsidas, S., Arabatzis, G., Chalikias, M., & Kalantonis, P. (2022). The mediating role of firm strategy in the relationship between green entrepreneurship, green innovation, and competitive advantage: the case of medium and large-sized firms in Greece. *Sustainability*, 14(6), Article 3286. <https://doi.org/10.3390/su14063286>.
30. Soomro, B. A., Ghumro, I. A., & Shah, N. (2020). Green entrepreneurship inclination among the younger generation: An avenue towards a green economy. *Sustainable Development*, 28(4), 585–594. <https://doi.org/10.1002/sd.2010>.
31. Surya, I. B. K., Kot, S., Astawa, I. P., Rihayana, I. G., & Arsha, I. M. R. M. (2024). Unlocking Sustainability through Innovation: A Green HR Approach for Hospitality Industry. *Virtual Economics*, 7(2), 50–62. [https://doi.org/10.34021/ve.2024.07.02\(3\)](https://doi.org/10.34021/ve.2024.07.02(3)).
32. Taborecka, J., Rajic, T., Vinczeova, M., & Kaputa, V. (2023). Attitudes and Actual Buying Behaviour of Sustainable Clothes from the Perspective of Female Generations in Slovakia. *Marketing and Management of Innovations*, 14(3), 125–133. <https://doi.org/10.21272/mmi.2023.3-11>.
33. Tambovceva, T., & Titko, J. (2020). Consumer perception of sharing economy: pilot survey in Latvia. *International Journal of Economic Policy in Emerging Economies (IJEPEE)*, 13(1), 72–84. <https://doi.org/10.1504/IJEPEE.2020.106681>.
34. Tarasova, H. (2018). Scientific and Methodical Approach to Adaptive Diversification of Industrial Enterprise Development under Crisis Conditions. *Virtual Economics*, 1(1), 42–52. [https://doi.org/10.34021/ve.2018.01.01\(3\)](https://doi.org/10.34021/ve.2018.01.01(3)).
35. Titko, J., Svirina, A., Astike, K., Uzule, K., Shina, I., & Zarina, V. (2023a). Impact of country-level cultural development on the achievement of Sustainable Development Goals. *Business, Management and Economics Engineering*, 21(2), 269–278. <https://doi.org/10.3846/bmee.2023.19423>.
36. Titko, J., Tambovceva, T., Atstaja, Dz., Lapinskaite, I., Solesvik, M., Svirina, A., & Uzule, K. (2023b). Attitude towards Sustainable Entrepreneurship among Students: Pilot Study in Latvia and Lithuania. *TalTech Journal of European Studies*, 13(1)/(37), 107–132. <https://doi.org/10.2478/bjes-2023-0006>.
37. Tkachenko, V., Klymchuk, M., & Ivakhnenko, I. (2019). Scientific prediction of the balanced energy saving development strategy of the construction projects. *Virtual Economics*, 2(2), 70–84. [https://doi.org/10.34021/ve.2019.02.02\(5\)](https://doi.org/10.34021/ve.2019.02.02(5)).
38. Tovmasyan, G. (2022). Promoting Female Entrepreneurship in Tourism for Sustainable Development. *Marketing and Management of Innovations*, 1, 18–36. <http://doi.org/10.21272/mmi.2022.1-02>.
39. Trapp, C. T., & Kanbach, D. K. (2021). Green entrepreneurship and business models: Deriving green technology business model archetypes. *Journal of cleaner production*, 297, Article 126694. <https://doi.org/10.1016/j.jclepro.2021.126694>.

40. Veckalne, R., Kapustins, M., & Tambovceva, T. (2023). Smart Cities, Green Diets: How the Lucy Veg App Supports Valencia's Vegan Community and Contributes to SDGs. *Virtual Economics*, 6(2), 7–22. [https://doi.org/10.34021/ve.2023.06.02\(1\)](https://doi.org/10.34021/ve.2023.06.02(1)).
41. Verina, N., Titko, J., & Shina, I. (2021). Digital Transformation Outcomes in Higher Education: Pilot Study in Latvia. *International Journal of Learning and Change (IJLC)*, 13(4/5), 459–473. <https://doi.org/10.1504/IJLC.2021.116661>.
42. Vrablikova, M., Ubreziová, I., Kubickova, M., & Skodova, L. (2024). Sustainable clothing buying behavior of Generations X and Y. *Marketing and Management of Innovations*, 15(3), 151–165. <https://doi.org/10.21272/mmi.2024.3-12>.
43. Wagan, S. M., Zhang, X., & Sidra, S. (2025). Green Innovation and Firm Performance: Market and Managerial Drivers. *Marketing and Management of Innovations*, 16(3), 1–14. <https://doi.org/10.21272/mmi.2025.3-01>.
44. Xie, F., Liu, Y., Guan, F., & Wang, N. (2020). How to coordinate the relationship between renewable energy consumption and green economic development: from the perspective of technological advancement. *Environmental Sciences Europe*, 32(1), Article 71. <https://doi.org/10.1186/s12302-020-00350-5>.

Understanding Household Energy Consumption Choice: Logit Model Estimates on the Role of Poverty, Health Status and Socio-economic Drivers in Turkey

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Abstract

In this article, the structure of demand for different types of energy among Turkish households is examined. This issue is of critical importance for ensuring economic stability, energy security, and sustainable development. The study is based on cross-sectional data obtained from the Household Budget Surveys published by the Turkish Statistical Institute (TURKSTAT), covering approximately 45,000 households over the period 2015–2019. Using a multidimensional household poverty index together with income-based poverty thresholds set at 50%, 60%, and 70% of median incomes, this study investigates, for the first time in the existing literature, the relationship between household poverty status, the health status of the head of the household, and energy demand in Turkey. The findings show that electricity and natural gas consumption increases as the poverty level decreases; furthermore, wealthier individuals prefer to use electricity while households in the lower 50% of median income choose to use cheaper types of fuel such as dried dung. Moreover, household characteristics, income level, and the education level of the head of the household are important factors in energy choice, but age and the marital status of the head of the household do not play a very crucial role in household energy consumption. The findings indicate that households' socio-economic characteristics, together with health status and poverty, are significant determinants of energy consumption behaviour and, consequently, environmental sustainability.

Key words

household energy demand, poverty, health, logit model, household budget survey, Turkey.

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Introduction

A better understanding of consumer behaviour, including how residential end-users make energy consumption decisions, is important not only for academics, but also for policymakers (Borožan, 2018). Although energy is vital for the modern economy, household energy usage – including cooling, heating, air conditioning and powering electrical appliances – contributes significantly to CO₂ emissions. Improving energy efficiency at the household level requires a better understanding of the link between energy consumers, energy sources, the economy, and the environment (Abubakar et al., 2024). Household energy use accounts for a significant proportion of worldwide energy consumption, responsible for 32% of total energy use and 19% of energy-related greenhouse gas emissions (GHG) (Xu et al., 2020). Furthermore, rising income levels, population growth, and urbanisation have led to an increase in energy demand, making energy a vital resource for power and economic growth. The growing world demand for energy sources is deteriorating the environment and raising the incidence and severity of energy poverty among households (Simsek et al., 2020). With the International Energy Agency (IEA) projecting a 50% increase in final energy demand by 2050, analysing energy efficiency and transitioning from traditional to modern and/or environmentally friendly energy sources is becoming increasingly important (Zhang et al., 2024).

The United Nations' Sustainable Development Goals (SDGs), specifically SDG7 and its target 7.1, highlight the importance of ensuring "universal access to affordable, reliable, and modern energy services" by 2030. Furthermore, the United Nations (UN) emphasises the importance of knowing the proportion of the population that relies primarily on clean fuels and technologies, broken down by major types of households and uses (e.g. cooling, heating and lighting) (UN, 2022). In this context, disaggregating energy usage provides decision makers with the necessary information to identify where efforts should be employed to improve overall access to clean and modern fuels. Although there are complex, multidimensional linkages between household energy consumption and several SDG targets beyond SDG7 – such as SDG1, SDG5, SDG8, SDG11, SDG13, and SDG16 – the determinants of household energy consumption have not been sufficiently examined empirically (An et al., 2025).

Moreover, the UN (2025) highlights the importance of analysing household energy consumption based on household surveys and censuses in order to evaluate progress towards the SGD targets. Despite this, little is known about the factors affecting energy consumption in the residential sector, since studies generally focus on the macroeconomic aspects of household energy consumption, such as the relationship between energy and/or electricity usage and economic growth, or the forecasting of future energy consumption in different countries using different methods such as time series analysis, bottom-up models, etc. (Hsu & Chen, 2003; Carpinteiro et al., 2007; Truong et al., 2008; Pai, 2006; Tsani, 2010; McLoughlin et al., 2013; Kim et al., 2023). Information about residential energy choices according to gender, wealth, education, whether the person lives in a rural or urban area, and the type of dwelling is essential for comparing populations and locations, and enables policymakers to monitor progress towards achieving SDG7. It also allows policymakers to intervene in marginalised regions and populations, providing more equitable access to modern energy sources for all (Abubakar et al., 2024).

The literature contains a limited number of empirical microeconomic studies on household energy consumption and the socioeconomic determinants of residential energy use. Furthermore, many of these studies test the energy ladder hypothesis (Kumar, 2024; Vo et al., 2024; Tinta, 2024), or analyse the income or price elasticities of different types of energy (Huang et al., 2024; Szép & Kashour, 2024) and investigate energy poverty issues (Liu & Hu, 2024; Masuku, 2024). Therefore, the current research will contribute to the existing body of literature examining the impact of household poverty status and the health condition of the head of the household on energy consumption, while considering several other socio-economic factors (e.g. income, gender, dwelling factors, marital status, education, age, and employment). Although research emphasises that demographic changes such as income levels, poverty, and well-being will affect the type and quantity of energy used, no study in the relevant

literature has investigated the role of poverty status, as determined by different levels of median income, or the role of health status on energy use. In this context, identifying which factors influence energy consumption is critical for developing efficient energy and environmental policies.

Like many other countries, Turkey has an increasing demand for energy to power its activities. However, its reliance on imported energy sources is putting pressure on the country's balance of payments and domestic price stability. In Turkey, the share of households in final energy consumption reached 32.1% in 2023, surpassing the manufacturing industry, which had a 31.8% share (TURKSTAT, 2024). This makes the residential sector one of the country's biggest energy consumers. According to the Energy Market Regulation Authority (EPDK), the share of households in final electricity use is 22.6%, whereas the related figure for natural gas consumption is around 28% (Energy Market Regulatory Authority, 2024). The proportion of energy derived from fossil fuels remains high at 83.5%, and final electricity demand is increasing by around 9% per year (TEIAS, 2024). Furthermore, the growth rate of natural gas usage by households was approximately 4% in 2020–2023. Hence, the type and quantity of energy are putting pressure on energy demand and sustainable economic development in Turkey. Energy-related emissions accounted for the largest proportion of greenhouse gas emissions in the country (in terms of CO₂ equivalent), reaching 71.3% in 2021 (TURKSTAT, 2023). For this reason, the household sector, as the main energy consumer, is an important consideration in formulating appropriate energy policies to ensure sustainability.

Despite the dynamic nature of the energy market and the critical role of energy in areas such as planning, investment, and environmental impact, there are very few academic studies based on microdata examining the factors affecting the energy demand of households, which account for a significant share of consumption in Turkey. Using micro-economic data from household surveys like “Longitudinal Micro Data Set of Income and Living Conditions Survey” and “Household Budget Surveys” there are some empirical studies investigating the role of individual or household characteristics on energy consumption (Özcan et al., 2013; İpek & İpek, 2022; Karaaslan & Algül, 2023). These studies confirmed the significant role of socio-economic characteristics such as gender, age, marital status, employment status, dependent children (İpek & İpek, 2022), dwelling features (Özcan et al., 2013; Karaaslan et al., 2022; Kayalica et al., 2020), household size (Ari et al., 2016) on residential energy and/or electricity use.

To date, no Turkish case study has simultaneously employed two distinct measures of poverty status or incorporated the health status of the household head in the analysis of household energy demand. According to certain researches (Bingdong et al., 2018; Li et al., 2024) economic poverty and health situation are very important drivers for energy choice and transition from traditional to clean energy. In this context, affordability and availability play a significant role in energy preferences and usage. Against the backdrop, using the microdata set from the TURKSTAT 2015-2019 Household Budget Survey, this study analyzes the socio-economic factors determining household energy demand, as well as the impact of household poverty and the head of household's health status on household energy demand for heating purposes.

The current study makes several contributions to existing literature. Firstly, while most studies on residential energy in Turkey generally focus on the macroeconomic dimension and energy demand forecasting, the current research provides a micro-econometric analysis of the residential energy sector. Secondly, while some studies have empirically analyzed household energy demand, they have ignored the effects of poverty and the health status of residents on energy usage. However, it has been argued that poverty and the personal health status of individuals have a significant influence on energy consumption patterns and the choice of energy sources, thereby contributing to environmental degradation (Bingdong et al., 2018; Li et al., 2024). Therefore, by constructing the relevant poverty index and using binary variables related to health status and poverty status, respectively, the current study examines the impact of household poverty and the health status of the household head on residential energy demand levels and energy type preferences for the first time in Turkey. Thirdly, it has been evaluated the impact of poverty on residential energy demand using two

variables: 1-the poverty index and 2- binary variables that represent being below three different poverty lines (estimated based on 50%, 60% and 70% of the median income, respectively). Fourthly, whereas previous empirical studies have investigated the effects of energy consumption and its environmental consequences on individual health, this study instead examines the effect of health status on energy consumption. Distinct from most prior research emphasizing cooking fuel choices in Asian and African households (Karaaslan & Algül, 2023), the current study contributes by analyzing heating fuel selection, which exerts a greater influence on overall energy demand and environment impact.

The rest of the paper is structured as follows: Section 2 provides a review of the literature on residential energy demand. Section 3 presents the data and econometric procedure. Section 4 summarizes the results and discussions. Section 5 concludes with some policy recommendations and Section 6 presents the limitations of the study and directions of future research.

1. Literature review

Analysing and managing energy demand is becoming imperative as it contributes to planning for future demand, energy security and supply, identifying conservation measures and designing strategies for a low-carbon economy (Suganthi & Samuel, 2012). A large body of literature has analysed household energy demand in both developed and developing countries, using different methodologies. These studies are commonly classified into four categories. The first branch basically forecasts the future demand for energy sources, including the residential sector, using models such as Autoregressive Integrated Moving Average (ARIMA), Seasonal Autoregressive Integrated Moving Average (SARIMA), Artificial Neural Network (ANN), Neural Network (NN), Wavelet non-linear multiscale decomposition, Fuzzy Logic etc. (Cao et al., 2024; Ediger et al., 2006; Aydinalp et al., 2002; Hsu & Chen, 2003; Carpinteiro et al., 2007; Truong et al., 2008; Pai, 2006). The second branch discusses the symmetric or asymmetric causalities between energy consumption (fossil energy, renewable energy or aggregate energy use) and economic growth and/or income levels using macro level data (Odhiambo, 2009; Tsani, 2010; Tuna & Tuna, 2019). The third branch evaluates the preferences of households from traditional energy types to modern energy sources (Energy ladder hypothesis) (Hosier & Dowd, 1987; Farsi et al., 2007; Mensah & Adu, 2015; Acharya & Marhold, 2019). Finally, the fourth branch investigates the determining factors of household energy and/or electricity consumption and highlights the important role of socio-economic characteristics such as income, education, dwelling size, behavioural efficiency, etc. on energy use in residential sector (Özcan et al., 2013; Karatasou & Santamouris, 2019; Ekholm et al., 2010; Wang et al., 2020; İpek & İpek, 2022; Yarbaşı & Çelik, 2023; Rao & Reddy, 2007; Weyman-Jones & Boucinha, 2024). Studies in this strand have revealed that household demand for energy and/or electricity is influenced by weather conditions (Chan, 2011), specific building characteristics such as floor area, age, building type etc. (Yohanis et al., 2008; Bartusch et al., 2012), stock of electrical appliances (Koç et al., 2015; Bedir et al., 2013), income level of the end user (Özcan et al., 2013; Yarbaşı & Çelik, 2023) and characteristics of household head such as age, education, marital status etc. (İpek & İpek, 2022; Karaaslan & Algül 2023). In this context, Suganthi & Samuel (2012) and Ferrari et al. (2019) have provided detailed reviews on empirical studies on energy demand. These empirical studies show that energy, economy, and environment are highly interrelated and energy management and/or modelling is essential for the economic prosperity and sustainability of the nations in the world.

Although analyzing and forecasting the energy consumption is vital for Turkey as the country is highly dependent on imported energy sources and faces increasing need for energy demand for sustainable economic growth, the academic studies on energy demand gained momentum in Turkey after the 2000s when energy market reforms were initiated. For example, using Household Budget Surveys (2002-2006) Özcan et al. (2013) have investigated how underlying socio-economic and dwelling factors change household energy consumption. The authors have found that factors such as monthly income, age, health concerns and type of dwelling are found to be important factors

explaining the energy choices in Turkey. Similarly, Koç et al. (2015) have estimated the income elasticity of residential electricity and some demographic variables such as gender, education and income using the 2007-2009 Household Budget Survey and assessed the welfare impact of the electricity tariff adjustment resulting from the electricity market reform.

Using Household Budget Survey (TURKSTAT, n.d.), Ari et al. (2016) have examined the link between household electricity consumption and 22 socio-economic variables in the residential sector, and they have demonstrated that the type and quantity of the electrical appliances, household size, household income, and dwelling type are important drivers of the household electricity consumption. Similarly, Kayalica et al. (2020) have compared the impact of household socio-economic status and expenditure characteristics on energy use using statistical optimization methods such as principal component analysis (PCA) and ANN. The authors have found that dwelling factors have a stronger impact on household energy use than other socio-economic and expenditure factors. Using the Income and Living Conditions Survey, İpek & İpek (2022) examined the role of socio-economic and dwelling factors on residential energy choice in the period of 2016-2019. The authors have found that residential space heating type preferences are influenced by socio-economic factors like education and dwelling factors such as dwelling age, and the energy ladder hypothesis is valid for Turkey. Again, İpek & İpek (2024) analyzed the energy poverty on health situation of Turkish residents.

Table 1. Empirical results of residential energy and electricity demand studies in Turkey.

Source	Period	Method	Variables	Results
Hamzaçebi (2007)	1970-2004	Artificial Neural Network (ANN)	Residential Electricity consumption	Residential electricity use will reach around 257 Twh in 2020.
Özcan et al. (2013)	2002-2006	Multinomial Logit Model	Household energy consumption (all kinds) and 9 socio-economic variables	Monthly income, health, age and type of dwelling are determining factors of energy use
Koç et al. (2015)	Household Budget Survey (2007-2009)	Working Leser	Household electricity use, household income, household size and electrical appliances ownership	The income elasticity ranges from 0.74 to 0.91 based on the income strata.
Ari et al. (2016)	Houshold Budget Survey (2012)	Ordered Logit Model	Residential Electricity consumption, 22 socio-economic variables	The type and number of electrical appliances, household size, household income, housing type positively affects residential electricity consumption.
Kayalica et al. (2020)	Houshold Budget Survey (2002-2017)	Principal Component Analysis (PCA), Artificial Neural Network (ANN)	Household energy use, 9 socio-economic variables and 10 expenditure groups.	Among the others dwelling characteristics have a strong effect. The effect of household expenditure on energy use is limited.
İpek & İpek (2022)	Income and Living Conditions Survey (2016-2019)	Random Effect Ordered Logit	Energy consumption of households for space heating, 19 socio-economic variables and dwelling variables	Energy type choice of household is affected by socio-economic and dwelling factors. Energy Ladder Hypothesis is valid for Turkey.
Yarbaşı & Çelik (2023)	Household Budget Survey (2019)	Heckman Sample Election Model	Electricity expenditures of households and 22 socio-economic factors and dwelling variables	The income level, demographic variables (like age, education level, marital status), characteristics of the dwelling (area) and stock of electrical devices (like air conditioner, tumble dryer, deep freezers) are important determinants of residential electricity use.
Karaaslan et al. (2022)	Household Budget Survey (2015-2018)	Multinomial Probit and Nested Logit	Household energy choice for heating and different socio-economic factors and dwelling variables	The socio-economic variables such as income, household size and education level of household, having a job, marital status, credit card ownership are key factors for energy choice.
Karaaslan & Algül (2023)	Household Budget Survey (2015-2018)	Quantile regression	Entire energy expenditure of household and different socio-economic factors and dwelling variables	The income level, demographic characteristics of household such as age, education level, marital status and properties of dwelling are important for energy expenditure of residential sector.

İpek & İpek (2024)	Income and Living Conditions Survey (2018-2021)	Ordered Model	Logit	Energy status	poverty, health	Support policies considering the income status of residents will not be sufficient.
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Source: Developed by authors.

As shown in Table 1, there are limited studies on residential energy demand and determinants of energy consumption in the household sector based on micro-data sets in Turkey. Furthermore, among these studies, no academic energy demand study has evaluated the role of poverty and health status on household energy type choice. On the contrary, only İpek & İpek (2024) analyzed the energy poverty on health situation of Turkish residents. In this context, the present study fills a research gap in the energy economics literature.

2. Methodology

2.1. Data

In this study, it has been used micro-level data from the Turkish Household Budget Survey (TURKSTAT, n.d.) available from the TURKSTAT for the period of 2015-2019. Data from the period during and after the Covid-19 pandemic are excluded. The COVID-19 pandemic led to significant disruptions in daily life, including prolonged lockdowns, increased work-from-home practices, and changes in mobility patterns. These factors resulted in an unusual spike in residential energy consumption that does not reflect the normal trends observed in prior years. Including this data skews the results and leads to biased conclusions. The survey includes rich and detailed information for three main groups of variables: variables related to household assets (type of dwelling owned, ownership of durable goods and transport vehicles), consumption expenditures (food and health expenditures), and variables related to individuals (age, marital status, employment status, and education, among others). The dependent variables are defined as binary variables of the consumption of specific type of energy, namely electricity, natural gas, coal, wood and dung. The main independent variables are the poverty index, a binary variable for households being below the poverty line, and the health status of the household head. The regression models also include a set of additional control variables capturing characteristics of the household and the household head. Table 2 presents summary statistics, including the mean, standard deviation, minimum, and maximum values, for the continuous covariates and main independent variables used in the analysis.

Table 2. Summary statistics for continuous variables.

	Mean	Std. Dev.	Min.	Max.
Household Income	23942.17	23613.83	3.214286	1017949
Household head age	50.55703	14.68839	16	99
Dwelling size	107.7617	35.27619	10	870
Poverty Index	0.0278376	0.9567713	-3.171375	4.247945

Source: Authors estimations from TURKSTAT Household Budget Survey (TURKSTAT, n.d.).

Table 3 presents the descriptive statistics for the categorical variables included in the analysis, based on data from the Turkish Household Budget Survey for the period 2015–2019. The variables capture household energy characteristics, dwelling features, household composition, and key socio-demographic attributes of the household head, including gender, marital status, education level, employment status, and health status. In addition, the table reports indicators of poverty status, defined using alternative thresholds of 50%, 60%, and 70% of median income.

Table 3. Summary statistics for categorical variables.

	Categorical Variables				
Energy Type	Electric	Dung	Wood	Coal	Natural Gas
	5.58	1.67	31.82	21.15	38.78

Residential heating system	Radiator 44.83	Stove 51.9	Air conditioner 3.27					
Age of Dwelling	Pre-1945 1.89	1946-1960 4.13	1961-1970 6.62	1971-1980 13.93	1981-1990 19.63	1991-2000 22.53	2001-2005 10.71	post-2005 20.56
Household Type	Couple without resident children 19.22	Couple with at least one resident children 51.4	Lone parents with at least one resident child 13.59	At Least One Nuclear Family and Other Persons 14.72	Multiple Persons without a Nuclear Family 1.07			
Ownership	Homeowner	Tenant	Lodging	Not owner but also not paying rent 13.82				
Gender	Male 85.7	Female 14.3						
Marital Status	Single 3.68	Married 82.59	Divorced 3.98	Widowed 9.75				
Education Level	Not completed any school 11.91	Primary School 42.93	Secondary School 13.2	High School 16.86	Vocational School 4.5	Bachelor 8.83	Master's Degree 1.38	PhD 0.39
Employment Status	Employed	Not Working (But Still Connected to Work)	Unemployed					
Probability of being under poverty lines constructed based on 50%, 60% and 70% of median income	66.67 d50	0.47 d60	32.86 d70					
Health Status	Poor 5.53	Good 94.47						

Source: Authors estimations from TURKSTAT Household Budget Survey (TURKSTAT, n.d.).

Considering socio-economic status of the household heads, the gender distribution is notably skewed, with males comprising 85.7% and females only 14.3%. Marital status data shows that a vast majority (82.59%) of the population is married. Singles account for 3.68%, divorced individuals represent 3.98%, and widowed persons make up 9.75%.

Educational levels vary widely among the population. Primary school education is the most common, with 42.93% having completed this level. Secondary school graduates account for 13.2%, high school graduates 16.86%, and 2-year university graduates 4.5%. Higher education degrees are less common, with 8.83% holding 4-year university degrees, 1.38% with master's degrees, and a mere 0.39% possessing doctorates. Additionally, 11.91% have not completed school. Employment data indicates that 66.67% of the population is employed. A small fraction (0.47%) is not working but still connected to work, while 32.86% are not working. The probability of being below the poverty line varies based on the certain percentage of median income used to measure the poverty line. 10.7% of the households are under poverty line based on the 50% of the median income, while 15.94% and 22.03% of the households are under the poverty line measured using 60% and 70% of the median income respectively. Household heads who report a bad health status are 5.53% of the entire sample while the others report good health status.

2.2. Econometric Model

Households in Turkey do not make mutually exclusive choices among energy sources. Instead, they often use more than one type of energy simultaneously (electricity and wood, electricity and LPG, natural gas and electricity). Consequently, the multinomial logit model, which assumes mutually exclusive alternatives, is not suitable for the data structure and is therefore not employed.

In contrast, estimating separate binary logit models for each energy source allows us to capture households' simultaneous use of multiple energy types and avoids imposing the Independence of

Irrelevant Alternatives (IIA) restriction required by the multinomial logit model. Therefore, separate logit models were the more appropriate methodological approach for this analysis.

Using the variables described in Section 3.1, the role of poverty and health status in the use of different energy types is examined. To investigate this, it has been employed binary logistic regression models. These models are particularly appropriate for the analysis because the dependent variables in the current study are binary, indicating whether a household consumes a specific type of energy (electricity, natural gas, coal, wood, or dried dung). The use of separate logistic regression models for each dependent variable reflects the assumption that decision regarding the use of each energy type are made independently. Households either use or do not use a given type of energy independently of others' energy choices, making the logit model suitable for modeling the binary outcome of energy usage while accounting for the influence of various explanatory variables on each energy type individually.

The general form of the logistic regression model is expressed as follows:

$$\log \left(\frac{P(Y_i = 1)}{P(Y_i = 0)} \right) = \beta_0 + \beta_1 PovertyIndex_i + \beta_2 UnderPovertyLine_i + \beta_3 HealthStatus_i + \sum(\beta_k ControlVariables_{ik}) + \varepsilon_i \quad (1)$$

where $P(Y_i = 1)$ – the probability that household i uses the given type of energy; $P(Y_i = 0)$ – the probability that household i does not use the given type of energy; $\log \left(\frac{P(Y_i = 1)}{P(Y_i = 0)} \right)$ – the log-odds (logit) of energy use for household i ; β_0 – the intercept term, representing the baseline level of the log-odds when all explanatory variables take a value of zero; β_1 – the coefficient associated with the Poverty Index variable; $PovertyIndex_i$ – a variable measuring the level of poverty for household i ; β_2 – the coefficient associated with the Under Poverty Line indicator; $UnderPovertyLine_i$ – a binary variable indicating whether household i lives below the poverty line; β_3 – the coefficient associated with the Health Status variable; $HealthStatus_i$ – a variable capturing the health status of household i ; β_k – the coefficients associated with the control variables, accounting for additional factors influencing energy use; $ControlVariables_{ik}$ – a summation term representing the combined effect of additional control variables; ε_i – the error term, capturing unobserved factors affecting energy use for household i .

For each energy type (electricity, natural gas, coal, wood and dung), the following logit models are specified:

$$\log \left(\frac{P(Electricity_i = 1)}{P(Electricity_i = 0)} \right) = \beta_0 + \beta_1 PovertyIndex_i + \beta_2 UnderPovertyLine_i + \beta_3 HealthStatus_i + \sum(\beta_k ControlVariables_{ik}) + \varepsilon_i \quad (2)$$

$$\log \left(\frac{P(Wood_i = 1)}{P(Wood_i = 0)} \right) = \beta_0 + \beta_1 PovertyIndex_i + \beta_2 UnderPovertyLine_i + \beta_3 HealthStatus_i + \sum(\beta_k ControlVariables_{ik}) + \varepsilon_i \quad (3)$$

$$\log \left(\frac{P(Dung_i = 1)}{P(Dung_i = 0)} \right) = \beta_0 + \beta_1 PovertyIndex_i + \beta_2 UnderPovertyLine_i + \beta_3 HealthStatus_i + \sum(\beta_k ControlVariables_{ik}) + \varepsilon_i \quad (4)$$

$$\log \left(\frac{P(NaturalGas_i = 1)}{P(NaturalGas_i = 0)} \right) = \beta_0 + \beta_1 PovertyIndex_i + \beta_2 UnderPovertyLine_i + \beta_3 HealthStatus_i + \sum(\beta_k ControlVariables_{ik}) + \varepsilon_i \quad (5)$$

$$\log \left(\frac{P(Coal_i = 1)}{P(Coal_i = 0)} \right) = \beta_0 + \beta_1 PovertyIndex_i + \beta_2 UnderPovertyLine_i + \beta_3 HealthStatus_i + \sum(\beta_k ControlVariables_{ik}) + \varepsilon_i \quad (6)$$

where $\log \left(\frac{P(\text{Electricity}_i = 1)}{P(\text{Electricity}_i = 0)} \right)$ – logarithm of the odds (log-odds) of electricity use by a household; $\log \left(\frac{P(\text{Wood}_i = 1)}{P(\text{Wood}_i = 0)} \right)$ – logarithm of the odds (log-odds) of wood use by a household; $\log \left(\frac{P(\text{Dung}_i = 1)}{P(\text{Dung}_i = 0)} \right)$ – logarithm of the odds (log-odds) of dung use by a household; $\log \left(\frac{P(\text{NaturalGas}_i = 1)}{P(\text{NaturalGas}_i = 0)} \right)$ – logarithm of the odds (log-odds) of natural gas use by a household; $\log \left(\frac{P(\text{Coal}_i = 1)}{P(\text{Coal}_i = 0)} \right)$ – logarithm of the odds (log-odds) of coal use by a household.

In equations, the first independent variable of interest is the poverty index. The poverty index was constructed using multidimensional indicators reflecting household living standards. The variables included in the index were selected from the Household Budget Survey to represent different aspects of poverty. These indicators cover housing quality—such as the presence of a bathroom, toilet, kitchen, balcony, garden, children’s play area, sauna, jacuzzi, security system, elevator, garage, swimming pool, generator, underfloor heating, central heating, natural gas, piped water systems and hot water availability. They also include ownership of durable goods and technological equipment, such as waste grinders, refrigerators, deep freezers, washing machines, tumble dryers, microwave ovens, air conditioners, carpet cleaners, game consoles, panel televisions, video cameras, satellite dishes, telephones, mobile phones, computers and internet connections. In addition, indicators of property ownership (including residences, apartments, summer houses, land, fields, greenhouses, vineyards, shops and hotels) and vehicle ownership (cars, motorcycles and watercraft) were incorporated. Finally, the index reflects broader aspects of living standards, including household expenditure capacity, savings behaviour, and the ability to take holidays. These indicators were coded as 0 = owned, 1 = not owned. Factor analysis was then applied to summarize this large number of variables into a single latent poverty dimension, and a poverty score was predicted for each household. The resulting score indicates that higher values correspond to higher levels of poverty. This method is widely used in the literature for multidimensional poverty measurement and provides a more comprehensive reflection of household living standards compared to income- or consumption-based measures alone. It is expected that households with a higher poverty index (indicating better economic status) are less likely to use traditional energy sources such as wood or dung, and more likely to use modern energy sources such as electricity and natural gas. Underpovertyline is the second independent variable of interest which also represents the poverty status of the household. It is a binary variable indicating whether a household is below a poverty line. It is hypothesised that being below the poverty line increases the likelihood of using cheaper and more traditional energy sources, such as wood and dung, while decreasing the likelihood of using more expensive energy sources like electricity and natural gas. The third main independent variable of interest is the health status of the household head, whose influence on energy consumption types is examined. For instance, households with poor health status often show a preference for cleaner energy sources such as electricity and natural gas, as these reduce exposure to health risks associated with traditional fuels like coal and dung. The health status variable is self-reported, based on the household head’s own assessment of their overall health. Although self-reported measures are subject to perceptual bias, they still offer valuable insight into the relationship between health conditions and household energy choices.

In modelling household energy choices, it has been controlled socio-economic, demographic and dwelling characteristics that the literature identifies as key determinants of residential energy demand. Household income is incorporated to reflect affordability constraints central to the energy ladder hypothesis, where higher-income households transition toward modern fuels (Hosier & Dowd, 1987). Dwelling-related variables—heating system type, dwelling size and building age—capture technological constraints and structural features shaping feasible fuel use, as older or poorly insulated homes typically rely more on solid fuels, while newer buildings are linked to modern systems and natural gas infrastructure (Yohanis et al., 2008; Ari et al., 2016). Household composition and housing tenure are included to reflect differences in energy needs and investment incentives, as

families with children, extended households and tenants demonstrate systematically different heating practices (Koç et al., 2015; İpek & İpek, 2022). Likewise, the gender, age, marital status, education and employment status of the household head account for behavioural and socio-economic factors influencing technology adoption, awareness of health risks and heating routines (Suganthi & Samuel, 2012; Karaaslan & Algül, 2023).

3. Research results

In this study, it has been aimed to investigate the role of poverty status and health status on household energy consumption in Turkey using equations (2)-(6). The results of this analysis provide a basis for the development of policy measures, such as energy subsidies or incentives for clean fuel, targeted at households according to their poverty and health conditions. In regressions, poverty situation is represented by two different variables. The first is the povertyindex that is a continuous variable and the second is a binary variable (underpovertyline), indicating whether the household is below a poverty line or not. It has been measured three different poverty lines based on 50%, 60% and 70% of the median income respectively. Therefore, each equation (2)-(6) is estimated using three different binary variables so that a total of 15 models are analyzed to examine the role of poverty in the consumption of five different types of energy, which are electricity, dried dung, wood, coal and natural gas. Moreover, the health-status of the household head is also included in the models as an additional covariate of interest. In addition to poverty status, the relationship between health status and fuel type preferences is analysed. When energy and health policies are considered jointly, the separate inclusion of health status in the model supports the development of more effective policy strategies. All logit models are estimated using heteroskedasticity-robust standard errors. Since the Household Budget Survey is a cross-sectional dataset in which each observation represents an independent household unit, there are no repeated household observations or a panel structure that would require the use of clustered standard errors. Therefore, robust standard errors are methodologically more appropriate for this analysis.

To account for macro-level shocks arising across years, year fixed effects are included in all models. This approach strengthens the explanatory power of the models and isolates the influence of time-specific factors.

The entire set of estimation results has been presented in six different tables. Tables 4 and 5 present the estimation results for the models in which the binary poverty indicator is defined using a poverty line set at 50% of the median income. Table 4 reports the marginal effects derived from logit models (2)–(4), where the dependent variables correspond to electricity, dung and wood consumption. These results provide insights into how poverty status and other socio-economic characteristics influence the use of energy sources.

Table 4. Marginal effects from logit models for electricity, dried dung and wood using poverty variable defined by 50% of median income.

Independent Variables	(1)	(2)	(3)	(4)	(5)	(6)
	Electricity	Electricity	Dung	Dung	Wood	Wood
Household Income	0.469*** (0.09)	0.464*** (0.09)	-0.136 (0.12)	-0.135 (0.12)	0.022 (0.04)	0.021 (0.04)
Base Category: Heating system (radiator)						
Heating system (Stove)	0.166*** (0.01)	0.166*** (0.01)	0.017*** (0.00)	0.017*** (0.00)	0.467*** (0.01)	0.467*** (0.01)
Heating system (Air conditioner)	0.963*** (0.01)	0.962*** (0.01)	0.000 (.)	0.000 (.)	-0.014*** (0.00)	-0.014*** (0.00)
Dwelling size -m2	-0.000*** (0.00)	-0.000*** (0.00)	0.000*** (0.00)	0.000*** (0.00)	0.000*** (0.00)	0.000*** (0.00)
Base Category: Age of Dwelling - (Pre-1945)						
Age of Dwelling - (1946-1960)	-0.000 (0.00)	-0.000 (0.00)	-0.012** (0.00)	-0.012** (0.00)	0.009 (0.01)	0.008 (0.01)
Age of Dwelling - (1961-1970)	-0.000 (0.00)	-0.000 (0.00)	-0.012** (0.00)	-0.012** (0.00)	0.007 (0.01)	0.007 (0.01)

Age of Dwelling – (1971-1980)	0.000 (0.00)	0.000 (0.00)	-0.012** (0.00)	-0.012** (0.00)	-0.003 (0.01)	-0.003 (0.01)
Age of Dwelling – (1981-1990)	0.004 (0.00)	0.004 (0.00)	-0.012** (0.00)	-0.012** (0.00)	-0.002 (0.01)	-0.002 (0.01)
Age of Dwelling – (1991-2000)	0.009 (0.00)	0.008 (0.00)	-0.006 (0.00)	-0.006 (0.00)	-0.002 (0.01)	-0.002 (0.01)
Age of Dwelling –(2001-2005)	0.009 (0.00)	0.009 (0.00)	-0.009* (0.00)	-0.009 (0.00)	-0.003 (0.01)	-0.003 (0.01)
Age of Dwelling –(Post 2005)	0.015** (0.00)	0.015** (0.00)	-0.003 (0.00)	-0.003 (0.00)	-0.025* (0.01)	-0.025* (0.01)
Base Category: Couple without resident children						
Couple with at least one resident child	-0.004 (0.00)	-0.004 (0.00)	0.010*** (0.00)	0.010*** (0.00)	-0.007 (0.00)	-0.006 (0.00)
Lone parents with at least one resident child	0.019*** (0.00)	0.019*** (0.00)	-0.001 (0.00)	-0.001 (0.00)	-0.022** (0.01)	-0.022** (0.01)
At Least One Nuclear Family and Other Persons	-0.008*** (0.00)	-0.008*** (0.00)	0.014*** (0.00)	0.014*** (0.00)	-0.016** (0.01)	-0.016** (0.01)
Multiple Persons without a Nuclear Family	0.027** (0.01)	0.026** (0.01)	-0.003 (0.01)	-0.003 (0.01)	-0.056* (0.02)	-0.056* (0.02)
Base Category: Homeowner						
Tenant	0.029*** (0.00)	0.029*** (0.00)	-0.017*** (0.00)	-0.017*** (0.00)	-0.045*** (0.00)	-0.044*** (0.00)
Lodging	0.006 (0.01)	0.006 (0.01)	0.000 (.)	0.000 (.)	0.023 (0.02)	0.024 (0.02)
Not owner but also not paying rent	0.002 (0.00)	0.002 (0.00)	-0.002 (0.00)	-0.002 (0.00)	0.010* (0.00)	0.010* (0.00)
Base Category: Gender-Male						
Female	-0.004 (0.00)	-0.004 (0.00)	-0.006 (0.00)	-0.006 (0.00)	0.004 (0.01)	0.003 (0.01)
Base Category: Single						
Married	-0.015** (0.01)	-0.015** (0.01)	0.003 (0.00)	0.003 (0.00)	0.016 (0.01)	0.016 (0.01)
Divorced	0.006 (0.01)	0.005 (0.01)	-0.008 (0.01)	-0.007 (0.01)	-0.019 (0.01)	-0.019 (0.01)
Widowed	-0.014** (0.01)	-0.014** (0.01)	0.001 (0.01)	0.001 (0.01)	0.015 (0.01)	0.015 (0.01)
Age	0.000 (0.00)	0.000 (0.00)	-0.001*** (0.00)	-0.001*** (0.00)	0.001*** (0.00)	0.001*** (0.00)
Base Category: Not completed any school						
Primary School	-0.004 (0.00)	-0.004 (0.00)	-0.014*** (0.00)	-0.013*** (0.00)	0.036*** (0.01)	0.035*** (0.01)
Secondary School	0.007* (0.00)	0.007* (0.00)	-0.018*** (0.00)	-0.017*** (0.00)	0.024*** (0.01)	0.024*** (0.01)
High School	0.010** (0.00)	0.010** (0.00)	-0.021*** (0.00)	-0.021*** (0.00)	0.016* (0.01)	0.015* (0.01)
Vocational School	0.012* (0.01)	0.012* (0.01)	-0.028*** (0.00)	-0.028*** (0.00)	0.005 (0.01)	0.005 (0.01)
Bachelor	0.019** (0.01)	0.018** (0.01)	-0.027*** (0.00)	-0.027*** (0.00)	-0.029* (0.01)	-0.030* (0.01)
Masters Degree	0.041** (0.01)	0.040** (0.01)	0.000 (.)	0.000 (.)	-0.066 (0.04)	-0.066 (0.04)
Ph.D	-0.022*** (0.00)	-0.022*** (0.00)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)
Base Category: Employment Status (Employed)						
Not Working (But Still Connected to Work)	0.001 (0.01)	0.001 (0.01)	0.007 (0.01)	0.007 (0.01)	-0.014 (0.02)	-0.014 (0.02)
Unemployed	0.011*** (0.00)	0.011*** (0.00)	-0.003* (0.00)	-0.004* (0.00)	-0.026*** (0.00)	-0.025*** (0.00)
Poverty Index	0.025*** (0.00)	0.025*** (0.00)	-0.026*** (0.00)	-0.026*** (0.00)	-0.067*** (0.00)	-0.067*** (0.00)
Base Category: Being above 50% of the median income						
d_50 (Being below 50% of the median income)	-0.001 (0.00)	-0.001 (0.00)	0.007** (0.00)	0.006** (0.00)	-0.013* (0.01)	-0.013* (0.01)
Base Category: Health Status (Poor)						
Health Status (good)		0.007* (0.00)		-0.004 (0.00)		0.009 (0.01)

N	45704	45704	42707	42707	45523	45523
Log-likelihood	-3782.83	-3780.40	-2667.14	-2665.83	-15098.64	-15097.61
Pseudo R ²	0.615	0.616	0.302	0.303	0.471	0.471
AIC	7639.67	7636.81	5400.29	5399.65	30269.29	30269.23
BIC	7962.68	7968.54	5686.14	5694.16	30583.42	30592.09
Mean VIF	3.27	3.21	3.27	3.21	3.27	3.21

Notes: *, **, *** symbols indicate the significance of the coefficients at the 10%, 5% and 1% levels of significance, respectively. (1)–(6) refer to different model specifications. Each model uses the same set of independent variables, presented in the first columns of the tables. Each column display both the model number and its corresponding dependent variable (wood, dung etc). Model (2), model (4), and model (6) aim at estimating additionally the role of health status (good health) of household head on the consumption of electricity, dung and wood. Year fixed effects are controlled.

Source: Own calculations.

Table 5 presents the marginal effects from logit models (5)–(6), focusing on coal and natural gas consumption as dependent variables. The estimates reported in this table highlight the role of poverty and household characteristics in shaping the choice between relatively cleaner fuels, such as natural gas, and more polluting alternatives, such as coal.

Table 5. Marginal effects from logit models for coal and natural gas using the poverty variable defined by 50% of median income.

Independent Variables	(1)	(2)	(3)	(4)
	Coal	Coal	Natural Gas	Natural Gas
Household Income	-0.013** (0.00)	-0.013** (0.00)	-0.016*** (0.00)	-0.016*** (0.00)
Base Category: Heating system (radiator)				
Heating system (Stove)	0.036*** (0.01)	0.036*** (0.01)	-0.166*** (0.00)	-0.166*** (0.00)
Heating system (Air conditioner)	-0.777*** (0.10)	-0.777*** (0.10)	-0.493*** (0.06)	-0.493*** (0.06)
Dwelling size -m2	0.001*** (0.00)	0.001*** (0.00)	-0.001*** (0.00)	-0.001*** (0.00)
Base Category: Age of Dwelling - (Pre-1945)				
Age of Dwelling -(1946-1960)	0.015 (0.01)	0.015 (0.01)	0.011 (0.02)	0.011 (0.02)
Age of Dwelling – (1961-1970)	0.031* (0.01)	0.031* (0.01)	0.021 (0.01)	0.022 (0.01)
Age of Dwelling – (1971-1980)	0.039** (0.01)	0.039** (0.01)	0.026 (0.01)	0.026 (0.01)
Age of Dwelling – (1981-1990)	0.037** (0.01)	0.037** (0.01)	0.021 (0.01)	0.022 (0.01)
Age of Dwelling – (1991-2000)	0.039** (0.01)	0.039** (0.01)	0.014 (0.01)	0.014 (0.01)
Age of Dwelling –(2001-2005)	0.065*** (0.01)	0.065*** (0.01)	-0.012 (0.01)	-0.012 (0.01)
Age of Dwelling –(Post 2005)	0.080*** (0.01)	0.080*** (0.01)	-0.030* (0.01)	-0.030* (0.01)
Base Category: Couple without resident children				
Couple with at least one resident child	0.016** (0.01)	0.016** (0.01)	-0.017*** (0.00)	-0.017*** (0.00)
Lone parents with at least one resident child	0.001 (0.01)	0.001 (0.01)	-0.011 (0.01)	-0.011 (0.01)
At Least One Nuclear Family and Other Persons	0.026*** (0.01)	0.026*** (0.01)	-0.024*** (0.00)	-0.024*** (0.00)
Multiple Persons without a Nuclear Family	0.016 (0.02)	0.016 (0.02)	-0.012 (0.01)	-0.012 (0.01)
Base Category: Homeowner				
Tenant	0.024*** (0.01)	0.024*** (0.01)	0.038*** (0.00)	0.038*** (0.00)
Lodging	0.097*** (0.01)	0.097*** (0.01)	-0.088*** (0.01)	-0.088*** (0.01)
Not owner but also not paying rent	0.006 (0.01)	0.006 (0.01)	0.023*** (0.00)	0.023*** (0.00)
Base Category: Gender-Male				

Female	0.015 (0.01)	0.015 (0.01)	-0.010 (0.01)	-0.010 (0.01)
Base Category: Single				
Married	0.032* (0.01)	0.032* (0.01)	-0.011 (0.01)	-0.011 (0.01)
Divorced	-0.003 (0.01)	-0.003 (0.01)	0.012 (0.01)	0.012 (0.01)
Widowed	0.029* (0.01)	0.029* (0.01)	0.011 (0.01)	0.011 (0.01)
Age	-0.000* (0.00)	-0.000* (0.00)	-0.001*** (0.00)	-0.001*** (0.00)
Base Category: Not completed any school				
Primary School	0.004 (0.01)	0.005 (0.01)	-0.013** (0.00)	-0.013* (0.01)
Secondary School	0.017* (0.01)	0.017* (0.01)	-0.019** (0.01)	-0.018** (0.01)
High School	0.048*** (0.01)	0.048*** (0.01)	-0.050*** (0.01)	-0.050*** (0.01)
Vocational School	0.079*** (0.01)	0.079*** (0.01)	-0.078*** (0.01)	-0.077*** (0.01)
Bachelor	0.075*** (0.01)	0.075*** (0.01)	-0.088*** (0.01)	-0.087*** (0.01)
Masters Degree	0.064** (0.02)	0.064** (0.02)	-0.091*** (0.01)	-0.091*** (0.01)
Ph.D	0.012 (0.04)	0.012 (0.04)	-0.065*** (0.02)	-0.064*** (0.02)
Base Category: Employment Status (Employed)				
Not Working (But Still Connected to Work)	0.034 (0.02)	0.034 (0.02)	-0.011 (0.02)	-0.012 (0.02)
Unemployed	0.008 (0.00)	0.008 (0.00)	0.022*** (0.00)	0.022*** (0.00)
Poverty Index	-0.109*** (0.00)	-0.109*** (0.00)	0.188*** (0.00)	0.188*** (0.00)
Base Category: Being above 50% of the median income				
d_50 (Being below 50% of the median income)	-0.050*** (0.01)	-0.050*** (0.01)	-0.046*** (0.01)	-0.046*** (0.01)
Base Category: Health Status (Poor)				
Health Status (good)		-0.001 (0.01)		-0.012* (0.01)
N	45704	45704	45704	45704
Log-likelihood	-20976.59	-20976.59	-9316.58	-9314.55
Pseudo R ²	0.111	0.111	0.695	0.695
AIC	42027.19	42029.17	18707.15	18705.10
BIC	42350.19	42360.91	19030.16	19036.83
Mean VIF	3.27	3.21	3.27	3.21

Notes: *, **, *** symbols indicate the significance of the coefficients at the 10%, 5% and 1% levels of significance, respectively. (1)–(4) refer to different model specifications. Each model uses the same set of independent variables, presented in the first columns of the tables. Each column display both the model number and its corresponding dependent variable (coal, natural gas etc). Model (2) and model (4) aim at estimating additionally the role of health status (good health) of household head on the consumption of coal and natural gas. Year fixed effects are controlled.

Source: Own calculations.

As explained in the previous section, there are two indicators of poverty in the models. The first one is the binary variable (underpovertyline), constructed using three different poverty lines and the second one is the poverty index. Tables 4 and 5 show that an increase in wealth (positive coefficient estimate of poverty index means increase in wealth or reduction in poverty) is associated with higher consumption of electricity and natural gas, while demand for dung, coal and wood declines as wealth rises or poverty decreases.

Considering the binary variable for being below the poverty line (based on 50% of the median income) also reduces the consumption of coal and wood, indicating that people who are below the poverty line calculated based on the 50% median income choose to use the cheapest energy types such as dried dung.

Tables 6 and 7 present the marginal effects where the binary poverty variable is created using the poverty line established based on 60% of the median income.

Table 6. Marginal effects from logit models for electricity, dried dung and wood using poverty variable defined by 60% of median income.

Independent Variables	(1)	(2)	(3)	(4)	(5)	(6)
	Electricity	Electricity	Dung	Dung	Wood	Wood
Household Income	0.009*** (0.00)	0.009*** (0.00)	-0.002 (0.00)	-0.002 (0.00)	0.002 (0.00)	0.002 (0.00)
Base Category: Heating system (radiator)						
Heating system (Stove)	0.166*** (0.01)	0.166*** (0.01)	0.017*** (0.00)	0.017*** (0.00)	0.467*** (0.01)	0.467*** (0.01)
Heating system (Air conditioner)	0.962*** (0.01)	0.962*** (0.01)	0.000 (.)	0.000 (.)	-0.014*** (0.00)	-0.014*** (0.00)
Dwelling size -m2	-0.000*** (0.00)	-0.000*** (0.00)	0.000*** (0.00)	0.000*** (0.00)	0.000*** (0.00)	0.000*** (0.00)
Base Category: Age of Dwelling - (Pre-1945)						
Age of Dwelling -(1946-1960)	-0.000 (0.00)	-0.000 (0.00)	-0.012** (0.00)	-0.012** (0.00)	0.009 (0.01)	0.008 (0.01)
Age of Dwelling – (1961-1970)	-0.000 (0.00)	-0.000 (0.00)	-0.012** (0.00)	-0.012** (0.00)	0.008 (0.01)	0.008 (0.01)
Age of Dwelling – (1971-1980)	0.000 (0.00)	-0.000 (0.00)	-0.012** (0.00)	-0.012** (0.00)	-0.003 (0.01)	-0.003 (0.01)
Age of Dwelling – (1981-1990)	0.004 (0.00)	0.004 (0.00)	-0.012** (0.00)	-0.012** (0.00)	-0.002 (0.01)	-0.002 (0.01)
Age of Dwelling – (1991-2000)	0.008 (0.00)	0.008 (0.00)	-0.007 (0.00)	-0.007 (0.00)	-0.002 (0.01)	-0.002 (0.01)
Age of Dwelling –(2001-2005)	0.009 (0.00)	0.009 (0.00)	-0.009* (0.00)	-0.009* (0.00)	-0.002 (0.01)	-0.003 (0.01)
Age of Dwelling –(Post 2005)	0.015** (0.00)	0.015** (0.00)	-0.003 (0.00)	-0.003 (0.00)	-0.025* (0.01)	-0.025* (0.01)
Base Category: Couple without resident children						
Couple with at least one resident child	-0.004 (0.00)	-0.004 (0.00)	0.010*** (0.00)	0.010*** (0.00)	-0.006 (0.00)	-0.006 (0.00)
Lone parents with at least one resident child	0.019*** (0.00)	0.020*** (0.00)	-0.001 (0.00)	-0.001 (0.00)	-0.022** (0.01)	-0.022** (0.01)
At Least One Nuclear Family and Other Persons	-0.008*** (0.00)	-0.008*** (0.00)	0.014*** (0.00)	0.014*** (0.00)	-0.016** (0.01)	-0.016** (0.01)
Multiple Persons without a Nuclear Family	0.027** (0.01)	0.027** (0.01)	-0.003 (0.01)	-0.003 (0.01)	-0.056* (0.02)	-0.056* (0.02)
Base Category: Homeowner						
Tenant	0.029*** (0.00)	0.029*** (0.00)	-0.017*** (0.00)	-0.017*** (0.00)	-0.044*** (0.00)	-0.044*** (0.00)
Lodging	0.006 (0.01)	0.006 (0.01)	0.000 (.)	0.000 (.)	0.023 (0.02)	0.023 (0.02)
Not owner but also not paying rent	0.002 (0.00)	0.002 (0.00)	-0.002 (0.00)	-0.002 (0.00)	0.010* (0.00)	0.010* (0.00)
Base Category: Gender-Male						
Female	-0.004 (0.00)	-0.004 (0.00)	-0.006 (0.00)	-0.006 (0.00)	0.004 (0.01)	0.003 (0.01)
Base Category: Single						
Married	-0.015** (0.01)	-0.015** (0.01)	0.003 (0.00)	0.003 (0.00)	0.016 (0.01)	0.016 (0.01)
Divorced	0.006 (0.01)	0.005 (0.01)	-0.008 (0.01)	-0.007 (0.01)	-0.019 (0.01)	-0.019 (0.01)
Widowed	-0.014** (0.01)	-0.014** (0.01)	0.001 (0.01)	0.002 (0.01)	0.015 (0.01)	0.015 (0.01)
Age	0.000 (0.00)	0.000 (0.00)	-0.001*** (0.00)	-0.001*** (0.00)	0.001*** (0.00)	0.001*** (0.00)
Base Category: Not completed any school						
Primary School	-0.004 (0.00)	-0.004 (0.00)	-0.013*** (0.00)	-0.013*** (0.00)	0.036*** (0.01)	0.035*** (0.01)
Secondary School	0.007* (0.00)	0.007* (0.00)	-0.017*** (0.00)	-0.017*** (0.00)	0.024*** (0.01)	0.024*** (0.01)

High School	0.010** (0.00)	0.010** (0.00)	-0.021*** (0.00)	-0.021*** (0.00)	0.016* (0.01)	0.015* (0.01)
Vocational School	0.012* (0.01)	0.012* (0.01)	-0.028*** (0.00)	-0.027*** (0.00)	0.005 (0.01)	0.004 (0.01)
Bachelor	0.019** (0.01)	0.019** (0.01)	-0.027*** (0.00)	-0.027*** (0.00)	-0.030* (0.01)	-0.030* (0.01)
Masters Degree	0.041** (0.01)	0.041** (0.01)	0.000 (.)	0.000 (.)	-0.066 (0.04)	-0.067 (0.04)
Ph.D	-0.022*** (0.00)	-0.022*** (0.00)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)
Base Category: Employment Status (Employed)						
Not Working (But Still Connected to Work)	0.001 (0.01)	0.001 (0.01)	0.007 (0.01)	0.007 (0.01)	-0.014 (0.02)	-0.014 (0.02)
Unemployed	0.011*** (0.00)	0.011*** (0.00)	-0.003* (0.00)	-0.004* (0.00)	-0.026*** (0.00)	-0.025*** (0.00)
Poverty Index	0.025*** (0.00)	0.025*** (0.00)	-0.026*** (0.00)	-0.026*** (0.00)	-0.067*** (0.00)	-0.067*** (0.00)
Base Category: Being above 50% of the median income						
d_50 (Being below 50% of the median income)	-0.003 (0.00)	-0.003 (0.00)	0.006** (0.00)	0.006** (0.00)	-0.012* (0.01)	-0.012* (0.01)
Base Category: Health Status (Poor)						
Health Status (good)		0.007* (0.00)		-0.004 (0.00)		0.009 (0.01)
N	45704	45704	42707	42707	45523	45523
Log-likelihood	-3782.33	-3779.92	-2667.74	-2666.27	-15099.03	-15097.95
Pseudo R ²	0.615	0.616	0.302	0.303	0.471	0.471
AIC	7638.66	7635.83	5401.48	5400.55	30270.05	30269.91
BIC	7961.66	7967.57	5687.33	5695.06	30584.19	30592.77
Mean VIF	3.28	3.22	3.28	3.22		

Notes: *, **, *** symbols indicate the significance of the coefficients at the 10%, 5% and 1% levels of significance, respectively. (1)–(6) refer to different model specifications. Each model uses the same set of independent variables, presented in the first columns of the tables. Each column display both the model number and its corresponding dependent variable (wood, dung etc). Model (2), model (4), and model (6) aim at estimating additionally the role of health status (good health) of household head on the consumption of electricity, dung and wood. Year fixed effects are controlled. Source: Own calculations.

Similarly, Table 6 shows the results for electricity, dung and wood consumption, while Table 7 represents the marginal effects where dependent variables are natural gas and coal consumption. Similar to the previous results, households below 60% of the median income experience an increase in dried dung consumption in comparison to those above this income level.

Table 7. Marginal effects from logit models for coal and natural gas using poverty variable defined by 60% of median income.

Independent Variables	(1)	(2)	(3)	(4)
	Coal	Coal	Natural Gas	Natural Gas
Household Income	-0.012** (0.00)	-0.012** (0.00)	-0.015*** (0.00)	-0.015*** (0.00)
Base Category: Heating system (radiator)				
Heating system (Stove)	0.038*** (0.01)	0.038*** (0.01)	-0.303*** (0.01)	-0.303*** (0.01)
Heating system (Air conditioner)	-0.193*** (0.01)	-0.193*** (0.01)	-0.493*** (0.01)	-0.493*** (0.01)
Dwelling size -m2	0.001*** (0.00)	0.001*** (0.00)	-0.001*** (0.00)	-0.001*** (0.00)
Base Category: Age of Dwelling - (Pre-1945)				
Age of Dwelling - (1946-1960)	0.014 (0.01)	0.014 (0.01)	0.011 (0.02)	0.011 (0.02)
Age of Dwelling – (1961-1970)	0.029* (0.01)	0.029* (0.01)	0.021 (0.01)	0.021 (0.01)
Age of Dwelling – (1971-1980)	0.037** (0.01)	0.037** (0.01)	0.024 (0.01)	0.025 (0.01)
Age of Dwelling – (1981-1990)	0.034** (0.01)	0.034** (0.01)	0.020 (0.01)	0.021 (0.01)

Age of Dwelling – (1991-2000)	0.036** (0.01)	0.036** (0.01)	0.013 (0.01)	0.013 (0.01)
Age of Dwelling –(2001-2005)	0.063*** (0.01)	0.063*** (0.01)	-0.012 (0.01)	-0.012 (0.01)
Age of Dwelling –(Post 2005)	0.078*** (0.01)	0.078*** (0.01)	-0.030* (0.01)	-0.030* (0.01)
Base Category: Couple without resident children				
Couple with at least one resident child	0.016** (0.01)	0.016** (0.01)	-0.017*** (0.00)	-0.017*** (0.00)
Lone parents with at least one resident child	0.001 (0.01)	0.001 (0.01)	-0.011 (0.01)	-0.011 (0.01)
At Least One Nuclear Family and Other Persons	0.027*** (0.01)	0.027*** (0.01)	-0.023*** (0.00)	-0.023*** (0.00)
Multiple Persons without a Nuclear Family	0.016 (0.02)	0.016 (0.02)	-0.012 (0.01)	-0.012 (0.01)
Base Category: Homeowner				
Tenant	0.025*** (0.01)	0.025*** (0.01)	0.037*** (0.00)	0.037*** (0.00)
Lodging	0.109*** (0.02)	0.109*** (0.02)	-0.107*** (0.01)	-0.107*** (0.01)
Not owner but also not paying rent	0.006 (0.01)	0.006 (0.01)	0.023*** (0.00)	0.023*** (0.00)
Base Category: Gender-Male				
Female	0.016 (0.01)	0.016 (0.01)	-0.010 (0.01)	-0.010 (0.01)
Base Category: Single				
Married	0.031** (0.01)	0.031** (0.01)	-0.011 (0.01)	-0.011 (0.01)
Divorced	-0.003 (0.01)	-0.003 (0.01)	0.011 (0.01)	0.011 (0.01)
Widowed	0.028* (0.01)	0.028* (0.01)	0.011 (0.01)	0.011 (0.01)
Age	-0.000* (0.00)	-0.000* (0.00)	-0.001*** (0.00)	-0.001*** (0.00)
Base Category: Not completed any school				
Primary School	0.004 (0.01)	0.004 (0.01)	-0.012** (0.00)	-0.011** (0.00)
Secondary School	0.016* (0.01)	0.016* (0.01)	-0.016*** (0.00)	-0.016** (0.00)
High School	0.048*** (0.01)	0.048*** (0.01)	-0.046*** (0.00)	-0.046*** (0.00)
Vocational School	0.082*** (0.01)	0.082*** (0.01)	-0.076*** (0.01)	-0.076*** (0.01)
Bachelor	0.076*** (0.01)	0.076*** (0.01)	-0.087*** (0.01)	-0.087*** (0.01)
Masters Degree	0.064** (0.02)	0.064** (0.02)	-0.091*** (0.01)	-0.091*** (0.01)
Ph.D	0.010 (0.04)	0.010 (0.04)	-0.062** (0.02)	-0.061** (0.02)
Base Category: Employment Status (Employed)				
Not Working (But Still Connected to Work)	0.034 (0.03)	0.034 (0.03)	-0.012 (0.02)	-0.013 (0.02)
Unemployed	0.008 (0.00)	0.008 (0.00)	0.022*** (0.00)	0.021*** (0.00)
Poverty Index	-0.109*** (0.00)	-0.109*** (0.00)	0.187*** (0.00)	0.187*** (0.00)
Base Category: Being above 50% of the median income				
d_50 (Being below 50% of the median income)	-0.040*** (0.01)	-0.040*** (0.01)	-0.029*** (0.00)	-0.029*** (0.00)
Base Category: Health Status (Poor)				
Health Status (good)		-0.000 (0.01)		-0.012* (0.01)
N	45704	45704	45704	45704
Log-likelihood	-20982.43	-20982.43	-9325.59	-9323.60
Pseudo R^2	0.11	0.11	0.69	0.70
AIC	42038.85	42040.85	18725.17	18723.20

BIC	42361.86	42372.59	19048.18	19054.94
Mean VIF	3.28	3.22	3.28	3.22

Notes: *, **, *** symbols indicate the significance of the coefficients at the 10%, 5% and 1% levels of significance, respectively. (1)–(4) refer to different model specifications. Each model uses the same set of independent variables, presented in the first columns of the tables. Each column display both the model number and its corresponding dependent variable (coal, natural gas etc). Model (2) and model (4) aim at estimating also the role of health status (good health) of household head on the consumption of coal and natural gas. Year fixed effects are controlled.

Source: Own calculations.

In contrast, households that earn less than 60% of the median income have a lower consumption of wood, coal, and natural gas than those that earn more than this amount. Those different types of energy consumption for households that earn less than 70% of the median income is similar as well. Results for binary poverty variable established using 70% of the median income are available at Tables 8 and 9.

Table 8. Marginal effects from logit models for coal and natural gas using poverty variable defined by 70% of median income.

Independent Variables	(1)	(2)	(3)	(4)	(5)	(6)
	Electricity	Electricity	Dung	Dung	Wood	Wood
Household Income	0.008*** (0.00)	0.007*** (0.00)	-0.004* (0.00)	-0.004* (0.00)	0.007 (0.00)	0.007 (0.00)
Base Category: Heating system (radiator)						
Heating system (Stove)	0.166*** (0.01)	0.165*** (0.01)	0.017*** (0.00)	0.017*** (0.00)	0.468*** (0.01)	0.468*** (0.01)
Heating system (Air conditioner)	0.962*** (0.01)	0.962*** (0.01)	0.000 (.)	0.000 (.)	-0.014*** (0.00)	-0.014*** (0.00)
Dwelling size -m2	-0.000** (0.00)	-0.000*** (0.00)	0.000*** (0.00)	0.000*** (0.00)	0.000*** (0.00)	0.000*** (0.00)
Base Category: Age of Dwelling - (Pre-1945)						
Age of Dwelling -(1946-1960)	-0.000 (0.00)	-0.000 (0.00)	-0.012** (0.00)	-0.012** (0.00)	0.009 (0.01)	0.009 (0.01)
Age of Dwelling – (1961-1970)	-0.000 (0.00)	-0.000 (0.00)	-0.012** (0.00)	-0.012** (0.00)	0.008 (0.01)	0.008 (0.01)
Age of Dwelling – (1971-1980)	0.000 (0.00)	-0.000 (0.00)	-0.012** (0.00)	-0.012** (0.00)	-0.002 (0.01)	-0.003 (0.01)
Age of Dwelling – (1981-1990)	0.004 (0.00)	0.004 (0.00)	-0.012** (0.00)	-0.012** (0.00)	-0.001 (0.01)	-0.002 (0.01)
Age of Dwelling – (1991-2000)	0.008 (0.00)	0.008 (0.00)	-0.007 (0.00)	-0.007 (0.00)	-0.002 (0.01)	-0.002 (0.01)
Age of Dwelling –(2001-2005)	0.009 (0.00)	0.009 (0.00)	-0.009* (0.00)	-0.009* (0.00)	-0.002 (0.01)	-0.002 (0.01)
Age of Dwelling –(Post 2005)	0.015** (0.00)	0.015** (0.00)	-0.003 (0.00)	-0.003 (0.00)	-0.024* (0.01)	-0.025* (0.01)
Base Category: Couple without resident children						
Couple with at least one resident child	-0.004 (0.00)	-0.004 (0.00)	0.010*** (0.00)	0.010*** (0.00)	-0.007 (0.00)	-0.007 (0.00)
Lone parents with at least one resident child	0.020*** (0.00)	0.020*** (0.00)	-0.001 (0.00)	-0.001 (0.00)	-0.023** (0.01)	-0.023** (0.01)
At Least One Nuclear Family and Other Persons	-0.008*** (0.00)	-0.008*** (0.00)	0.014*** (0.00)	0.014*** (0.00)	-0.016** (0.01)	-0.016** (0.01)
Multiple Persons without a Nuclear Family	0.027** (0.01)	0.027** (0.01)	-0.003 (0.01)	-0.003 (0.01)	-0.057* (0.02)	-0.057* (0.02)
Base Category: Homeowner						
Tenant	0.029*** (0.00)	0.029*** (0.00)	-0.017*** (0.00)	-0.017*** (0.00)	-0.044*** (0.00)	-0.044*** (0.00)
Lodging	0.005 (0.01)	0.005 (0.01)	0.000 (.)	0.000 (.)	0.024 (0.02)	0.024 (0.02)
Not owner but also not paying rent	0.002 (0.00)	0.002 (0.00)	-0.002 (0.00)	-0.003 (0.00)	0.010* (0.00)	0.010* (0.00)
Base Category: Gender-Male						
Female	-0.004 (0.00)	-0.004 (0.00)	-0.006 (0.00)	-0.006 (0.00)	0.004 (0.01)	0.003 (0.01)

Base Category: Single						
Married	-0.015** (0.01)	-0.015** (0.01)	0.003 (0.00)	0.003 (0.00)	0.016 (0.01)	0.016 (0.01)
Divorced	0.006 (0.01)	0.005 (0.01)	-0.008 (0.01)	-0.007 (0.01)	-0.019 (0.01)	-0.019 (0.01)
Widowed	-0.014** (0.01)	-0.015** (0.01)	0.001 (0.01)	0.001 (0.01)	0.016 (0.01)	0.016 (0.01)
Age	0.000 (0.00)	0.000 (0.00)	-0.001*** (0.00)	-0.001*** (0.00)	0.001*** (0.00)	0.001*** (0.00)
Base Category: Not completed any school						
Primary School	-0.004 (0.00)	-0.004 (0.00)	-0.014*** (0.00)	-0.013*** (0.00)	0.036*** (0.01)	0.036*** (0.01)
Secondary School	0.007* (0.00)	0.007* (0.00)	-0.018*** (0.00)	-0.018*** (0.00)	0.025*** (0.01)	0.024*** (0.01)
High School	0.010** (0.00)	0.010** (0.00)	-0.021*** (0.00)	-0.021*** (0.00)	0.016* (0.01)	0.016* (0.01)
Vocational School	0.012* (0.01)	0.011* (0.01)	-0.028*** (0.00)	-0.028*** (0.00)	0.005 (0.01)	0.004 (0.01)
Bachelor	0.019*** (0.01)	0.019** (0.01)	-0.027*** (0.00)	-0.027*** (0.00)	-0.031* (0.01)	-0.031* (0.01)
Masters Degree	0.042** (0.01)	0.042** (0.01)	0.000 (.)	0.000 (.)	-0.068 (0.04)	-0.068 (0.04)
Ph.D	-0.022*** (0.00)	-0.022*** (0.00)	0.000 (.)	0.000 (.)	0.000 (.)	0.000 (.)
Base Category: Employment Status (Employed)						
Not Working (But Still Connected to Work)	0.001 (0.01)	0.001 (0.01)	0.006 (0.01)	0.006 (0.01)	-0.014 (0.02)	-0.014 (0.02)
Unemployed	0.011*** (0.00)	0.011*** (0.00)	-0.003 (0.00)	-0.003* (0.00)	-0.026*** (0.00)	-0.025*** (0.00)
Poverty Index	0.025*** (0.00)	0.025*** (0.00)	-0.026*** (0.00)	-0.026*** (0.00)	-0.066*** (0.00)	-0.067*** (0.00)
Base Category: Being above 50% of the median income						
d_50 (Being below 50% of the median income)	-0.005* (0.00)	-0.005* (0.00)	0.003 (0.00)	0.003 (0.00)	-0.001 (0.01)	-0.001 (0.01)
Base Category: Health Status (Poor)						
Health Status (good)		0.007* (0.00)		-0.004 (0.00)		0.009 (0.01)
N	45704	45704	42707	42707	45523	45523
Log-likelihood	-3780.65	-3778.24	-2672.27	-2670.84	-15101.46	-15100.38
Pseudo R ²	0.616	0.616	0.301	0.301	0.471	0.471
AIC	7635.31	7632.49	5410.53	5409.68	30274.92	30274.76
BIC	7958.31	7964.22	5696.38	5704.19	30589.06	30597.62
Mean VIF	3.29	3.23	3.29	3.23	3.29	3.23

Notes: *, **, *** symbols indicate the significance of the coefficients at the 10%, 5% and 1% levels of significance, respectively. (1)–(4) refer to different model specifications. Each model uses the same set of independent variables, presented in the first columns of the tables. Each column display both the model number and its corresponding dependent variable (coal, natural gas). Model (2) and model (4) aim at estimating also the role of health status (good health) of household head on the consumption of coal and natural gas. Year fixed effects are controlled.

Source: Own calculations.

Tables 8 and 9 present the marginal effects from logit models of electricity, dung, wood, coal, and natural gas consumption, based on a 70% median income poverty threshold. The results are consistent with broader evidence linking poverty status to household energy choices.

Table 9. Marginal effects from logit models for coal and natural gas using poverty variable defined by 70% of median income.

Independent Variables	(1)	(2)	(3)	(4)
	Coal	Coal	Natural Gas	Natural Gas
Household Income	-0.009 (0.00)	-0.009 (0.00)	-0.017*** (0.00)	-0.017*** (0.00)
Base Category: Heating system (radiator)				
Heating system (Stove)	0.039*** (0.01)	0.039*** (0.01)	-0.302*** (0.01)	-0.302*** (0.01)

Heating system (Air conditioner)	-0.193*** (0.01)	-0.193*** (0.01)	-0.493*** (0.01)	-0.493*** (0.01)
Dwelling size -m2	0.001*** (0.00)	0.001*** (0.00)	-0.001*** (0.00)	-0.001*** (0.00)
Base Category: Age of Dwelling - (Pre-1945)				
Age of Dwelling -(1946-1960)	0.015 (0.01)	0.015 (0.01)	0.011 (0.02)	0.011 (0.02)
Age of Dwelling – (1961-1970)	0.030* (0.01)	0.030* (0.01)	0.021 (0.01)	0.021 (0.01)
Age of Dwelling – (1971-1980)	0.038*** (0.01)	0.038*** (0.01)	0.025 (0.01)	0.025 (0.01)
Age of Dwelling – (1981-1990)	0.035** (0.01)	0.035** (0.01)	0.021 (0.01)	0.021 (0.01)
Age of Dwelling – (1991-2000)	0.037** (0.01)	0.037** (0.01)	0.014 (0.01)	0.014 (0.01)
Age of Dwelling –(2001-2005)	0.064*** (0.01)	0.064*** (0.01)	-0.011 (0.01)	-0.011 (0.01)
Age of Dwelling –(Post 2005)	0.079*** (0.01)	0.079*** (0.01)	-0.030* (0.01)	-0.030* (0.01)
Base Category: Couple without resident children				
Couple with at least one resident child	0.016** (0.01)	0.016** (0.01)	-0.016*** (0.00)	-0.017*** (0.00)
Lone parents with at least one resident child	0.000 (0.01)	0.000 (0.01)	-0.011 (0.01)	-0.011 (0.01)
At Least One Nuclear Family and Other Persons	0.027*** (0.01)	0.027*** (0.01)	-0.023*** (0.00)	-0.023*** (0.00)
Multiple Persons without a Nuclear Family	0.015 (0.02)	0.015 (0.02)	-0.012 (0.01)	-0.012 (0.01)
Base Category: Homeowner				
Tenant	0.026*** (0.01)	0.026*** (0.01)	0.037*** (0.00)	0.037*** (0.00)
Lodging	0.109*** (0.02)	0.109*** (0.02)	-0.107*** (0.01)	-0.107*** (0.01)
Not owner but also not paying rent	0.006 (0.01)	0.006 (0.01)	0.024*** (0.00)	0.023*** (0.00)
Base Category: Gender-Male				
Female	0.016 (0.01)	0.016 (0.01)	-0.010 (0.01)	-0.010 (0.01)
Base Category: Single				
Married	0.031** (0.01)	0.031** (0.01)	-0.011 (0.01)	-0.011 (0.01)
Divorced	-0.002 (0.01)	-0.002 (0.01)	0.012 (0.01)	0.012 (0.01)
Widowed	0.028* (0.01)	0.028* (0.01)	0.011 (0.01)	0.011 (0.01)
Age	-0.000* (0.00)	-0.000* (0.00)	-0.001*** (0.00)	-0.001*** (0.00)
Base Category: Not completed any school				
Primary School	0.005 (0.01)	0.005 (0.01)	-0.012** (0.00)	-0.012** (0.00)
Secondary School	0.017* (0.01)	0.017* (0.01)	-0.017*** (0.00)	-0.016** (0.00)
High School	0.048*** (0.01)	0.048*** (0.01)	-0.047*** (0.00)	-0.046*** (0.00)
Vocational School	0.081*** (0.01)	0.081*** (0.01)	-0.077*** (0.01)	-0.076*** (0.01)
Bachelor	0.075*** (0.01)	0.075*** (0.01)	-0.088*** (0.01)	-0.087*** (0.01)
Masters Degree	0.061** (0.02)	0.061** (0.02)	-0.091*** (0.01)	-0.091*** (0.01)
Ph.D	0.006 (0.04)	0.006 (0.04)	-0.061** (0.02)	-0.060** (0.02)
Base Category: Employment Status (Employed)				
Not Working (But Still Connected to Work)	0.034 (0.03)	0.034 (0.03)	-0.012 (0.02)	-0.013 (0.02)
Unemployed	0.008	0.008	0.022***	0.021***

	(0.00)	(0.00)	(0.00)	(0.00)
Poverty Index	-0.109***	-0.109***	0.187***	0.187***
	(0.00)	(0.00)	(0.00)	(0.00)
Base Category: Being above 50% of the median income				
d_50 (Being below 50% of the median income)	-0.028***	-0.028***	-0.027***	-0.027***
	(0.01)	(0.01)	(0.00)	(0.00)
Base Category: Health Status (Poor)				
Health Status (good)		0.000		-0.012*
		(0.01)		(0.01)
N	45704	45704	45704	45704
Log-likelihood	-20991.39	-20991.39	-9322.23	-9320.08
Pseudo R ²				
AIC	42056.78	42058.78	18718.45	18716.16
BIC	42379.79	42390.52	19041.46	19047.90
Mean VIF	-0.009	-0.009	-0.017***	-0.017***

Notes: *, **, *** symbols indicate the significance of the coefficients at the 10%, 5% and 1% levels of significance, respectively. (1)–(4) refer to different model specifications. Each model uses the same set of independent variables, presented in the first columns of the tables. Each column display both the model number and its corresponding dependent variable (coal, natural gas etc). Model (2) and model (4) aim at estimating also the role of health status (good health) of household head on the consumption of coal and natural gas. Year fixed effects are controlled.

Source: Own calculations.

4. Discussion

The findings reveal that poor households generally tend to opt for cheaper and more traditional fuel types and avoid more modern and expensive fuel types. These results are consistent with those reported by Karaaslan et al. (2022), Karaaslan & Algül (2023) and Özcan et al. (2013). These results are also consistent with the broader energy poverty literature, which shows that low-income households worldwide tend to rely on traditional, low-cost fuels due to affordability constraints. This situation plays an important role in the planning of energy policies and social assistance. Developing strategies specifically aimed at improving energy access for low-income households enhance their quality of life.

With regard to the results concerning the role of the health status of the household head in the use of different types of energy, individuals in good health have a higher electricity demand than those in poor health. This pattern aligns with the energy ladder hypothesis, suggesting that healthier individuals tend to rely more on modern, electricity-intensive appliances.

Households with poor health status often prefer cleaner energy sources such as electricity. Contrary to these expectations, findings indicate that people in good health tend to use a greater number of electrical appliances. Healthy individuals frequently have higher income levels, providing them with better access to electrical products and devices. Moreover, those in better health participate more often in activities that require the use of various electrical appliances. For instance, they spend more time using exercise equipment, home entertainment systems and other technological devices that enhance overall well-being. Good health is associated with maintaining a comfortable living environment, which typically includes the use of air conditioning, heating and lighting. Healthier people also adopt new technologies more readily, many of which are electricity-intensive.

However, the demand for natural gas is lower for healthy household heads than for those in poor health. This lower demand appears to reflect a fuel substitution effect, with households in better socioeconomic and health conditions replacing natural gas with electricity-intensive technologies. This interpretation is supported by the behavioral economics of energy choice, which highlights convenience and usability as key drivers of household fuel substitution (Frederiks et al., 2015).

Some intriguing results have been obtained in relation to the control variables. Considering the age of the dwelling, buildings built after 2001 use more electricity than those built before 1945. The buildings built after 2001 aim to use clean energy sources due to their energy efficiency and advanced modern heating systems. The use of traditional fuels such as dried dung, wood and coal is common in older buildings. These fuels are typically used because older buildings are less energy efficient and

lack modern heating systems. In this context, the government and/or municipalities might implement energy infrastructure and heating system programs, especially for old buildings. On the other hand, there has been a decrease in the use of natural gas in buildings built after 2001. This change seems linked to the adoption of alternative techniques (electric heating systems) or the installation of new energy systems (solar panels) during this period. Moreover, the use of natural gas is more related to the availability of infrastructure in the neighborhood where the dwelling is located. If there is no available infrastructure for natural gas, even the new buildings would not have access to it. These patterns reflect widely documented relationships between dwelling characteristics and heating fuel selection in the built-environment and residential energy literature.

As the size of the dwelling (in square meters) increases, the demand for electricity and natural gas decreases and the use of wood and coal increases. Improvements in architectural features and insulation systems in larger dwellings lead to a reduction in demand for clean energy sources such as electricity and natural gas, owing to enhanced energy efficiency. Compared to homeowners, tenants show an increase in demand for electricity, coal and natural gas, while their demand for dung and wood decreases. Tenants living in short-term accommodation tend to prefer more widespread and modern energy sources. In comparison with central heating systems with radiators, households with stoves show an increase in demand for electricity, wood, dung and coal. Compared with central heating systems using radiators, households that rely on stoves exhibit higher demand for electricity, wood, dung, and coal, alongside a lower demand for natural gas. This pattern reflects technical compatibility: stoves operate more efficiently with electricity and solid fuels, whereas radiator-based systems function more effectively with natural gas. Similarly, households with air conditioning systems, as opposed to central heating systems, show an increase in electricity demand, which is an expected result. These findings align with those of İpek & İpek (2022), Karaaslan et al. (2022) and Karaaslan & Algül (2023).

Similar to previous studies in this field, the findings indicate that demographic and economic factors influence residential energy demand. Higher household income is associated with increased electricity demand. This suggests that households with higher incomes prefer to use electricity. In addition, the use of coal and natural gas decreases as household income increases. In other words, higher income households do not prefer to use coal and gas. This finding supports the "energy ladder hypothesis" for households in Turkey. However, Turkish consumers consider electricity more efficient and convenient than natural gas. The individual characteristics of the household head also emerge as influential factors according to the estimates. Compared to illiterate, an increase in the educational level of the head of the household increases the demand for electricity; however, at the Ph.D. level, electricity consumption decreases. Recently, especially following the government's intensified efforts to promote the use of clean energy in both Turkey and the EU, it has been observed that more highly educated people are investing in alternative forms of energy, such as solar panels. As the level of education increases, the use of dung decreases, suggesting that households with higher levels of education do not prefer to use dung, which is common in rural areas from where educated people migrate to urban areas for working purposes. Those results consistent with the consensus in previous studies in literature. Compared to illiterate household heads, those with primary and secondary education have an increased demand for wood, while those with bachelor education have a decreased demand for wood. Coal demand increases as the level of education increases. Normally higher education is associated with an increase in clean energy demand; however, obtained results show that demand for natural gas decreases with the level of education, indicating that households do not prefer to use natural gas as the education level of household head increases. This finding contradicts with the result of İpek & İpek (2022). However, this result arises from the lack of natural gas infrastructure and the low economic pricing of coal in many regions in Turkey. Moreover, higher household education levels improve social resources, identity and income. In this case, they develop luxury-oriented lifestyle, resulting the increase consumption of commodities like automobiles, computer as well as energy in the form fuel, electricity etc. (Wang et al. 2020).

Considering the findings for other socio-economic characteristics, the gender of the household head has no significant effect on the energy demand for heating. This indicates that there is no noticeable difference between male and female heads in their choice of energy sources for heating. The married household heads tend to use less electricity and prefer coal more than singles. This pattern reflects the presence of more household members, such as children and the fact that coal is cheaper than electricity. When examining the impact of employment status on energy demand, it is observed that unemployed individuals have a higher demand for electricity and natural gas compared to employed individuals. However, unemployed individuals use less wood compared to their employed counterparts. Unemployed individuals spend more time at home, increasing demand for electricity and gas for heating, cooking, and appliances, while avoiding labour-intensive fuels such as wood. Finally, in urban areas where unemployment is more prevalent, access to electricity and natural gas infrastructure is typically better, whereas wood use is more common in rural or semi-rural settings.

Conclusions

Household energy preference is key matter for energy policy and sustainability issues since residential sector is a substantial part of the aggregate energy demand and environmental pollution. Sustainability requires that world consider to issues of energy preferences and/or efficiency due to climate change concerns. Hence, better understanding of household's energy choice is a very important issue. Accordingly, this study provides the first analysis in the literature of the impact of poverty, measured using different median income thresholds, as well as health status and other socio-economic factors, on household energy consumption in Turkey, employing logit models based on TURKSTAT's Household Budget Surveys.

Current study concludes that poverty and household health status are important drivers of residential energy consumption and fuel preferences. Accordingly, it is observed that as poverty decreases, households tend to move towards more modern and comfortable energy sources. The assessment of poverty and health status shows that households increase their consumption of electricity and natural gas as the level of poverty decreases. At the 50%, 60% and 70% median income levels, those below the 50% median income line choose to use cheaper types of fuel such as dried dung. In addition, healthier individuals prefer to use electricity as they tend to use more appliances and engage in different activities such as using exercise equipment, home entertainment systems and other technological devices. Overall, the findings point to the need for a just energy transition that simultaneously addresses energy poverty, rising aggregate demand, and environmental pollution. Policies should prioritise targeted support for low-income households to facilitate a shift away from highly polluting fuels such as dried dung towards cleaner energy sources, alongside investments in electricity and natural gas infrastructure in disadvantaged areas. At the same time, as poverty declines and healthier households increase electricity use through greater appliance ownership, progressive tariff structures and energy-efficiency measures are needed to manage demand growth and limit emissions.

The results also indicate that certain characteristics of household heads and dwelling features act as important drivers of household energy choice, energy use and environmental impact. Regarding dwelling characteristics, buildings built after 2001 use more electricity, but older buildings use traditional fuels. In this context, the government and/or municipalities might implement energy infrastructure and heating system programs, especially for old buildings.

Looking at demographic and economic factors, it's generally observed that households with higher income levels prefer better fuel types (cleaner, more convenient and more efficient such as electricity and natural gas) for space heating. Encouraging the use of cleaner energy among low-income households requires the introduction of targeted government subsidies. In addition, the level of education has a positive effect on electricity consumption. In this respect, the use of traditional fuels (such as dung) decreases as the level of education increases. Interestingly, coal demand rises with the

level of education, as coal remains a cheaper energy source in many parts of Turkey. These findings highlight that organizing educational programs aimed at households to increase energy literacy and environmental awareness will contribute to conscious energy consumption and reduce the environmental impact of energy consumption.

The findings carry important policy implications. As urbanization (new buildings), education level and income are expected to increase soon, electricity consumption will also increase. Therefore, Turkey should make the necessary investments in electricity generation to meet the additional demand. Furthermore, more effective incentive policies should be introduced to encourage households to invest in renewable energy infrastructure. This would speed up the shift away from fossil fuels and towards cleaner energy sources. All these efforts will contribute towards the country's sustainability targets, such as the National Energy Plan and the Renewable Energy Road Map, which are in line with the UN's SDG targets, such as SDG7. Natural gas demand will increase both due to changing household preferences and to realize increased electricity production. However, given the country's exchange rate problem, this would worsen the already distorted price stability and balance of payments.

Moreover, although significant progress has been made in the field of renewable energy in Turkey in recent years, the desired level of renewable energy development has not yet been achieved. Promoting renewable energy through more effective mechanisms will contribute to both the balance of payments and sustainable economic growth by meeting the country's energy needs with domestic resources. Another important point is that coal consumption will remain important in the energy preferences of Turkish households. As Turkey has experienced a wave of inflation in recent years, high inflation will negatively affect households, especially the poor. For this reason, households experiencing falling real incomes often return to cheaper and lower-quality fuels for economic reasons. Additionally, energy subsidies and incentives for low-income households increase access to cleaner and more efficient energy sources, supporting a more sustainable energy usage structure.

The current study offers new evidence on the determinants of household energy choices in Turkey, but several limitations should be noted. First, the data set does not include local and/or time-varying energy price information, subsidies or tariff structures, which are known to play a central role in shaping household fuel choice. The absence of such price variation limits economic incentives and substitution patterns across fuels. The availability of regional and provincial energy usage data enables future studies to empirically examine regional energy demand, as well as the effects of socio-economic differences and/or incentive policies. Second, despite extensive controls, potential endogeneity remains a concern, particularly in the relationship between income, poverty and energy choice, owing to the presence of unobserved factors affecting these variables. As noted earlier, poverty and health status are shaped by unobserved socio-economic or environmental factors, generating potential omitted-variable bias and limiting the causal interpretation of the results. Third, the Household Budget Survey lacks behavioural or attitudinal variables, such as environmental awareness, cultural norms, risk preferences or energy-saving practices, which shape household preferences. Finally, the analysis does not incorporate regional heterogeneity, despite significant differences in climate, infrastructure and socio-economic conditions across provinces. Future research should address these limitations by combining micro-level survey data with regional energy prices, infrastructure maps and climatic indicators. The use of causal identification strategies such as instrumental variables or natural experiments would help mitigate endogeneity concerns. Finally, the elasticity of energy sources was not calculated due to the unavailability of reliable price information on the types of energy purchased by households. This elasticity would also be important for measuring the effects of energy policies. For these reasons, the findings should be interpreted as associative rather than causal, and future research would benefit from richer data sources that incorporate prices, elasticities behavioural indicators and regional variation.

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Reference

1. Abubakar, I. R., Alola, A. A., Bekun, F. V., & Onifade, S. T. (2024). Investigating the determinants of household energy consumption in Nigeria: Insights and implications. *Energy, Sustainability and Society*, 14(29), 1–13. <https://doi.org/10.1186/s13705-024-00451-6>.
2. Acharya, B., & Marhold, K. (2019). Determinants of household energy use and fuel switching behavior in Nepal. *Energy*, 169, 1132–1138. <https://doi.org/10.1016/j.energy.2018.12.109>.
3. An, X., Dang, N., Zhang, F., Li, Y., Xie, Y., & Wang, Q. (2025). Decoding the synergies of sustainable development goals in household energy transitions: A global knowledge network analysis. *Renewable and Sustainable Energy Reviews*, 224, Article 116069. <https://doi.org/10.1016/j.rser.2025.116069>.
4. Ari, E., Aydin, N., Karacan, S., & Saracli, S. (2016). Analysis of households' electricity consumption with ordered logit models: Example of Turkey. *International Journal of Humanities and Social Science Invention*, 5(6), 73–84. [https://www.ijhssi.org/papers/v5\(6\)/I0506073084.pdf](https://www.ijhssi.org/papers/v5(6)/I0506073084.pdf).
5. Aydinalp, M., Ugursal, V. I., & Fung, A. S. (2002). Modeling of the appliance, lighting, and space-cooling energy consumptions in the residential sector using neural networks. *Applied Energy*, 71(2), 87–110. [https://doi.org/10.1016/S0306-2619\(01\)00049-6](https://doi.org/10.1016/S0306-2619(01)00049-6).
6. Bartusch, C., Odlare, M., Wallin, F., & Wester, L. (2012). Exploring variance in residential electricity consumption: Household features and building properties. *Applied Energy*, 92, 637–643. <https://doi.org/10.1016/j.apenergy.2011.04.034>.
7. Bedir, M., Hasselaar, E., & Itard, L. (2013). Determinants of electricity consumption in Dutch dwellings. *Energy & Buildings*, 58, 194–207. <https://doi.org/10.1016/j.enbuild.2012.10.016>.
8. Bingdong, H., Hua, L., & Huang, J. (2018). Household cooking fuel choice and economic poverty: Evidence from a nationwide survey in China. *Energy and Buildings*, 166, 319–329. <https://doi.org/10.1016/j.enbuild.2018.02.012>.
9. Borožan, D. (2018). Regional-level household energy consumption determinants: The European perspective. *Renewable and Sustainable Energy Reviews*, 90, 347–355. <https://doi.org/10.1016/j.rser.2018.03.038>.
10. Cao, W., Liu, H., Zhang, X., & Zeng, Y. (2024). Residential load forecasting based on long short-term memory, considering temporal local attention. *Sustainability*, 16(24), Article 11252. <https://doi.org/10.3390/su162411252>.
11. Carpinteiro, O. A. S., Leme, R. C., de Souza, A. C. Z., Pinheiro, C. A. M., & Moreira, E. M. (2007). Long-term load forecasting via a hierarchical neural model with time integrators. *Electric Power Systems Research*, 77(3–4), 371–378. <https://doi.org/10.1016/j.epsr.2006.03.014>.
12. Chan, A. L. S. (2011). Developing future hourly weather files for studying the impact of climate change on building energy performance in Hong Kong. *Energy and Buildings*, 43(10), 2860–2868. <https://doi.org/10.1016/j.enbuild.2011.07.003>.

13. Ediger, V. Ş., Akar, S., & Uğurlu, B. (2006). Forecasting production of fossil fuel sources in Turkey using a comparative regression and ARIMA model. *Energy Policy*, 34(18), 3836–3846. <https://doi.org/10.1016/j.enpol.2005.08.023>.
14. Ekholm, T., Krey, V., Pachauri, S., & Riahi, K. (2010). Determinants of household energy consumption in India. *Energy Policy*, 38(10), 5696–5707. <https://doi.org/10.1016/j.enpol.2010.05.017>.
15. Energy Market Regulatory Authority. (2024). *Electricity market sector development report*. <http://epdk.gov.tr/Detay/Icerik/3-0-0-102/yillik-rapor-elektrik-piyasasi-gelisim-raporlari>.
16. Farsi, M., Filippini, M., & Pachauri, S. (2007). Fuel choices in urban Indian households. *Environment and Development Economics*, 12(6), 757–774. <https://doi.org/10.1017/S1355770X07003932>.
17. Ferrari, S., Zagarella, F., Caputo, P., & D'Amico, A. (2019). Results of a literature review on methods for estimating buildings energy demand at district level. *Energy*, 175, 1130–1137. <https://doi.org/10.1016/j.energy.2019.03.172>.
18. Frederiks, E. R., Stenner, K., & Hobman, E. V. (2015). Household energy use: Applying behavioral economics to understand consumer decision-making and behaviour. *Renewable and Sustainable Energy Reviews*, 41, 1385–1394. <https://doi.org/10.1016/j.rser.2014.09.026>.
19. Hamzaçebi, C. (2007). Forecasting of Turkey's net electricity energy consumption on sectoral bases. *Energy Policy*, 35(3), 2009–2016. <https://doi.org/10.1016/j.enpol.2006.03.014>.
20. Hosier, R. H., & Dowd, J. (1987). Household fuel choice in Zimbabwe: An empirical test of the energy ladder hypothesis. *Resources and Energy*, 9(4), 347–361. [https://doi.org/10.1016/0165-0572\(87\)90003-X](https://doi.org/10.1016/0165-0572(87)90003-X)
21. Hsu, C. C., & Chen, C. Y. (2003). Regional load forecasting in Taiwan—Applications of artificial neural networks. *Energy Conversion and Management*, 44(12), 1941–1949. [https://doi.org/10.1016/S0196-8904\(02\)00225-X](https://doi.org/10.1016/S0196-8904(02)00225-X).
22. Huang, W., Li, H., & Li, Z. (2024). A comprehensive study to estimate income and price elasticities of household electricity consumption using Auto-metrics. *Heliyon*, 10(8), Article e28656. <https://doi.org/10.1016/j.heliyon.2024.e28656>.
23. İpek, E., & İpek, Ö. (2024). Energy poverty and health in Turkey: Evidence from longitudinal data. *Renewable and Sustainable Energy Reviews*, 203, Article 114777. <https://doi.org/10.1016/j.rser.2024.114777>.
24. İpek, Ö., & İpek, E. (2022). Determinants of energy demand for residential space heating in Turkey. *Renewable Energy*, 194, 1026–1033. <https://doi.org/10.1016/j.renene.2022.05.158>.
25. Karaaslan, K. Ç., Algül, Y., & Karaaslan, A. (2022). Space heating preferences in households: Nested logit model approach in Turkey. *Energy and Buildings*, 273(15), Article 112353. <https://doi.org/10.1016/j.enbuild.2022.112353>.
26. Karaaslan, K. Ç., & Algül, Y. (2023). Determinants of energy expenditures for Turkish households using quantile regression and data from an original survey in Turkey. *Environmental Science and Pollution Research*, 30, 38939–38954. <https://doi.org/10.1007/s11356-022-24323-8>.
27. Karatasou, S., & Santamouris, M. (2019). Socio-economic status and residential energy consumption: A latent variable approach. *Energy and Buildings*, 198, 100–105. <https://doi.org/10.1016/j.enbuild.2019.06.013>.
28. Kayalica, M. O., Ozozen, A., Guven, D., Kayakutlu, G., & Bayar, A. A. (2020). Electricity consumption analysis based on Turkish Household Budget Surveys. *Energy, Ecology and Environment*, 5, 444–455. <https://doi.org/10.1007/s40974-020-00193-z>.
29. Kim, H., Park, S., & Kim, S. (2023). Time-series clustering and forecasting household electricity demand using smart meter data. *Energy Reports*, 9, 4111–4121. <https://doi.org/10.1016/j.egyr.2023.03.042>.

30. Koç, A. A., Bölük, G., & Beyaz, F. B. (2015). The impact of economic crisis and tariff adjustment on residential electricity demand in Turkey. *Ekonomik Yaklaşım (Economic Research)*, 26(97), 1–22. <https://doi.org/10.5455/ey.35714>.
31. Kumar, R. (2024). Validity of energy ladder hypothesis through types of residence: An ordered probit analysis for Indian households. *The Indian Economic Journal*, 1–17. <https://doi.org/10.1177/00194662241265482>.
32. Li, H., Li, Y., Zheng, G., & Zhou, Y. (2024). Interaction between household energy consumption and health: A systematic review. *Renewable and Sustainable Energy Reviews*, 189, Article 113859. <https://doi.org/10.1016/j.rser.2023.113859>.
33. Liu, H., & Hu, T. (2024). Energy poverty alleviation and its implications for household energy consumption and health. *Environment, Development and Sustainability*, 26, 10063–10083. <https://doi.org/10.1007/s10668-023-03135-x>.
34. Masuku, B. (2024). Rethinking South Africa's household energy poverty through the lens of off-grid energy transition. *Development Southern Africa*, 41(3), 467–489. <https://doi.org/10.1080/0376835X.2023.2300411>.
35. McLoughlin, F., Duffy, A., & Conlon, M. (2013). Evaluation of time series techniques to characterise domestic electricity demand. *Energy*, 50, 120–130. <https://doi.org/10.1016/j.energy.2012.11.048>.
36. Mensah, J. T., & Adu, G. (2015). An empirical analysis of household energy choice in Ghana. *Renewable and Sustainable Energy Reviews*, 51, 1402–1411. <https://doi.org/10.1016/j.rser.2015.07.050>.
37. Odhiambo, N. M. (2009). Electricity consumption and economic growth in South Africa: A trivariate causality test. *Energy Economics*, 31(5), 635–640. <https://doi.org/10.1016/j.eneco.2009.01.005>.
38. Özcan, K. M., Gülay, E., & Üçdoğruk, Ş. (2013). Economic and demographic determinants of household energy use in Turkey. *Energy Policy*, 60, 550–557. <https://doi.org/10.1016/j.enpol.2013.05.046>.
39. Pai, P. F. (2006). Hybrid ellipsoidal fuzzy systems in forecasting regional electricity loads. *Energy Conversion and Management*, 47(15–16), 2283–2289. <https://doi.org/10.1016/j.enconman.2005.11.017>.
40. Rao, M. N., & Reddy, B. S. (2007). Variations in energy use by Indian households: Analysis of micro level data. *Energy*, 32(2), 143–153. <https://doi.org/10.1016/j.energy.2006.03.012>.
41. Simsek, Y., Santika, W. G., Anissuzzaman, M., Urmee, T., Bahri, P. A., & Escobar, R. (2020). An analysis of additional energy requirement to meet the sustainable development goals. *Journal of Cleaner Production*, 272, Article 122646. <https://doi.org/10.1016/j.jclepro.2020.122646>.
42. Suganthi, L., & Samuel, A. A. (2012). Energy models for demand forecasting—A review. *Renewable and Sustainable Energy Reviews*, 16(2), 1223–1240. <https://doi.org/10.1016/j.rser.2011.08.014>.
43. Szép, T., & Kashour, M. (2024). Price and income elasticities of Hungarian household energy demand: Implications for energy policy in the context of the energy crisis. *Green and Low-Carbon Economy*, 2(3), 174–183. <https://doi.org/10.47852/bonviewGLCE32021155>.
44. TEİAŞ. (2024). *Turkey electricity generation-transmission statistics for 2024*. Turkish Electricity Transmission Corporation (TEİAŞ). <https://www.teias.gov.tr/turkiye-elektrik-uretim-iletim-istatistikleri>.
45. Tinta, A. A. (2024). Ladder or stacking: Lessons from Burkina Faso. *Energy Policy*, 186, Article 113933. <https://doi.org/10.1016/j.enpol.2023.113933>.
46. Truong, N. V., Wang, L., & Wong, P. K. C. (2008). Modeling and short-term forecasting of daily peak power demand in Victoria using two-dimensional wavelet-based SDP models. *International Journal of Electrical Power & Energy Systems*, 30(9), 511–518. <https://doi.org/10.1016/j.ijepes.2008.04.006>.

47. Tsani, S. Z. (2010). Energy consumption and economic growth: A causality analysis for Greece. *Energy Economics*, 32(3), 582–590. <https://doi.org/10.1016/j.eneco.2009.09.007>.
48. Tuna, G., & Tuna, V. E. (2019). The asymmetric causal relationship between renewable and non-renewable energy consumption and economic growth in ASEAN-5 countries. *Resources Policy*, 62, 114–124. <https://doi.org/10.1016/j.resourpol.2019.03.010>.
49. TURKSTAT. (2023). *Greenhouse gas emissions statistics, 1990–2021* (Press Release No. 49672). Turkish Statistical Institute. <https://data.tuik.gov.tr/Bulten/Index?p=Sera-Gazi-Emisyon-Istatistikleri-1990-2021-49672&dil=1>.
50. TURKSTAT. (2024). *Energy accounting 2023* (Newsletter No. 54135). Turkish Statistical Institute. <https://data.tuik.gov.tr/Bulten/Index?p=Enerji-Hesaplari-2023-54135>.
51. TURKSTAT. (n.d.). *Household Budget Survey*. <https://data.tuik.gov.tr/Search/Search?text=Household%20Budget%20Survey&dil=2>.
52. UN. (2022). *Global issue: Population*. United Nations. <https://www.un.org/en/global-issues/population>.
53. UN. (2025). *The 17 sustainable development goals (SDGs)*. United Nations. <https://sdgs.un.org/goals>.
54. Vo, D. H., Vo, A. T., & Ho, C. M. (2024). Understanding the characteristics of the household energy transition in a developing country. *Heliyon*, 10(1), Article e23977. <https://doi.org/10.1016/j.heliyon.2024.e23977>.
55. Wang, S., Xie, Z., & Wu, R. (2020). Examining the effects of education level inequality on energy consumption: Evidence from Guangdong Province. *Journal of Environmental Management*, 269, Article 110761. <https://doi.org/10.1016/j.jenvman.2020.110761>.
56. Weyman-Jones, T., & Boucinha, J. M. (2024). Behavioral efficiency and residential electricity consumption: A microdata study. *Sustainability*, 16(15), Article 6646. <https://doi.org/10.3390/su16156646>.
57. Xu, X., Xiao, B., & Li, C. Z. (2020). Critical factors of electricity consumption in residential buildings: An analysis from the point of occupant characteristics view. *Journal of Cleaner Production*, 256, Article 120423. <https://doi.org/10.1016/j.jclepro.2020.120423>.
58. Yarbaşı, İ. Y., & Çelik, A. K. (2023). The determinants of household electricity in Turkey: An implementation of Heckman sample selection model. *Energy*, 283, Article 128431. <https://doi.org/10.1016/j.energy.2023.128431>.
59. Yohanis, Y. G., Mondol, J. D., Wright, A., & Norton, B. (2008). Real-life energy use in the UK: How occupancy and dwelling characteristics affect domestic electricity use. *Energy and Buildings*, 40(6), 1053–1059. <https://doi.org/10.1016/j.enbuild.2007.09.001>.
60. Zhang, M., Zhang, D., & Xie, T. (2024). Balancing urban energy considering economic growth and environmental sustainability through integration of renewable energy. *Sustainable Cities and Society*, 101, Article 105178. <https://doi.org/10.1016/j.scs.2024.105178>.

Unlocking Entrepreneurial Spirit: Students' Views on University Support for Business Ventures

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Abstract

Despite existing research on student entrepreneurial potential, opportunities for further exploration persist. On the one hand, this paper is part of the current research on student entrepreneurship. On the other hand, the article attempts to provide an answer to the question of how entrepreneurial potential is shaped in the cross-section of different fields of study, in relation to Polish- and English-language studies as well as full-time and part-time students. The added value of this article is the development of a fully proprietary questionnaire form calibrated both in terms of its scale and psychometric properties. The results reveal the entrepreneurial potential of the surveyed students and show how it varies by field and mode of study, as well as between Polish- and English-language students. The study also offers recommendations for university policies to better support and promote student entrepreneurship.

Key words

students' entrepreneurial potential, entrepreneurship dimensions, entrepreneurship education.

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Introduction

Entrepreneurial potential is a broad, expansive, and multifaceted topic (Krueger Jr & Brazeal, 1994; Santos et al., 2013; Jayawarna et al., 2014; Sanetra-Półgrabi, 2017). By encompassing personal characteristics and environmental influences, it plays a key role in explaining individuals' aspirations to engage in entrepreneurial activity (Ward et al., 2019). Understanding factors describing entrepreneurial potential requires research focusing on cognitive attributes (Baron, 1998), behavioural tendencies (Baron, 2007), and external conditions that support or hinder the development of entrepreneurship (Kurdyś-Kujawska & Wojtkowska, 2023). The identification of entrepreneurial potential is therefore often based on recognising key characteristics of individuals,

such as creativity, risk-taking, autonomy, and motivation to achieve goals (Curral et al., 2013). Social and institutional factors (Liu & Yao-Ping Peng, 2025) also contribute to the formation of entrepreneurial mindsets, including access to role models, education (Virk & Gambhir, 2024; Ogunsade et al., 2021), and economic opportunities (Galloway et al., 2006).

Researchers from the field of social psychology show that direct entrepreneurial effects are related to so-called entrepreneurial intentions (Liñán & Fayolle, 2015). These strands of research are separated into two main paradigms: a) cognitive (regarding personal aspects), and b) contextual or environmental factors (Franco et al., 2010); as well as myriads of other strands that describe entrepreneurial potential based on associated circumstances or traits (Galloway et al., 2006). The intent described by Liñán et al. (2011), the split described by Franco et al. (2010), as well as the empirical research conveyed by Zhang et al. (2015), stress the importance of entrepreneurial intentions in understanding entrepreneurial potential. The influence of personal (demographic, attitudes, experience) or external (supports, barriers) factors also support the above approach, arguing that factors such as aptitudes, past learning experiences, social norms, support, and barriers may directly or indirectly lead to changes in entrepreneurial intentions (Pfeifer et al., 2016; Kosharnaya et al., 2019).

It is worth noting that Galloway et al. (2006), find that entrepreneurial role models are linked to entrepreneurial intent, urgency, and economic autonomy, with the coexistence of these traits indicating entrepreneurial potential. Moreover, entrepreneurial characteristics such as calculated risk-taking, creative tendency, high need for achievement and autonomy, as well as an internal locus of control are used to determine entrepreneurial tendencies (Holienka et al., 2013). The researchers also explored how neuroticism, extraversion, openness to experience, agreeableness, and conscientiousness (Zhao & Seibert, 2006) influence entrepreneurial potential. According to Liñán et al. (2011), entrepreneurial potential results not only from individual motivation but also from the broader environment and situational conditions, highlighting the need to jointly consider motivational, environmental, and situational determinants. Based on this, Santos et al. (2013) describes entrepreneurial potential in four dimensions: entrepreneurial motivations, management competencies, psychological competencies, and social competencies. Athayde (2009) argues that attitudes – cognitive (beliefs), affective (emotions), and behavioural (actions) – are instrumental dimensions describing entrepreneurship and entrepreneurial potential.

Researchers also analysed how the education system and the way entrepreneurship is taught (Ho et al., 2014; Küttim et al., 2014; Wilson, 2008) stimulate entrepreneurial potential, which consequently influences the presence of entrepreneurship among students. Notable research explaining entrepreneurial potential at the intersection of education and business ventures includes the role of organisational and institutional factors (Saeed et al., 2015), the propensity for business start-ups among alumni (Gerry et al., 2008), as well as links to a broad range of fields of education (Teixeira, 2008).

There is a huge variety of ways to identify and describe entrepreneurial potential, including its diverse (i.e. lacking a universal pattern) and multi-channel impact on the likelihood of individuals deciding to enter a business (Turker & Sonmez Selcuk, 2009). As a result, this topic is interesting and as yet insufficiently investigated. Universities and the academic community remain a special space for this type of exploration. This served as inspiration to develop an original survey questionnaire, enabling the diagnosis of the entrepreneurial potential of students of one of the oldest and largest non-public universities in Poland. The research was embedded in the current literature, and the tool used for the study was designed by an interdisciplinary research team consisting of economists, a statistician and methodology expert, a psychologist, and a management specialist. The use of a unique (fully original) tool, the large size of the research sample (over 1,500 people), as well as the coverage of all fields of study offered by the university (in native and English languages), make the research unique not only on a national level but also on a multinational scale.

The empirical analysis presented in this paper offers evidence that personal attributes play a pivotal role in driving business ownership. The modelling results show that a strong internal locus of control, creativity, and motivation significantly increases the likelihood of a student owning a business. In contrast, the willingness to take risks does not emerge as a significant predictor, suggesting that in our context (which is a relatively young group of respondents), confidence, innovation, and drive matter more than risk propensity. These findings reinforce the idea that cognitive and motivational factors are central to entrepreneurial potential, providing a strong empirical foundation that connects theoretical insights with real-world outcomes.

This paper primarily aims to enrich the existing literature by offering robust empirical evidence based on data collected from a large and diverse group of students. Using a fully original survey tool and a comprehensive modelling approach, the study extends previous findings and provides a deeper understanding of how personal attributes shape entrepreneurial potential. Rather than introducing a new conceptual framework, the contribution lies in the methodological rigor and empirical scope of the research, which together offer valuable insights for both the national and international academic community.

The paper is structured in five sections. The next section discusses the theoretical foundations. In the third section, we present our data and methodology. Then, we describe the results. Finally, we discuss the findings and conclude the article.

1. Literature review

1.1 *Students' entrepreneurial potential*

Although entrepreneurial potential is linked with entrepreneurial intentions (Bela et al., 2021), these concepts must be clearly distinguished. Entrepreneurial potential is latent and precedes entrepreneurial intentions both causally and temporally (Krueger & Brazeal, 1994). Intentions are thus secondary to entrepreneurial potential (Varamäki et al., 2015), and do not always transform into decisions to start a business (Krueger Jr & Brazeal, 1994).

Entrepreneurial potential represents a combination of knowledge and skills related to entrepreneurship, finance, and cooperative relationships aimed at building new businesses (Pauli & Osowska, 2019). It consists of entrepreneurial personality traits and environmental variables that influence an individual's intentions to establish a business (Ward et al., 2019). This viewpoint is also supported by Santos et al. (2013). Entrepreneurial potential is therefore complex, relying both on genetic and social factors (Menshikov et al., 2021), encompassing innate as well as acquired characteristics. Krueger and Brazeal (1994) further elaborate on this topic, proposing a model of entrepreneurial potential viewed as an interactive process involving perceived desirability (including social norms and attitudes), perceived feasibility (self-efficacy), and propensity to act. However, their standpoint lacks precision; the authors restrict themselves to constructing a theoretical model without explicitly defining entrepreneurial potential. This gap is addressed by Raab et al. (2005), who define entrepreneurial potential as the extent to which an individual possesses traits commonly associated with successful entrepreneurs. Within this approach, entrepreneurial potential can be defined at both national (Harada, 2005; Mueller, 2004; Nguyen et al., 2009) and individual levels (Athayde, 2009; Wong et al., 2005). Considering the specific nature and subject of this research (university students), the individual-level approach has been adopted in this paper.

When analysing determinants influencing entrepreneurial potential among young individuals (including students), numerous individual and social factors should be considered (Mitrovic Veljkovic et al., 2019). Role models, socio-psychological support, and material resources are crucial for the development of entrepreneurial potential (Shapero & Sokol, 1982). Entrepreneurship education occupies a particularly important place in this context (Ghanem, 2020; Küttim et al., 2014). Ibicioglu et al. (2008) demonstrated that students attending entrepreneurship-related courses exhibit greater courage, activity, and willingness to take risks compared to their peers. Despite the objective benefits derived from entrepreneurship education, approaches vary depending on the cultural and

economic context. Consequently, entrepreneurship courses remain underrepresented at European universities (Klandt & Volkmann, 2006), whereas the situation in the U.S. is significantly different due to deeply ingrained entrepreneurial traditions (Lee et al., 2005).

Students' entrepreneurial potential also varies across fields of study. Importantly, this advantage does not always favour business-related programs. Teixeira (2008) demonstrated that pharmacy students, compared to others, display higher entrepreneurial potential. Similar results were obtained by Palimaka and Rodzinka (2018), who found that journalism students were almost twice as likely as economics and finance students to plan to start a business during their studies, with psychology in management students exhibiting the least entrepreneurial tendencies.

Salamzadeh et al. (2014) showed that humanities, fine arts, and psychology students possess better entrepreneurial traits compared to those in engineering, basic sciences, and medical disciplines. Similarly, Swarupa and Goyal (2020) found entrepreneurial potential among students in creative and recreational fields (arts, humanities – specifically literature, linguistics, history, archaeology, audiovisual techniques, media production, sports, architecture, and urban planning), as well as law and health (pharmacy and veterinary studies).

The presented evidence indicates that the issue of students' entrepreneurial potential remains incompletely understood. Moreover, recent studies underline the necessity of moving beyond stereotypical assumptions that students in business-related programs inherently possess greater entrepreneurial potential. This paper aligns with this narrative while shedding new light on the identification and evaluation of entrepreneurial potential. It emphasizes differentiation not only based on fields of study but also by degree level (undergraduate and graduate), mode of study (full-time and part-time), and finally, the language in which students pursue their studies.

These observations justify formulating the following research questions:

RQ1: Does high entrepreneurial self-assessment lead students to engage more frequently in business activities compared to their peers?

RQ2: Students from which fields of study exhibit higher entrepreneurial potential?

RQ3: Is there a relationship between the language in which students acquire knowledge and their entrepreneurial potential for starting own businesses?

1.2 Entrepreneurial dimensions

Entrepreneurial potential, discussed in the previous section as a combination of personality traits (Sexton & Bowman, 1983), individual predispositions (Samer Ali & Rashid, 2024), and acquired experiences (Jayawarna et al., 2014), are typically presented in the literature through various dimensions that constitute it. However, the number of these dimensions is not fixed; instead, individual authors propose distinct, original approaches to identifying and naming them.

Fillis and Rentschler (2010) state that entrepreneurial potential comprises three dimensions (groups of traits): innovativeness, risk-taking, and proactiveness. Individuals who exhibit these traits are more inclined to start their own business compared to those lacking them. Yan (2010) similarly argues that entrepreneurial potential is determined by three dimensions, two of which overlap with the classification proposed by Fillis & Rentschler (2010): internal locus of control, risk-taking propensity, and proactiveness. In contrast, Curral et al. (2013) identify four dimensions of entrepreneurial potential: entrepreneurial motivations, psychological competencies, social competencies, and management competencies. Rajković et al. (2021) also describe entrepreneurial potential through four dimensions: leadership, creativity, achievements, and personal control. Dhas and Balaji (2023) suggest that entrepreneurial potential consists of entrepreneurial education, decision-making abilities, risk-taking propensity, proactive personality, and creativity. Meanwhile, Mitrovic Veljkovic et al. (2019) propose a broader range of dimensions shaping entrepreneurial potential, including intellectual abilities, self-confidence, motivation, social relations, constitutions, emotionality, extroversion, and organizational skills.

Considering the diverse yet frequently overlapping perspectives mentioned above, the authors of this article align themselves with Caird's (1991) viewpoint, which advocates narrowing the

dimensions of entrepreneurial potential down to locus of control, motivation, creativity, and propensity to take risks. Several arguments support adopting Caird's (1991) classification for further research. First, this classification incorporates all key aspects of entrepreneurial potential appearing across other models, including locus of control, risk-taking propensity, creativity, proactiveness, and social skills. These categories appear in the models proposed by Fillis and Rentschler (2010), Curral et al. (2013), and Dhas and Balaji (2023), suggesting that Caird's (1991) approach effectively integrates various research perspectives into a coherent whole. Secondly, Caird's (1991) model not only addresses psychological traits such as motivation, personal control, or extraversion, but also entrepreneurial competencies (organizational skills) and risk-taking propensity. This holistic perspective, combining personality attributes with practical skills, renders Caird's (1991) classification the most comprehensive among alternatives. Moreover, Caird's (1991) perspective aligns well with both earlier entrepreneurial studies and subsequent academic approaches. The dimensions included in this model correspond closely with the findings of Rajković et al. (2021) on proactiveness and decision-making abilities, as well as with Dhas and Balaji's (2023) emphasis on psychological and social competencies. Thus, Caird's (1991) classification most accurately captures the dimensions of entrepreneurial potential, providing extensive coverage of key attributes, integrating psychological and managerial competencies, and aligning with other scholarly frameworks, making it both comprehensive and universally applicable.

The first characteristic trait to be explored is locus of control. It is defined (in this research) and said to be represented in an individual that takes responsibility for successes and failures, attributing outcomes to their own ability and effort (Caird, 1991). This is an internal perception of locus of control as mentioned by Mueller and Thomas (2001). "It is an 'internal' believes that one has influence over outcomes through ability, effort, or skills while an 'external' believes that forces outside the control of the individual determine outcomes" Mueller and Thomas (2001). Schjoedt and Shaver (2012) similarly refers to people believing that the outcomes of their actions are under (internal) or beyond (external) their control, stating it is unidimensional though generalized. The link to entrepreneurial potential becomes apparent when considering the trait as favourable to working with complex information by a person's own initiative (Raab et al., 2005). This link emphasizes the tendencies that may be presented in a person with entrepreneurial potential (Brandstätter, 2011). People with a high internal locus of control demonstrate a stronger achievement orientation. This being emotional intelligence competency that involves an individual seeking assessment and feedback to further improve in line with their personal standard of excellence (Elliot & Harackiewicz, 1994). A trait which isn't commonly mentioned in the pursuit of entrepreneurial potential in a person, however, not dissimilar to locus of control. Botezat and Borza (2016), informs that it is reasonable for individuals that do not demonstrate internal locus of control to possess the ability to transfer failure and hence success into their work. Finally, positive correlations have been found between internal locus of control and entrepreneurial intention (Hsiung, 2018).

The second characteristic trait of entrepreneurial potential is motivation. This is a complex trait to measure, and it can be distinguished between outcome-focused (to complete a goal) and process-focused (elements related to the process of goal pursuit, with less of an emphasis on the outcome) (Touré-Tillery & Fishbach, 2014). Motivation could be analysed as stimulation when there is competition with a standard of excellence in situations where performance may be assessed for success or failure (Caird, 1991). It's the process-focused view of striving for specifically difficult and challenging goals, supported by high personal standards of excellence. References to this need for achievement or drive for success are mentioned by other authors in studies on entrepreneurial potential (Zeffane, 2013). Ward et al. (2019), looks at entrepreneurial potential and recognises that intrinsic motivation to achieve personal goals pushes individuals to act upon that goal. This being particularly interesting when looking at perceived controllability and efficacy, knowledge, and skills that could influence an individual's motives to pursue business, as it may signal venture creation as an achievable goal. González-Tejero et al. (2022) tries to understand entrepreneurial motivation and

consequently finds it to be observed in individuals that can find opportunities based on their current needs, stating that this gives rise to entrepreneurial or intra-entrepreneurial actions. Finally, it seems possible that these driving motivations work as an impetus for entrepreneurial passion (Saif & Ghania, 2020) and therefore a trait by which potential can be determined.

The third characteristic trait of entrepreneurial potential is creativity. It is operationally defined as the tendency to be imaginative, innovative, curious, and versatile (Caird, 1991). The measure of creativeness attempts to assess the respondent's subjective evaluation of their creative ability in terms of fluency (ability to produce a large number of ideas), originality (ability to produce uncommon, new, imaginative, or unusual ideas), flexibility (ability to shift from one approach to another), and innovation (ability to perceive in a way that is different to the usual/established obvious way). Other views on creativity are presented by (Eysenck, 1983; Rhodes, 1961) who splits the trait into person, process, product and press, where the person approach includes research on personal characteristics and traits. Process research is more behavioural and involves creative thinking and techniques. Research on creative products assumes that products can be investigated through measures of their quality and quantity and press refers to factors within and especially outside individuals which affect the creativity. Simpler views are presented by Thompson (2004), who names creativity as the source of ideas and opportunities, presenting the trait as one of the facets of an entrepreneur. This link to entrepreneurs is strengthened by (Mitrovic Veljkovic et al., 2019) who names creativity as an essential trait. Berglund and Wennberg (2006) observe creativity among entrepreneurship students and interestingly defines the trait as a mix between novelty and appropriateness that associates problem-solving. This broadens creativity, encompassing adaptive behaviours that help an individual get through, as stated by Berglund and Wennberg (2006), turbulent environments. This kind of creativity opens the capacity for observing entrepreneurial mindsets in individuals branching off the work conducted by (Sánchez-López & Pedraza, 2020) which ties in comfortably to entrepreneurial potential and what this paper is trying to establish within individuals.

The last trait of entrepreneurial potential is the propensity to take risks. It appears that sensitivity to risk characterises entrepreneurial behaviour, and it manifests as risk-avoidance or risk-taking in different reward situations. The term in the literature is operationally defined as the ability to deal with incomplete information and act on a risky option, that requires skill, to actualise challenging but realistic goals (Caird, 1991). An important view and link include (Palmer, 1971) who exercises that the willingness of an individual to deal with uncertain situations with uncertain outcomes has the capacity to be a measure of entrepreneurial potential. Brindley (2005), when discussing barriers to women achieving their entrepreneurial potential links the risk-taking propensity to an overall level of demonstrated confidence within an individual and finds that women and men exhibited similar traits (regarding propensity) but according to Brockhaus Sr (1980) there were still noticeable differences in risk taking. The gender gap is also mentioned by other authors. Yordanova and Alexandrova-Boshnakova (2011) interestingly found that gender has an indirect effect on risk perception via overconfidence and risk propensity. This is attributed to the fact that many other factors play a role in determining an individual's risk-taking propensity and hence entrepreneurial potential. It is worth shedding light on the findings of Brockhaus Sr (1980), who conducted a study that determined the level of risk-taking propensity does not distinguish new entrepreneurs either from their managers or from the general population. This in relation to entrepreneurial potential suggests risk-taking propensity may not be such a reliable source in determining it. However, results of a different study that examined generational differences in entrepreneurial potential found that Y generation (1980-1995) had a higher entrepreneurial potential tendency than X generation (1966-1979) and Baby Boomers generation (1945-1965) due to their higher tendency of taking risks. These interesting studies outline the need for further research to be conducted on risk-taking propensity in relation to entrepreneurial potential among individuals.

2. Methodology

2.1 Data collection and sample

The research was carried out on the entire population of students at the University of Information Technology and Management in Rzeszów, UITM (Poland). Poland provides a relevant and valuable context for studying entrepreneurial potential for several reasons. As a member of the European Union, it offers a relatively stable legal and institutional environment that supports business development. At the same time, it has become an increasingly attractive destination for international students from diverse economic and cultural backgrounds, creating a unique setting for cross-national research. This diversity allows for the observation of how students from various countries interact within the same educational environment while facing different external realities. The research covered all fields of study (Aviation Management, Computer graphics and multimedia production, Computer science, Cosmetology, Cybersecurity, Data science, Dietetics, English Philology, English Philology with Chinese, Finance and accounting in management, Game design and development, Global aviation management, Graphic design, International business management, Journalism and social communication, Logistics, Management, Nursing, Physiotherapy, Programming and Psychology in management), modes of study (full-time and part-time studies), tracks of study (Polish-language and English-language) and level of study (bachelor's and master's degrees). Thanks to this, it was possible to comprehensively analyse the entrepreneurial potential of UITM students in all the sections indicated above. The study assumed that each field of study must be represented by at least 20% of the people studying in it. As a result, a sample of 1,526 students was obtained (i.e. 29.8% of all UITM students), which was representative of both the fields and population of students studying at UITM (Table 1).

Table 1. UITM student population and research sample.

Field of Study	Responses	Total Number of Students	%
Aviation Management	64	246	26.0%
Computer Science	247	624	39.6%
Cybersecurity	18	79	22.8%
Data Science	46	82	56.1%
English philology	98	256	38.3%
English Philology with Chinese	16	50	32.0%
Finance and accounting in management	41	176	23.3%
Physiotherapy - uniform master's degree	61	165	37.0%
Game Design and Development	35	125	28.0%
Global Aviation Management	2	9	22.2%
Computer graphics and multimedia production	126	486	25.9%
International Business Management	57	139	41.0%
Cosmetology	141	549	25.7%
Logistics	125	482	25.9%
Management	148	558	26.5%
Nursing	55	262	21.0%
Programming	117	451	25.9%
Graphic design	22	61	36.1%
Psychology in management	52	216	24.1%
Dietetics	21	33	63.6%
Journalism and Social Communication	28	46	60.9%

Source: Own elaboration.

To ensure easy access to the survey and the scale of the research data was collected using the online platform LimeSurvey. The platform allowed all students to access the survey in Polish and English languages. This was important due to the two-track nature of the fields of study offered at the university. It ensured that the research did not limit the scope of participants by eliminating language barriers. The survey was distributed among the student population using a link sent directly to students. The employment and consequent use of QR codes (linking to the LimeSurvey platform)

became especially useful when targeting fields of study that had not achieved the required minimum 20% representativeness. A direct approach was subsequently used, inviting students to take part in the survey during their classes.

The privacy and confidentiality of the participants were strictly maintained, and the collected data was utilized solely for research purposes. Based on the findings, it can be inferred that the participants demonstrated a clear understanding of the instructions, and no difficulties were reported throughout the data collection process.

Figure 1 illustrates the country of origin of the students who participated in the survey. Nearly half (48.7%) of student entrepreneurs originate from Poland, followed by Ukraine (18.3%), Zimbabwe (8.9%), and Kazakhstan (5.8%).

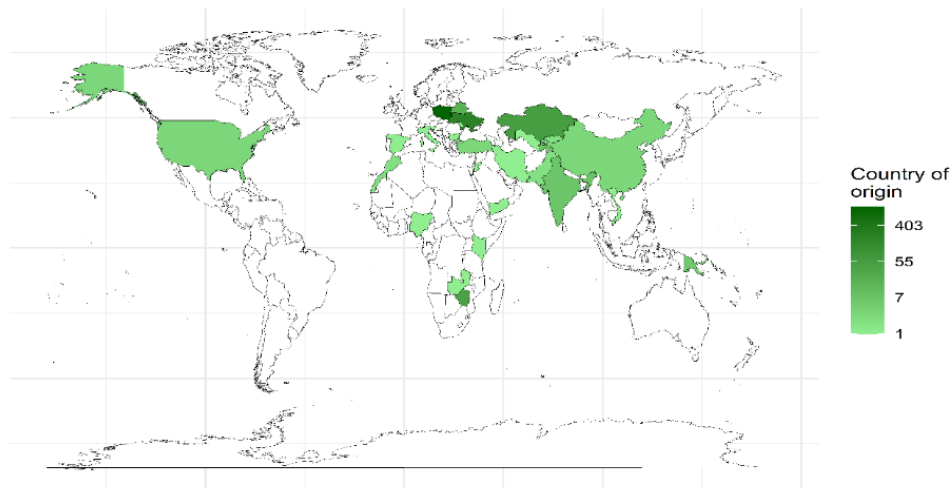


Figure 1. Geographical distribution of surveyed students - by country of origin.

Source: Own elaboration.

The remaining 18.3% belong to other countries such as Belarus, India, China, Pakistan and USA. The significant representation of Ukraine and Kazakhstan suggests that regional proximity and economic similarities may influence entrepreneurial engagement among students. The notable presence of Zimbabwean student entrepreneurs indicates that individuals from emerging economies actively leverage business opportunities, possibly as a response to economic conditions in their home countries.

International students who choose to study in Poland demonstrate a high level of personal entrepreneurial capacity through their educational migration (i.e. moving abroad at a young age, studying in a foreign language, and adapting to a new legal and cultural context). Their presence in the sample adds an additional interpretative layer, showing how varying levels of entrepreneurial potential manifest in a highly diverse academic environment. As a result, this study captures entrepreneurial potential in a way that is simultaneously local (reflecting the Polish institutional setting) and global (encompassing the individual attributes and experiences that students bring from their countries of origin). The focus is on measuring personal characteristics that shape entrepreneurial tendencies rather than directly assessing institutional differences between countries.

1.2 Methods

In this research, an original survey questionnaire was used to determine the entrepreneurial potential of students. The survey was developed in cooperation with experts in fields such as economics, sociology, and psychology to ensure the reliability and psychometricity of the chosen method that would be used to determine the entrepreneurial potential of students. The final iteration of the survey consists of three parts and a total of 44 questions. Due to the defined research questions in this article, Part B on the forms of entrepreneurial support expected by students from the university was omitted. Thus, the research focused on Parts A and C (Appendix A). Part A operationalizes

students' entrepreneurial potential through four dimensions: locus of control, motivation, creativity, and risk-taking propensity, enabling a detailed analysis of each trait while collectively offering a comprehensive method to evaluate entrepreneurial potential. The selection of these dimensions is based on theoretical frameworks, which indicate that they encompass key traits and competencies relevant for initiating and managing entrepreneurial activities, while integrating both psychological and practical aspects. Locus of control and motivation reflects students' self-esteem and their internal readiness to engage in business activities. Creativity reflects differences in innovative abilities in various fields of study. Risk-taking propensity, on the other hand, allows for the assessment of the likelihood of starting a business in different linguistic and cultural contexts. The use of these dimensions allows for a comprehensive assessment of entrepreneurial potential in different groups of students, taking into account both individual characteristics and environmental and cultural factors that may influence the flourishing of entrepreneurship. It is important to note that all questions used a 5-point Likert scale (Joshi et al., 2015) ranging from definitely agree to definitely disagree. The use of a Likert scale on all questions in this part of the survey for all dimensions allowed for an easy comparison and analysis to take place between each of the dimensions. This also provided an easy way to test the reliability of the dimensions. Table 2 provides a summary of the distribution of questions per dimension with the retrospective reliability test results. Entrepreneurship potential was examined considering four complementary dimensions, to describe which variables were developed in the form of scales with the following names: locus of control, creativity, motivation, willingness to take risks. The reliability of each scale was confirmed by the Cronbach's Alpha test (Cronbach, 1951). Formula 1 highlights the method that was used:

$$\alpha = \frac{N\bar{c}}{\bar{v} + (N-1)\bar{c}} \quad (1)$$

where N corresponds to the position on the Likert scale, $\bar{v}$ is the mean variance, $\bar{c}$ is the mean covariance between positions on the Likert scale. For this research, it was assumed that above a level of 0.6, good reliability had been achieved for a given dimension (Martins & Martins, 2002).

Table 2. Question distribution and reliability indicator for dimensions in part (A) of the survey.

Dimension	Questions	Number of Items	Cronbach's α
Locus of control	A1, A2, A3, A4, A5, A6, A7, A8 and A9	9	0.72
Creativity	A10, A11, A12, A13, A14 and A15	6	0.71
Motivation	A16, A17, A18, A19, A20, A21, A22, A23 and A24	9	0.79
Risk-taking propensity	A25, A26, A27 and A28.	4	0.62

Source: Own elaboration.

Each dimension of the survey tool in Table 2 is linked to the research questions. Locus of control and motivation capture students' self-assessment and drive for entrepreneurial activities (RQ1). Creativity reflects differences in innovative capacities across fields of study (RQ2). Risk-taking propensity indicates the likelihood of initiating business activities in diverse linguistic or cultural contexts (RQ3).

The second part of the survey (B) was implemented to determine and review the respondents' opinions towards different forms of entrepreneurship support offered by UITM. It also collected information on the needs of students in this area by asking respondents what forms of support they would like to see introduced. Most questions in this part of the survey were questions with multiple-choice answers. This meant that students could express more than one opinion and better contribute to the gathered data. The multiple-choice questions also had an option that was named 'other', allowing students to express their needs even if it had not been listed in the options provided by the research. As indicated above, the defined research questions did not refer to the questions included in Part B of the survey. Therefore, they were not included in the analysis.

The last part of the survey (C) allowed for the metric analysis of a respondent completing the survey. In this part, information on gender, age, employment status, mode of study, track of study, country of origin, level of study and field of study were collected. This allowed the research to then cross-sectionally analyse data collected on the entrepreneurial potential of students and their metrics.

A 5-point Likert scale was used for each dimension, which enabled the analysis of correlations between individual questions of each index. In the next step, the results were scaled using the linear scaling method (Formula 2). First, the average value for all variables in each scale was calculated for each respondent, then the median was calculated and then the results were scaled so that the median was 100 using the following formula:

$$V_D = \mu_D \times \left(\frac{100}{M_D}\right) \quad (2)$$

where V_D is the rescaled value of a respondent in each dimension, μ_D is the arithmetic mean of the Likert scale response, and M_D is the median score for the retrospective dimension. Then, individual dimensions were presented using histograms (see Figures 1, 3, 5 and 7). Collected responses above 100 indicate an above-average result in each dimension. All analyses and their graphical visualizations were carried out in the R programming environment.

To analyse the likelihood of business ownership among students, logit and probit models were estimated, as these are commonly used for binary dependent variables. The dependent variable y represents whether a student owns a business ($y = 1$) or not ($y = 0$). While the country of registration is not specified, the act of founding and operating a business reflects a concrete manifestation of entrepreneurial behavior and serves as a robust indicator of individual entrepreneurial potential. For international students, additional barriers such as language, legal, and administrative differences may make entrepreneurship particularly demanding, highlighting the strength of their entrepreneurial capabilities. This approach allows for a comprehensive assessment of individual entrepreneurial capacity while acknowledging that broader contextual factors may also influence business ownership. The independent variables include locus of control, creativity, motivation, and risk-taking propensity, which capture key psychological factors influencing entrepreneurial engagement. The general form of the models estimates the probability of owning a business as:

$$P(y = 1 | x) = F(\beta_0 + \beta_1 x_1 + \beta_2 x_2 + \beta_3 x_3 + \beta_4 x_4) \quad (3)$$

For the logit model we have used the logistic function:

$$P(y = 1 | x) = \frac{e^{\beta_0 + \sum \beta_i x_i}}{1 + e^{\beta_0 + \sum \beta_i x_i}} \quad (4)$$

and for the probit model we have used standard normal cumulative distribution function:

$$P(y = 1 | x) = \Phi(\beta_0 + \sum \beta_i x_i) \quad (5)$$

Both models were estimated using the maximum likelihood method, ensuring that predicted probabilities remain between 0 and 1. The coefficients in these models indicate how a change in an independent variable affects the likelihood of business ownership, but their magnitude is not directly interpretable due to differences in scale. Instead, marginal effects were computed to assess the actual impact of each explanatory variable on the probability of business ownership. These results provide a robust framework for understanding the psychological determinants of student entrepreneurship.

3. Research results

3.1 Locus of control

Figure 2 shows the distribution of the locus of control among respondents. The results indicate that students are not characterised by a high locus of control. This since only 707 respondents (46.3%) were above the median.

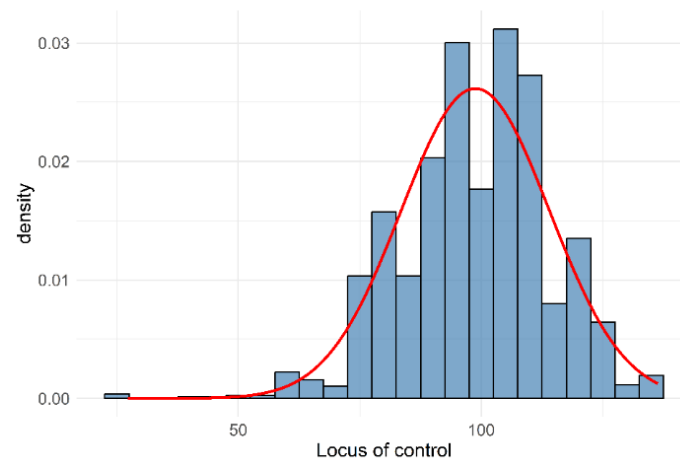


Figure 2. Locus of control among respondents.

Source: Own elaboration.

In other words, had a higher-than-average locus of control. This distribution highlights variability in students' perceived personal agency, which is relevant for understanding individual entrepreneurial potential. Figure 2 demonstrates these results below. The highest correlation observed (0.70; $p < 0.001$) was between question A1, which represents self-assessed entrepreneurship, and question A2, which measures the opinion of family and friends regarding the student's entrepreneurial abilities. The obtained result may indicate consistency in the perception of social roles. The social identity concept (Goffman, 1959) suggests that individuals shape their self-perception and the perception of others based on the social role they fulfil in each context. Those perceived as entrepreneurial may assume the role of a leader or innovator, which, in line with societal expectations, is strongly associated with entrepreneurship.

Additional noteworthy correlations include the following: A1 and A3 (indicating a strong character personality; 0.38; $p < 0.001$), A1 and A5 (describing an entrepreneurial person as persistent; 0.35; $p < 0.001$), and A1 and A7 (suggesting that an entrepreneurial person's life is shaped by their own actions; 0.29; $p < 0.001$). Individuals who believe that their success depends on their own effort are more likely to take risks, persevere, overcome difficulties, and face challenges (Rotter, 1966). Such individuals often perceive themselves as the "creators" of their success, which reinforces their entrepreneurial identity (Luthans, 2002). On the other hand, the correlation analysis reveals no statistically significant relationship (-0.01 ; $p = 0.69$) between questions A1 and A8, which represents the belief that success is an innate trait rather than a result of one's own actions. However, there is a correlation with responses to question A9, which indicates that success is attributed to hard work rather than luck (0.14; $p < 0.001$).

It is important to note that the measure of business ownership used in the study does not differentiate between enterprises registered in Poland and those in students' countries of origin. Consequently, while the presence of a business indicates tangible entrepreneurial behaviour, interpretation should consider that international students may face additional barriers (language, legal, and administrative differences), which could affect both the likelihood and scope of entrepreneurial activity. Moreover, the sample includes young respondents, whose responses may reflect aspirations rather than fully realized business activities. The analysis, therefore, focuses on individual-level entrepreneurial potential, acknowledging that reported ownership or intentions may

vary in maturity and practical realization. This approach ensures that the observed correlations between locus of control and entrepreneurial behaviour are interpreted within a nuanced context, rather than assuming uniform entrepreneurial engagement across all age groups and national backgrounds (Fig. 3).

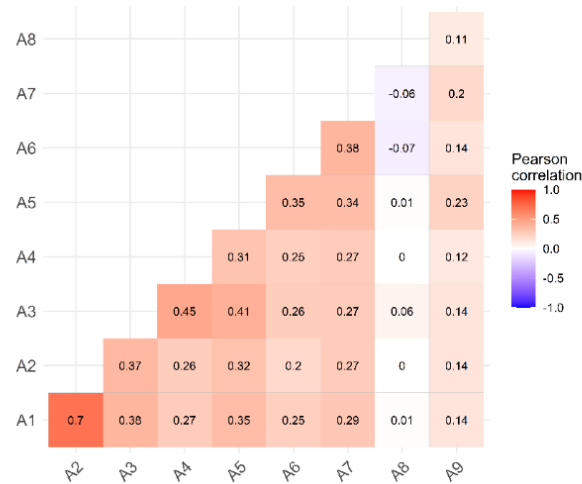


Figure 3. Correlation between questions that determine the locus of control.

Note: A1 – I am an entrepreneurial person, A2 – My family and friends consider me an entrepreneurial person, A3 – I consider myself a person of strong character, A4 – In stressful situations I can concentrate and think clearly, A5 – I am a person who never gives up, A6 – The setbacks I experience provide me with lessons for the future, A7 – My life is determined by my own actions, A8 – To what extent do you agree with the statement that you are either naturally good at something or you are not; effort makes no difference, A9 – To what extent do you agree with the statement that being successful is a result of working hard, luck has nothing to do with it.

Source: Own elaboration.

Entrepreneurship theory further suggests that entrepreneurial individuals exhibit perseverance, a strong work ethic, and a commitment to developing their ideas, even in the face of failure. McClelland (1961), in his motivation theory, emphasizes that entrepreneurs possess a high need for achievement, which is linked to attributing success to their own efforts rather than external factors such as luck. Such individuals develop a high resilience to failure, as setbacks are perceived as an inherent part of the learning and growth process.

3.2 Creativity

The results show that 989 respondents (58.8%) were above the median, demonstrating above average level of creativity. Figure 4 shows the distribution of this variable. This indicates that a substantial proportion of students possess cognitive flexibility and innovative thinking, which are key components of entrepreneurial potential. Most correlations observed in the motivation dimension are highly significant at $p < 0.001$.

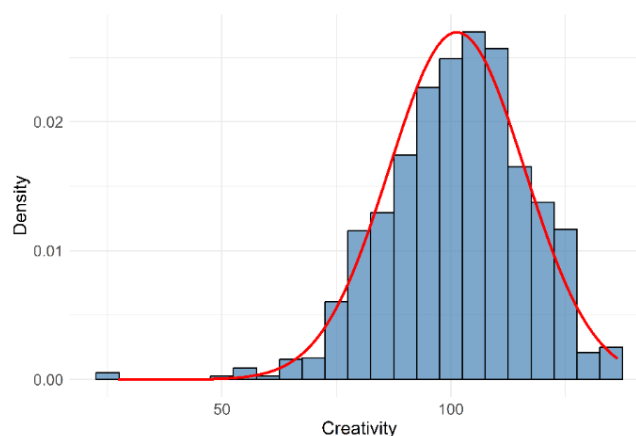


Figure 4. Creativity among respondents.

Source: Own elaboration.

Figure 5 demonstrates the highest correlation between question A11 (ability to find oneself in any situation) and question A12 (ease of adaptation to new circumstances; 0.48; $p < 0.001$).

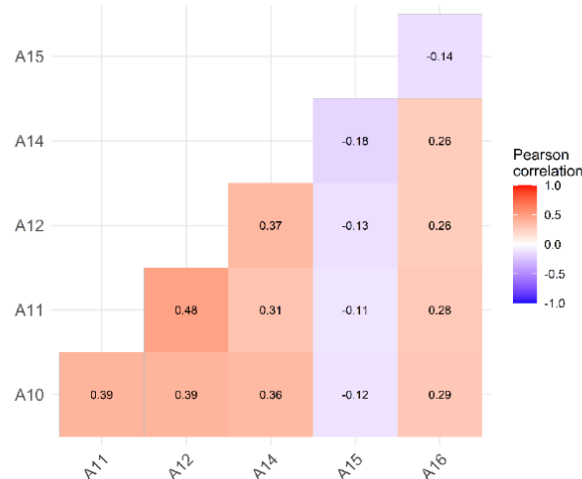


Figure 5. Correlation between questions that determine creativity.

Note: A10 – In difficult and complex situations, I always find a few alternatives to solve the problem, A11 – I can find myself in any, even in the most unfavourable circumstances, A12 – I can easily adapt to new circumstances, A13 – I am able to look at a situation from different points of view, A14 – I like to find out about things even if it means handling some problems while doing so, A15 – I prefer doing things in the usual way rather than trying out new ways, A16 – I am seriously thinking about starting a business.

Source: Own elaboration.

The obtained result can be linked to the experiential learning theory (Kolb, 2014), which emphasizes the role of prior experiences in developing adaptive skills. Students who navigate diverse situations effectively, may translate their experiences into practical problem-solving strategies, which is essential for entrepreneurial activities.

Moreover, positive correlations are observed between question A10 (ability to identify multiple alternatives in challenging situations) and questions A11, A12, and A14. These correlations suggest that creative students are not only flexible in thinking but also resilient, capable of turning setbacks into learning opportunities (Masten, 2001; Shane, 2003). This aligns with findings from our logit and probit analyses, which indicate that creativity is a significant predictor of entrepreneurial potential among students.

It is worth noting that question A10 exhibits a small but statistically significant correlation with question A15 (reluctance to adopt new problem-solving methods). This may reflect that some students prefer established approaches over radical innovation, highlighting that entrepreneurial creativity can manifest in both adaptive and incremental forms. Furthermore, questions A11, A12, and A14 exhibit positive correlations with question A16 (declaration of interest in starting one's own business). This suggests that cognitive flexibility and adaptability (Diamond, 2013) are associated with students' intentions to engage in entrepreneurship, although the actual realization of these intentions may depend on contextual factors, including the country of business registration and institutional frameworks.

Given the diverse age and international composition of the sample, the observed correlations between creativity and entrepreneurial potential should be interpreted with caution. In particular, variations in respondents' experience levels and the country in which they may actually operate a business could influence the practical realization of entrepreneurial intentions. Therefore, while creativity emerges as a significant individual-level predictor, contextual factors and sample heterogeneity should be taken into account when generalizing these findings.

Additionally, there is a small but statistically significant correlation between question A15 and question A16 (0.14; $p < 0.001$). This finding supports the notion that entrepreneurial success does not

always require groundbreaking innovation; many students may leverage existing methods efficiently to create value (Kirzner, 2015; Schumpeter, 2004).

3.3 Motivation

The results indicated that most students are below the median in the motivation dimension. A score above 100 was recorded for only 681 students, which represented 44.6% of all students at the university. These results are graphically demonstrated on Figure 6.

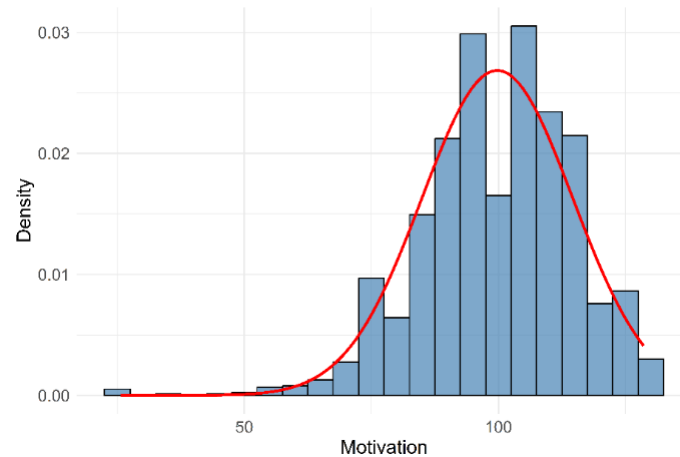


Figure 6. Motivation among respondents.

Source: Own elaboration.

Figure 7 displays the highest positive correlation (0.73; $p < 0.001$) between question A16 (declaration of interest in starting one's own business) and A17 (willingness to do anything to become an entrepreneur).

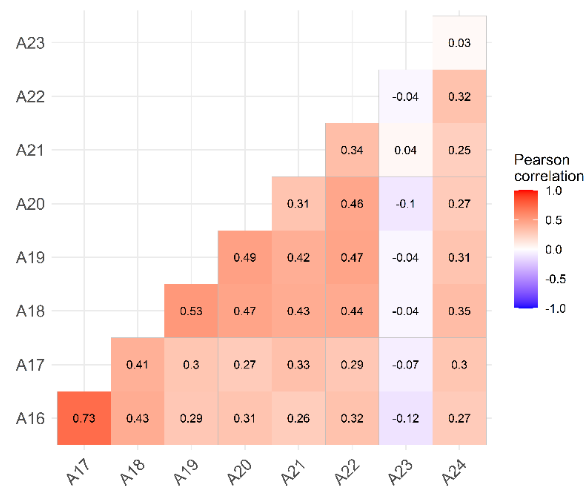


Figure 7. Correlation between questions that determine motivation.

Note: A16 – I am seriously thinking about starting a business, A17 – I am ready to do anything to become an entrepreneur, A18 – I make a determined effort to achieve the goals I set for myself, A19 – I try to cope with solving problems no matter how difficult they are, A20 – Dealing with difficult situations strengthens and develops me, A21 – I implement developed plans from start to finish, A22 – I am open to new experiences, A23 – I would not mind routine unchallenging work if the pay was good, A24 – When I am faced with a challenge, I think more about the results of succeeding than the effects of failing.

Source: Own elaboration.

The finding aligns with the perspective of Klinkosz and Sękowski (2006), as cited in Schuler & Prochaska (2000). The authors highlight that individuals with a high need for achievement are more inclined to engage in entrepreneurial activities. They demonstrate determination and a willingness to make sacrifices in pursuit of their goals. Conversely, a moderate positive correlation (0.53; $p < 0.001$)

is observed between questions A18 (reflecting a commitment to giving one's best to accomplish objectives) and A19 (indicating a proficiency in problem-solving regardless of complexity). Hollenbeck & Klein (1987) demonstrate that commitment to goal achievement is crucial for attaining successful outcomes. Consequently, individuals with a high level of commitment are more proficient in overcoming challenges encountered along the path to reaching their objectives.

Additionally, there is a correlation between question A23 (willingness to accept routine, undemanding work with adequate remuneration) and questions A16 (0.12; $p < 0.001$) and A17 (0.07; $p = 0.0074$). The identified relationship is consistent with the views of Batz Liñeiro et al. (2024). In their opinion, individuals seeking financial stability through routine employment may simultaneously consider entrepreneurship as a means of improving their economic situation. The relationship between a preference for stable work and entrepreneurial aspirations is therefore complex and cannot be described in a binary manner.

The observed relations between motivation and entrepreneurial potential should be interpreted with consideration for the sample's heterogeneity. In particular, international students may face barriers in translating motivation into actual business ownership, depending on whether entrepreneurial activity occurs in Poland or their country of origin. Moreover, young respondents may report high motivational scores reflecting aspirations rather than tangible entrepreneurial actions. Despite these contextual factors, the significant correlations between motivation-related items and entrepreneurial intentions (A16, A17) underscore the role of intrinsic drive and commitment as key individual-level determinants of entrepreneurial potential. These findings are consistent with prior research highlighting the predictive value of motivational traits for entrepreneurial behaviour (Hollenbeck & Klein, 1987; Klinkosz & Sękowski, 2006), while also acknowledging the need to consider age and contextual limitations when generalizing the results.

3.4 Risk-taking propensity

The results of the linear scaling indicate that most students can be characterised by a low risk-taking propensity. Out of the 1526 surveyed students, 754 (48.8%) were above the median for this dimension. The results are graphically demonstrated by Figure 8.

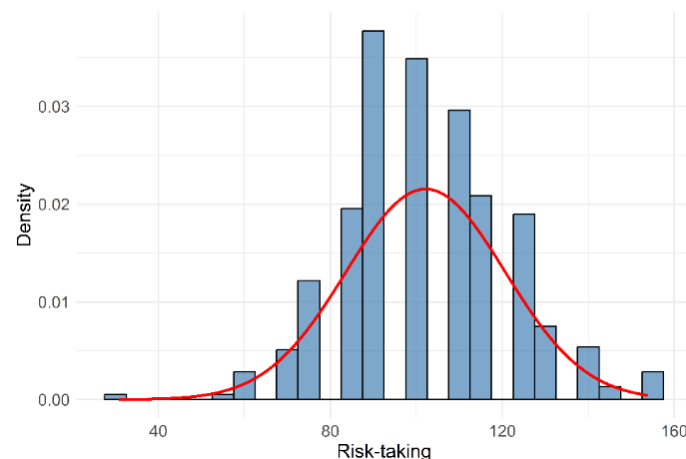


Figure 8. Risk-taking propensity of respondents.

Source: Own elaboration.

Figure 9 reveals a weak negative correlation (-0.19 ; $p < 0.001$) between question A25 (pertaining to the inclination to embrace new challenges) and question A26 (describing pessimism and excessive caution in difficult situations). The above finding suggests that individuals with a higher level of pessimism tend to focus on the negative aspects of risk, which may lead them to avoid taking on new challenges. However, this relationship is weak, as other factors, such as individual experiences and personality traits, also influence the willingness to engage in challenges (Dohmen et al., 2023).

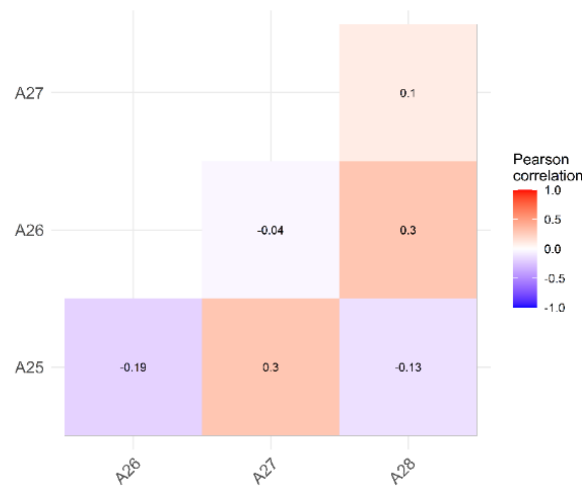


Figure 9. Correlation between questions that determine risk-taking.

Note: A25 – I like to take on challenges that allow me to prove myself in new situations, A26 – I tend to be pessimistic and overly cautious in difficult situations, A27 – Before making an important decision, I prefer to weigh up the pros and cons fairly quickly rather than spending a long time thinking about it, A28 – If there is a chance of failure, I would rather not do it.

Source: Own elaboration.

Furthermore, a moderate positive correlation (0.30; $p < 0.001$) is observed between questions A25 and A27 (indicating the ability to swiftly analyse the pros and cons before making important decisions). This result aligns with the view of Cassey et al. (2014), who argues that individuals who readily take on challenges in new situations often make decisions quickly, without unnecessary hesitation. Such individuals tend to process information more rapidly (Wickelgren, 1977) and have a lower need for multifaceted and time-consuming analyses, enabling them to act efficiently, even in unfamiliar circumstances.

Additionally, there is a weak correlation (0.13; $p < 0.001$) between questions A25 and A28 (indicating a tendency to avoid actions with a risk of failure). The observed pattern indicates that individuals who enjoy taking on challenges often accept the possibility of failure (Jagacinski et al., 2008) as an integral part of the learning and development process. However, when the probability of failure is high, even these individuals may choose to withdraw from action. Nonetheless, this relationship is generally weak, as individual risk tolerance and the assessment of potential benefits play a crucial role in decision-making (Wang et al., 2022).

While these correlations describe individual tendencies, their interpretation must consider the broader context. Risk-taking propensity is a key psychological trait influencing entrepreneurial behaviour (Stewart Jr & Roth, 2001). In our study, the generally low level of risk-taking suggests that many students are cautious when considering entrepreneurship, which may partly explain the limited number of actual business owners.

Given the diversity of the sample, including international and young respondents, the reported entrepreneurial activity may vary in meaning. For instance, it remains unclear whether international students referred to businesses in Poland or their home countries, and younger participants may express aspirations rather than real experience. Therefore, risk-taking propensity should be seen as an indicator of entrepreneurial potential rather than direct entrepreneurial outcomes.

While risk-taking is an important predictor of entrepreneurial behaviour, it is shaped by contextual, cultural, and developmental factors, which must be considered when interpreting these results.

3.5 Fields of study

The results of the respondents' self-assessment of their entrepreneurial potential are presented on Figure 10. The results show that 867 students (56.8% of all respondents) describe themselves as

entrepreneurial. Of this group, 279 (18.3%) declare strongly that they are entrepreneurial. In contrast, 237 respondents (15.5%) do not see themselves as an entrepreneurial person.

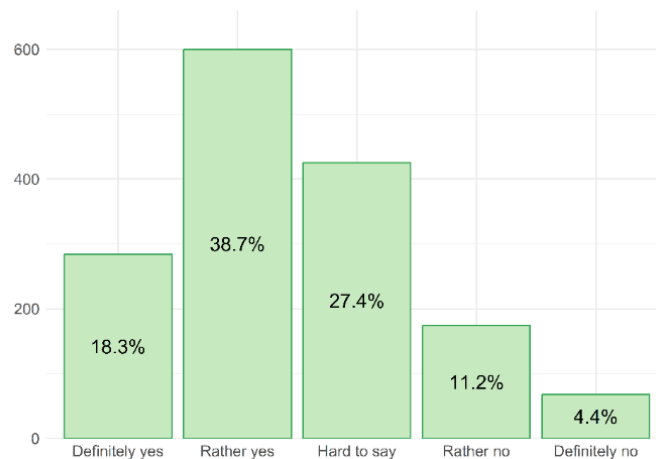


Figure 10. Self-assessment of entrepreneurship.

Source: Own elaboration.

Additionally, there are noticeable differences between students in different fields of study in how they perceive themselves as entrepreneurial (Appendix B). Respondents that most often considered themselves to be entrepreneurial persons are students in management (12.5%), information technology (12.2%) and logistics (10.8%). While the fields of study for which none or very few students chose to describe themselves as entrepreneurial, was English Philology with Chinese (0.0%), English Philology (0.4%) and game design and development (0.7%).

Data on the fields of study with the highest number of students running their own businesses was collected (Figure 11). Among the persons surveyed who run their own business, the largest number represented the International Business Management field (25 persons), followed by Management and Information Technology (24 and 23 persons respectively).

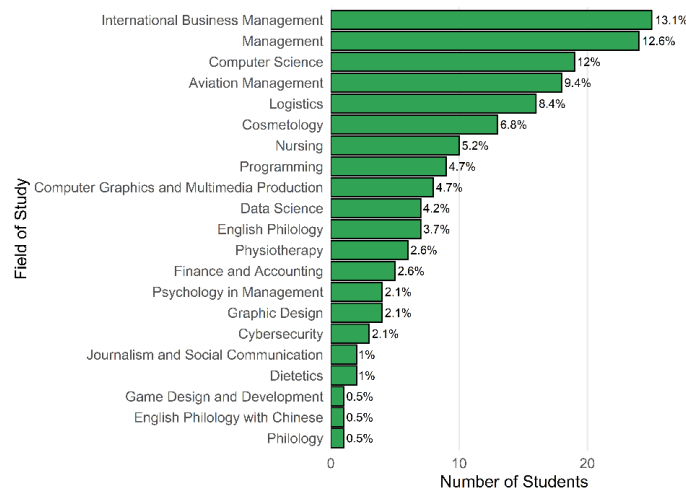


Figure 11. Business owners by field of study.

Source: Own elaboration.

The highest percentage of student entrepreneurs is observed in International Business Management (13.1%), Management (12.6%), and Computer Science (12%), aligning with expectations that business-related and technology-oriented fields equip students with the knowledge and competencies necessary for starting and managing enterprises. This observation is consistent with previous findings (Hmieleski & Baron, 2009; Nabi & Holden, 2008), which indicate that students

in management and IT-related disciplines develop both strategic and technical skills essential for entrepreneurship. Aviation Management (9.4%) and Logistics (8.4%) also show strong entrepreneurial representation, suggesting that industries requiring operational efficiency and global market awareness foster business initiatives among students. Interestingly, fields traditionally associated with service provision, such as Cosmetology (6.8%) and Nursing (5.2%), demonstrate notable levels of business ownership. This reflects broader labour market trends, where self-employment is a common career path in personal care and private healthcare services, allowing professionals to establish independent practices.

Lower entrepreneurial engagement is observed in humanities and social sciences, with English Philology (3.7%), Physiotherapy (2.6%), and Finance and Accounting (2.6%) displaying relatively limited business activity. While finance-related disciplines provide knowledge applicable to entrepreneurship, students in this field may prefer corporate or institutional career paths over independent ventures (Klimkowska & Klimkowski, 2020).

The estimated logit and probit models (Table 2) yield largely consistent results regarding the determinants of business ownership. In both models, the intercept is negative and statistically significant, reflecting a low baseline probability of owning a business when the predictors are zero.

Table 2. Modelling results – dependent variable: owning a business.

	Logit	Probit
Intercept	-10.69 *** [<0.01]	-5.72 *** [<0.01]
Locus of control	0.03 *** [<0.01]	0.02 *** [<0.01]
Creativity	0.02 ** [0.01]	0.01** [0.01]
Motivation	0.02* [0.03]	0.01* [0.02]
Risk-taking propensity	0.01 [0.24]	0.002 [0.25]
AIC	1019.5	1021.4

Source: Own elaboration.

The coefficient for Locus of control is positive and highly significant (0.03 in the logit model and 0.02 in the probit model, both with $p < 0.01$), indicating that a higher internal locus of control is associated with an increased likelihood of business ownership. Creativity also has a positive influence on the probability of owning a business, with coefficients of 0.02 (logit) and 0.01 (probit), significant at the 1% level, suggesting that more creative individuals are more inclined to engage in entrepreneurship. Motivation shows a positive and significant effect (0.02 in the logit model at $p = 0.03$ and 0.01 in the probit model at $p = 0.02$). The Risk-taking Propensity does not appear to be a statistically significant predictor in either model (0.01 in the logit and 0.002 in the probit model, with $p > 0.24$ in both cases), implying that its role in determining business ownership is less clear or potentially mediated by other factors.

The results indicate that internal psychological traits (particularly locus of control, creativity, and motivation) are strong predictors of business ownership. This finding underscores the role of cognitive and motivational factors in fostering entrepreneurial behaviour (McClelland, 1961; Shane, 2003). In contrast, risk-taking propensity was not significant, suggesting that risk tolerance may influence entrepreneurship indirectly or be moderated by other factors, such as cultural or institutional barriers.

The interpretation of these findings should take into account the diversity of the sample. Because the survey included students from various countries and age groups, the reported business ownership may refer to enterprises operating under very different legal and economic conditions. Additionally, for the youngest respondents, certain answers could reflect future intentions or plans rather than

current entrepreneurial activity. This context is essential for accurately understanding the scope and meaning of the results.

The models provide valuable evidence that individual psychological factors are crucial for understanding entrepreneurial potential, but their impact should be viewed in light of contextual and developmental considerations.

4. Discussion

The research results obtained from the analysed data provided answers to the formulated research questions. The findings demonstrate that fields of study in which students exhibit high entrepreneurial self-assessment correlate with their declarations of running their own businesses (RQ1). This outcome aligns with expectations, as Chen et al. (1998) show that students with high entrepreneurial self-assessment – defined as a strong belief in their ability to successfully perform entrepreneurship-related tasks – are significantly more likely to engage in business activities. However, entrepreneurial self-assessment can be subjective (Lyons et al., 2015; Wach et al., 2017). Therefore, understanding how individuals are perceived by their surroundings is particularly important in identifying their actual entrepreneurial potential (Pinheiro et al., 2023). Confirming this relationship through the presented research adds significant value to the existing studies on students' entrepreneurial potential (Zhang et al., 2023) while also shaping directions for further research in this area.

The analyses also highlighted the relationship between the language in which students pursue their studies and their entrepreneurial potential (RQ3). Studying in a foreign language is indicative of resourcefulness and entrepreneurial tendencies (Wijaya & Gracia, 2024). Individuals with an internal locus of control believe they have influence over their lives and decisions, which fosters business initiatives (Annisa et al., 2021). Moreover, the willingness to take business risks is linked to a readiness to engage in uncertain situations (Mueller & Thomas, 2001). Therefore, studying in a foreign language, often in a foreign country, can serve as a "litmus test" for assessing one's preparedness to enter the business world.

The modelling results show that the top predictors of business ownership are a strong internal locus of control, high creativity, and solid motivation. In simple terms, students who believe they control their own fate, who are creative, and who are self-driven are much more likely to own a business. On the other hand, the willingness to take risks did not play a significant role as a predictor of entrepreneurship potential in the tested group of students. This may be associated with the age of the respondents.

The study further revealed that management-related fields and computer science (Norhaidah Abu Haris & Abu Talib Othman, 2017) are particularly popular among students who run their own businesses (RQ2). Management students acquire knowledge in business strategy, marketing, and finance – key competencies necessary for running a business (Fayolle & Gailly, 2015; Hmieleski & Baron, 2009). Meanwhile, computer science students develop technical skills that enable them to create products and services based on modern technologies (Nabi & Holden, 2008). Complementing these qualifications with general academic courses (such as the basics of economics, personal business models, or fundamental management principles) and providing support in business conceptualization facilitates the process of starting a business.

At the opposite end of the entrepreneurial potential spectrum are students majoring in Chinese philology, with as many as 36% of respondents not perceiving themselves as entrepreneurial. This result suggests that these students are more likely to associate their career plans with salaried employment rather than self-employment. This perspective aligns with the findings of Klimkowska and Klimkowski (2020) as well as Trojak et al. (2023). The qualifications gained by English Philology students are predominantly service-oriented and are more strongly linked to employment rather than independent business ventures (Alhassan et al., 2021).

Conclusions

The study provides valuable insights into the entrepreneurial potential of students at the University of Information Technology and Management in Rzeszow (Poland). The research methodology, based on an original psychometric tool operationalizing four theoretical dimensions: locus of control, motivation, creativity, and risk-taking propensity, combined with rigorous statistical analyses, ensured reliability and validity of the results. Given the heterogeneous composition of the sample, which included students from diverse countries, cultural backgrounds, and educational systems, the findings primarily reflect individual-level entrepreneurial potential rather than specific national or institutional conditions.

The estimated logit and probit models indicate that key psychological traits, specifically internal locus of control, creativity, and motivation are significant predictors of business ownership among students, whereas risk-taking propensity does not show a statistically significant effect. For international students, additional challenges such as language barriers, unfamiliar legal frameworks, and administrative requirements may further highlight the role of personal traits in entrepreneurial activity. These results emphasize the importance of cognitive and motivational factors in shaping entrepreneurial behaviour.

While the study focused on a single university, limiting the direct generalizability of findings to other educational contexts or countries, it provides a robust basis for understanding the individual-level determinants of entrepreneurial potential. Extending this research to international samples and integrating qualitative methods, such as interviews or focus groups, would allow for comparative analyses across different cultural and institutional contexts and offer a deeper understanding of the factors shaping entrepreneurial potential.

The high reliability of the developed research tool, combined with its adaptation to an international student population, supports its future application in cross-cultural studies and underscores the relevance of assessing entrepreneurial potential at the individual level, taking into account the broader socio-cultural and institutional environment.

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Data Availability Statement: The data utilized in this manuscript were obtained through a survey conducted within the framework of a research project. The dataset is securely stored on the servers of the University of Information Technology and Management in Rzeszow. Access to the data may be granted to interested parties upon request submitted via email to the corresponding author.

Conflicts of Interest: The authors affirm no conflict of interest.

Appendix A

Survey on student entrepreneurial potential and forms of business support expected by students

The staff of the Department of Entrepreneurship at UITM in Rzeszow are conducting research on the potential for entrepreneurship among students and the forms of support from the University that students planning to start a business expect. Answers to the questions in the survey are anonymous. The results will be used to develop solutions aimed at effectively supporting those planning to set up a business. We hope for honest and comprehensive answers. Incomplete questionnaires will not provide full knowledge of the topic under investigation. The survey will take no longer than 10 minutes to complete.

Thank you for completing the survey

(A) Student Entrepreneurial Potential (In each question, please only choose one response)

A1. I am an entrepreneurial person

- a) Definitely agree
- b) Rather agree

- c) Neither agree or disagree
- d) Rather disagree
- e) Definitely disagree

A2. My family and friends consider me an entrepreneurial person

- a) Definitely agree
- b) Rather agree
- c) Neither agree or disagree
- d) Rather disagree
- e) Definitely disagree

A3. I consider myself a person of strong character

- a) Definitely agree
- b) Rather agree
- c) Neither agree or disagree
- d) Rather disagree
- e) Definitely disagree

A4. In stressful situations I can concentrate and think clearly

- a) Definitely agree
- b) Rather agree
- c) Neither agree or disagree
- d) Rather disagree
- e) Definitely disagree

A5. I am a person who never gives up

- a) Definitely agree
- b) Rather agree
- c) Neither agree or disagree
- d) Rather disagree
- e) Definitely disagree

A6. The setbacks I experience provide me with lessons for the future

- a) Definitely agree
- b) Rather agree
- c) Neither agree or disagree
- d) Rather disagree
- e) Definitely disagree

A7. My life is determined by my own actions

- a) Definitely agree
- b) Rather agree
- c) Neither agree or disagree
- d) Rather disagree
- e) Definitely disagree

A8. To what extent do you agree with the statement that you are either naturally good at something or you are not; effort makes no difference

- a) Definitely agree
- b) Rather agree
- c) Neither agree or disagree
- d) Rather disagree
- e) Definitely disagree

A9. To what extent do you agree with the statement that being successful is a result of working hard, luck has nothing to do with it

- a) Definitely agree
- b) Rather agree
- c) Neither agree or disagree
- d) Rather disagree
- e) Definitely disagree

A10. In difficult and complex situations, I always find a few alternatives to solve the problem

- a) Definitely agree
- b) Rather agree
- c) Neither agree or disagree
- d) Rather disagree
- e) Definitely disagree

A11. I can find myself in any, even in the most unfavourable circumstances

- a) Definitely agree
- b) Rather agree
- c) Neither agree or disagree
- d) Rather disagree
- e) Definitely disagree

A12. I can easily adapt to new circumstances

- a) Definitely agree
- b) Rather agree
- c) Neither agree or disagree
- d) Rather disagree
- e) Definitely disagree

A13. I am able to look at a situation from different points of view

- a) Definitely agree
- b) Rather agree
- c) Neither agree or disagree
- d) Rather disagree
- e) Definitely disagree

A14. I like to find out about things even if it means handling some problems while doing so

- a) Definitely agree
- b) Rather agree
- c) Neither agree or disagree
- d) Rather disagree
- e) Definitely disagree

A15. I prefer doing things in the usual way rather than trying out new ways

- a) Definitely agree
- b) Rather agree
- c) Neither agree or disagree
- d) Rather disagree
- e) Definitely disagree

A16. I am seriously thinking about starting a business

- a) Definitely agree
- b) Rather agree
- c) Neither agree or disagree
- d) Rather disagree
- e) Definitely disagree

A17. I am ready to do anything to become an entrepreneur

- a) Definitely agree
- b) Rather agree
- c) Neither agree or disagree
- d) Rather disagree
- e) Definitely disagree

A18. I make a determined effort to achieve the goals I set for myself

- a) Definitely agree
- b) Rather agree
- c) Neither agree or disagree
- d) Rather disagree
- e) Definitely disagree

A19. I try to cope with solving problems no matter how difficult they are

- a) Definitely agree
- b) Rather agree
- c) Neither agree or disagree
- d) Rather disagree
- e) Definitely disagree

A20. Dealing with difficult situations strengthens and develops me

- a) Definitely agree
- b) Rather agree
- c) Neither agree or disagree
- d) Rather disagree
- e) Definitely disagree

A21. I implement developed plans from start to finish

- a) Definitely agree
- b) Rather agree
- c) Neither agree or disagree
- d) Rather disagree
- e) Definitely disagree

A22. I am open to new experiences

- a) Definitely agree
- b) Rather agree
- c) Neither agree or disagree
- d) Rather disagree
- e) Definitely disagree

A23. I would not mind routine unchallenging work if the pay was good

- a) Definitely agree
- b) Rather agree
- c) Neither agree or disagree
- d) Rather disagree
- e) Definitely disagree

A24. When I am faced with a challenge, I think more about the results of succeeding than the effects of failing

- a) Definitely agree
- b) Rather agree
- c) Neither agree or disagree
- d) Rather disagree
- e) Definitely disagree

A25. I like to take on challenges that allow me to prove myself in new situations

- a) Definitely agree
- b) Rather agree
- c) Neither agree or disagree
- d) Rather disagree
- e) Definitely disagree

A26. I tend to be pessimistic and overly cautious in difficult situations

- a) Definitely agree
- b) Rather agree
- c) Neither agree or disagree
- d) Rather disagree
- e) Definitely disagree

A27. Before making an important decision, I prefer to weigh up the pros and cons fairly quickly rather than spending a long time thinking about it

- a) Definitely agree
- b) Rather agree
- c) Neither agree or disagree
- d) Rather disagree
- e) Definitely disagree

A28. If there is a chance of failure, I would rather not do it

- a) Definitely agree
- b) Rather agree
- c) Neither agree or disagree
- d) Rather disagree
- e) Definitely disagree

(B) Expectations entrepreneurship support offered by UITM (For each question, choose only one response)

B1. Do you run a business or are you a shareholder in a company? (If "No" go to question B2, if "Yes" go to question B3)

- a) Yes
- b) No

B2. Do you plan to start a business while studying at UITP?

- a) Definitely agree
- b) Rather agree
- c) Neither agree or disagree
- d) Rather disagree
- e) Definitely disagree

B3. Have you ever used UITMs support in setting up and running a business? (If "Yes" go to question B4 and then B6, if "No" go to question B5)

- a) Yes
- b) No

B4. What was the support provided by UITM about?

- a) support in preparing a business plan
- b) financial and accounting support
- c) legal support
- d) participation in thematic training courses for entrepreneurs
- e) support in obtaining external funding for starting a business
- f) support in developing a product strategy
- g) support in developing a marketing strategy
- h) Other, which

B5. If you did not use the support offered by UITM when setting up your business, what was the reason?

- a) I was not aware that such support was available
- b) I had no need for the support offered by the university
- c) I think that the market offers better support than the university
- d) I did not know who / which units at the university to approach for support
- e) I did not want the support provided to create future obligations towards the university
- f) I needed financial support which I could not get from the university
- g) Other, which

B6. Are you interested in taking advantage of the start-up and business assistance offered by UITM again? (If "Yes" go to question B7. If "No" go to question B8).

- a) Yes
- b) No

B7. What kind of support do you expect from UITM when setting up your business, taking into account your previous experience with support from the University?

- a) assistance in the preparation of a business plan
- b) financial and accounting advice
- c) legal advice
- d) direct financial support from UITM
- e) participation in thematic training courses
- f) support in the development of a business model
- g) assistance in choosing the organizational and legal form of business activity
- h) assistance in the procedure of registering business activity
- i) assistance in obtaining funds for starting business activity
- j) possibility to consult business ideas with practitioners
- k) Other, which

B8. If you do not plan to use UITMs support when setting up your business, what are the reasons for this?

- a) I do not think that the university has an attractive offer of support
- b) I need financial support, which I will not get at university
- c) I don't want too many people to know about my business idea
- d) I don't want to have obligations towards the university
- e) I have more confidence in external experts
- f) I have had bad experiences with applying for university support
- g) The support provided by the university has not met my expectations
- h) Services provided by other market players meet my needs better
- i) Other, which

(C) METRICS

C1. Gender:

- a) Female
- b) Male

C2. Age:

- a) from 16 to 18
- b) from 19 to 21
- c) from 22 to 24
- d) from 25 to 30
- e) from 31 to 40
- f) from 41 and above

C3. Employment status:

- a) full-time employee
- b) part-time employee
- c) unemployed
- d) freelancer
- e) self-employed
- f) trainee/apprentice
- g) economically inactive

C4. Mode of study:

- a) Offline
- b) Online

C5. Track of study:

- a) Polish -Language
- b) English-Language

C6. Country of Origin:

- a) Poland,
- b) Ukraine,
- c) Kazakhstan,
- d) China,
- e) India,
- f) Belarus,
- g) Other, which

C7. Level of study:

- a) Bachelor
- b) Master
- c) Postgraduate

C8. Field of Study:

- a) Aviation Management
- b) Computer science
- c) Social Work
- d) Game Design and Development
- e) International Business Management
- f) Nursing
- g) Programming
- h) Global Aviation Management
- i) Cybersecurity
- j) Data Science
- k) (.....)

Thank you for filling in the questionnaire

Note: The minimum age of participants was set at 16 to include students from countries such as Ukraine, Kazakhstan, China, India, Belarus, Spain, Pakistan, Papua New Guinea, Morocco, Kyrgyzstan, Turkey, Jordan, Vietnam, Tajikistan, Zambia, Nigeria, Uzbekistan, Kenya, Moldova, Yemen, Zimbabwe and others, where university education typically begins at a younger age. This approach ensured that all first-year students could participate in the study without being excluded based on age.

Appendix B**Table 3.** Cross-analysis for questions: A1. I am an enterprising person and a C8. Courses of study.

C8.	A1.										Total	
	Definitely yes		Most likely yes		Hard to say		Probably not		Definitely not			
	N	%	N	%	N	%	N	%	N	%	N	%
N/A	1	0.4%	3	0.5%	2	0.5%	0	0.0%	0	0.0%	6	0.4%
Aviation Management (AM) & Global AM	19	6.8%	25	4.3%	10	2.4%	9	5.3%	3	4.5%	66	4.3%
Cybersecurity	3	1.1%	7	1.2%	6	1.4%	1	0.6%	1	1.5%	18	1.2%
Data Science	7	2.5%	24	4.1%	10	2.4%	4	2.4%	1	1.5%	46	3.0%
Dietetics	3	1.1%	8	1.4%	8	1.9%	1	0.6%	1	1.5%	21	1.4%
Journalism and Social Communication	7	2.5%	12	2.0%	6	1.4%	1	0.6%	2	3.0%	28	1.8%

Philology	1	0.4%	0	0.0%	0	0.0%	0	0.0%	0	0.0%	1	0.1%
English philology	6	2.2%	39	6.6%	34	8.1%	16	9.4%	2	3.0%	97	6.4%
English philology with Chinese	0	0.0%	6	1.0%	7	1.7%	1	0.6%	2	3.0%	16	1.0%
Finance and accounting in management	14	5.0%	9	1.5%	14	3.3%	3	1.8%	1	1.5%	41	2.7%
Physiotherapy - uniform master's degree	5	1.8%	21	3.6%	27	6.4%	6	3.5%	2	3.0%	61	4.0%
Computer graphics and multimedia production	9	3.2%	51	8.7%	44	10.4%	13	7.6%	9	13.4%	126	8.3%
Computer Science	34	12.2%	100	17.0%	75	17.8%	25	14.7%	13	19.4%	247	16.2%
International Business Management	28	10.0%	21	3.6%	4	0.9%	2	1.2%	2	3.0%	57	3.7%
Cosmetology	20	7.2%	65	11.1%	38	9.0%	13	7.6%	5	7.5%	141	9.2%
Logistics	30	10.8%	51	8.7%	31	7.3%	10	5.9%	3	4.5%	125	8.2%
Nursing	28	10.0%	16	2.7%	4	0.9%	3	1.8%	4	6.0%	55	3.6%
Programming	13	4.7%	32	5.4%	41	9.7%	27	15.9%	4	6.0%	117	7.7%
Game Design and Development	2	0.7%	10	1.7%	16	3.8%	7	4.1%	0	0.0%	35	2.3%
Graphic design	6	2.2%	3	0.5%	5	1.2%	6	3.5%	2	3.0%	22	1.4%
Psychology in management	8	2.9%	24	4.1%	14	3.3%	6	3.5%	0	0.0%	52	3.4%
Management	35	12.5%	61	10.4%	26	6.2%	16	9.4%	10	14.9%	148	9.7%
Total	279	100%	588	100%	422	100%	170	100%	67	100.0%	1526	100%

Source: Own elaboration.

Reference

1. Alhassan, A., Ali, N. A., & Ali, H. I. H. (2021). EFL students' challenges in English-medium business programmes: Perspectives from students and content teachers. *Cogent Education*, 8(1), Article 1888671. <https://doi.org/10.1080/2331186X.2021.1888671>.
2. Annisa, D. N., Tentama, F., & Bashori, K. (2021). The role of family support and internal locus of control in entrepreneurial intention of vocational high school students. *International Journal of Evaluation and Research in Education*, 10(2), 381–388. <https://doi.org/10.11591/ijere.v10i2.20934>.
3. Athayde, R. (2009). Measuring enterprise potential in young people. *Entrepreneurship Theory and Practice*, 33(2), 481–500. <https://doi.org/10.1111/j.1540-6520.2009.00300.x>.
4. Baron, R. A. (1998). Cognitive mechanisms in entrepreneurship: Why and when entrepreneurs think differently than other people. *Journal of Business Venturing*, 13(4), 275–294. [https://doi.org/10.1016/S0883-9026\(97\)00031-1](https://doi.org/10.1016/S0883-9026(97)00031-1).
5. Baron, R. A. (2007). Behavioral and cognitive factors in entrepreneurship: Entrepreneurs as the active element in new venture creation. *Strategic Entrepreneurship Journal*, 1(1-2), 167–182. <https://doi.org/10.1002/sej.12>.
6. Batz Liñeiro, A., Romero Ochoa, J. A., & Montes de la Barrera, J. (2024). Exploring entrepreneurial intentions and motivations: A comparative analysis of opportunity-driven and necessity-driven entrepreneurs. *Journal of Innovation and Entrepreneurship*, 13(1), 1–28. <https://doi.org/10.1186/s13731-024-00366-8>.
7. Bela, L. R., Riani, A. L., & Indriayu, M. (2021). The effect of entrepreneurial potential on intention students in universities. *IOSR Journal of Economics and Finance*, 12(4), 30–34. <https://doi.org/10.9790/5933-1204023034>.

8. Berglund, H., & Wennberg, K. (2006). Creativity among entrepreneurship students: Comparing engineering and business education. *International Journal of Continuing Engineering Education and Life Long Learning*, 16(5), 366–379. <https://doi.org/10.1504/IJCEELL.2006.010959>.
9. Botezat, E. A., & Borza, A. F. (2016). Exploring entrepreneurial potential among students. *Analele Universității din Oradea-Științe Economice*, 15(2), 488–496.
10. Brandstätter, H. (2011). Personality aspects of entrepreneurship: A look at five meta-analyses. *Personality and Individual Differences*, 51(3), 222–230. <https://doi.org/10.1016/j.paid.2010.07.007>.
11. Brindley, C. (2005). Barriers to women achieving their entrepreneurial potential: Women and risk. *International Journal of Entrepreneurial Behavior & Research*, 11(2), 144–161. <https://doi.org/10.1108/13552550510590554>.
12. Brockhaus Sr, R. H. (1980). Risk taking propensity of entrepreneurs. *Academy of Management Journal*, 23(3), 509–520. <https://doi.org/10.5465/255515>.
13. Caird, S. (1991). Testing enterprising tendency in occupational groups. *British Journal of Management*, 2(4), 177–186. <https://doi.org/10.1111/j.1467-8551.1991.tb00025.x>.
14. Cassey, P., Heathcote, A., & Brown, S. D. (2014). Brain and behavior in decision-making. *PLoS Computational Biology*, 10(7), 1–8. <https://doi.org/10.1371/journal.pcbi.1003700>.
15. Chen, C. C., Greene, P. G., & Crick, A. (1998). Does entrepreneurial self-efficacy distinguish entrepreneurs from managers? *Journal of Business Venturing*, 13(4), 295–316. [https://doi.org/10.1016/S0883-9026\(97\)00029-3](https://doi.org/10.1016/S0883-9026(97)00029-3).
16. Cronbach, L. J. (1951). Coefficient alpha and the internal structure of tests. *Psychometrika*, 16(3), 297–334. <https://doi.org/10.1007/BF02310555>.
17. Curral, L., Santos, S. C., & Caetano, A. (2013). Theoretical foundations on the entrepreneurial potential. *Amity Business Journal*, 2, 1–11.
18. Dhas, D., & Balaji, K. C. (2023). Factors of entrepreneurship potentiality and their impact on entrepreneurial intention with mediating effect of self-efficacy. *Humanities And Social Science Studies Peer-Reviewed, Bi-Annual, Interdisciplinary UGC Care List Journal*, 12(1), 135–146.
19. Diamond, A. (2013). Executive functions. *Annual Review of Psychology*, 64(1), 135–168. <https://doi.org/10.1146/annurev-psych-113011-143750>.
20. Dohmen, T., Quercia, S., & Willrodt, J. (2023). On the psychology of the relation between optimism and risk taking. *Journal of Risk and Uncertainty*, 67, 193–214. <https://doi.org/10.1007/s11166-023-09409-z>.
21. Elliot, A. J., & Harackiewicz, J. M. (1994). Goal setting, achievement orientation, and intrinsic motivation: A mediational analysis. *Journal of Personality and Social Psychology*, 66(5), 968–980. <https://doi.org/10.1037/0022-3514.66.5.968>.
22. Eysenck, H. J. (1983). The roots of creativity: Cognitive ability or personality trait? *Roeper Review*, 5(4), 10–12. <https://doi.org/10.1080/02783198309552714>.
23. Fayolle, A., & Gailly, B. (2015). The impact of entrepreneurship education on entrepreneurial attitudes and intention: Hysteresis and persistence. *Journal of Small Business Management*, 53(1), 75–93. <https://doi.org/10.1111/jsbm.12065>.
24. Fillis, I. A. N., & Rentschler, R. (2010). The role of creativity in entrepreneurship. *Journal of Enterprising Culture*, 18(01), 49–81. <https://doi.org/10.1142/S0218495810000501>.
25. Franco, M., Haase, H., & Lautenschläger, A. (2010). Students' entrepreneurial intentions: An inter-regional comparison. *Education+ Training*, 52(4), 260–275. <https://doi.org/10.1108/00400911011050945>.
26. Galloway, L., Kelly, S., & Keogh, W. (2006). Identifying entrepreneurial potential in students. *National Council for Graduate Entrepreneurship Working Paper*, 6, 1–20.
27. Gerry, C., Marques, C. S., & Nogueira, F. (2008). Tracking student entrepreneurial potential: Personal attributes and the propensity for business start-ups after graduation in a Portuguese university. *Problems and Perspectives in Management*, 6(4), 45–53.

28. Ghanem, B. (2020). The impact of promoting the concept of entrepreneurship in education colleges of different disciplines on entrepreneurial orientation. *International Journal of Arts and Social Science*, 3(3), 26–37.
29. Goffman, E. (1959). *The presentation of self in everyday life*. New York: Anchor Books.
30. González-Tejero, C. B., Ulrich, K., & Carrilero, A. (2022). The entrepreneurial motivation, Covid-19, and the new normal. *Entrepreneurial Business and Economics Review*, 10(2), 205–217. <https://doi.org/10.15678/EBER.2022.100212>.
31. Harada, N. (2005). Potential entrepreneurship in Japan. *Small Business Economics*, 25, 293–304. <https://doi.org/10.1007/s11187-004-6464-1>.
32. Hmieleski, K. M., & Baron, R. A. (2009). Entrepreneurs' optimism and the influence of business education on entrepreneurial intentions. *Academy of Management Journal*, 52(3), 473–488. <https://doi.org/10.5465/amj.2009.41330755>.
33. Ho, Y. P., Low, P. C., & Wong, P. K. (2014). Do university entrepreneurship programs influence students' entrepreneurial behavior? An empirical analysis of university students in Singapore. In *Innovative pathways for university entrepreneurship in the 21st Century* (Vol. 24, pp. 65–87). Emerald Group Publishing Limited. <https://doi.org/10.1108/S1048-473620140000024003>.
34. Holienka, M., Mrva, M., & Marcin, P. (2013). Role of family entrepreneurial role-models in determining students' preferences towards entrepreneurship. In *ICERI2013 Proceedings* (pp. 3722–3730). IATED.
35. Hollenbeck, J. R., & Klein, H. J. (1987). Goal commitment and the goal-setting process: Problems, prospects, and proposals for future research. *Journal of Applied Psychology*, 72(2), 212–220. <https://doi.org/10.1037/0021-9010.72.2.212>.
36. Hsiung, T. (2018). Satisfaction with entrepreneurial education and entrepreneurial intention: The moderating role of internal locus of control. *International Journal of Education and Research*, 6(4), 139–146.
37. Ibicioglu, H., Baysal, H., & Ozkul, A. S. (2008). The role of high education in entrepreneurship training in respect of transition economies Albania sample. In *First International Conference on Management and Economics* (Vol. 1, pp. 91–108).
38. Jagacinski, C. M., Kumar, S., & Kokkinou, I. (2008). Challenge seeking: The relationship of achievement goals to choice of task difficulty level in ego-involving and neutral conditions. *Motivation and Emotion*, 32, 310–322. <https://doi.org/10.1007/s11031-008-9103-3>.
39. Jayawarna, D., Oswald, J., & Macpherson, A. (2014). Entrepreneurial potential: The role of human and cultural capitals. *International Small Business Journal*, 32(8), 918–943. <https://doi.org/10.1177/0266242614525795>.
40. Joshi, A., Kale, S., Chandel, S., & Pal, D. K. (2015). Likert scale: Explored and explained. *British Journal of Applied Science & Technology*, 7(4), 396–403. <https://doi.org/10.9734/BJAST/2015/14975>.
41. Kirzner, I. M. (2015). *Competition and entrepreneurship*. Chicago: University of Chicago Press.
42. Klandt, H., & Volkmann, C. (2006). Development and prospects of academic entrepreneurship education in Germany. *Higher Education in Europe*, 31(2), 195–208. <https://doi.org/10.1080/03797720600940880>.
43. Klimkowska, K., & Klimkowski, K. (2020). Entrepreneurial potential of students graduating from translation studies. *HERMES-Journal of Language and Communication in Business*, 60, 13–27. <https://doi.org/10.7146/hjlc.v60i0.121308>.
44. Klinkosz, W., & Sękowski, A. (2006). H. Schulera i M. Prochaski polska wersja Inwentarza Motywacji Osiągnięć–Leistungsmotivationsinventar (LMI). *Czasopismo Psychologiczne*, 12(2), 253–264.
45. Kolb, D. A. (2014). *Experiential learning: Experience as the source of learning and development*. New York: Prentice Hall.

46. Kosharnaya, G. B., Yurasov, I. A., Korzh, N. V., Karimova, L. F., Tarkhanova, E. S., & Danilova, E. A. (2019). Factors of students' entrepreneurial potential development in Russia. On the example of the Penza region. *Revista Espacios*, 40(23). <https://www.revistaespacios.com/a19v40n23/19402319.html>.
47. Krueger Jr, N. F., & Brazeal, D. V. (1994). Entrepreneurial potential and potential entrepreneurs. *Entrepreneurship Theory and Practice*, 18(3), 91–104. <https://doi.org/10.1177/104225879401800307>.
48. Kurdyś-Kujawska, A., & Wojtkowska, A. (2023). To be or not to be an entrepreneur: What motivates and what limits students' entrepreneurial initiatives? *Scientific Papers of Silesian University of Technology. Organization & Management*, 188, 259–278. <http://dx.doi.org/10.29119/1641-3466.2023.188.15>.
49. Küttim, M., Kallaste, M., Venesaar, U., & Kiis, A. (2014). Entrepreneurship education at university level and students' entrepreneurial intentions. *Procedia - Social and Behavioral Sciences*, 110, 658–668. <https://doi.org/10.1016/j.sbspro.2013.12.910>.
50. Lee, S. M., Chang, D., & Lim, S. B. (2005). Impact of entrepreneurship education: A comparative study of the US and Korea. *The International Entrepreneurship and Management Journal*, 1, 27–43. <https://doi.org/10.1007/s11365-005-6674-2>.
51. Liñán, F., & Fayolle, A. (2015). A systematic literature review on entrepreneurial intentions: Citation, thematic analyses, and research agenda. *International Entrepreneurship and Management Journal*, 11, 907–933. <https://doi.org/10.1007/s11365-015-0356-5>.
52. Liñán, F., Santos, F. J., & Fernández, J. (2011). The influence of perceptions on potential entrepreneurs. *International Entrepreneurship and Management Journal*, 7, 373–390. <https://doi.org/10.1007/s11365-011-0199-7>.
53. Liu, Q., & Yao-Ping Peng, M. (2025). Exploring factors influencing university students' entrepreneurial intentions: The role of attitudes, beliefs, and environmental support. *PLoS ONE*, 20(1), 1–18. <https://doi.org/10.1371/journal.pone.0316392>.
54. Luthans, F. (2002). The need for and meaning of positive organizational behavior. *Journal of Organizational Behavior: The International Journal of Industrial, Occupational and Organizational Psychology and Behavior*, 23(6), 695–706. <https://doi.org/10.1002/job.165>.
55. Lyons, R., Lynn, T., & Mac an Bhaird, C. (2015). Individual level assessment in entrepreneurship education: An investigation of theories and techniques. *Journal of Entrepreneurship Education*, 18(1), 136–156.
56. Martins, E., & Martins, N. (2002). An organisational culture model to promote creativity and innovation. *SA Journal of Industrial Psychology*, 28(4), 58–65. <https://doi.org/10.4102/sajip.v28i4.71>.
57. Masten, A. S. (2001). Ordinary magic: Resilience processes in development. *American Psychologist*, 56(3), 227–238. <https://doi.org/10.1037//0003-066X.56.3.227>.
58. McClelland, D. C. (1961). *The Achieving Society*. Princeton, NJ: Van Nostrand. <https://doi.org/10.1037/14359-000>.
59. Menshikov, V., Kokina, I., & Ruza, O. (2021). The entrepreneurial potential of Latvian students: The role of the university environment. *Entrepreneurship and Sustainability Issues*, 9(1), 502–518. [https://doi.org/10.9770/jesi.2021.9.1\(31\)](https://doi.org/10.9770/jesi.2021.9.1(31)).
60. Mitrovic Veljkovic, S., Maric, M., Subotic, M., Dudic, B., & Greguš, M. (2019). Family entrepreneurship and personal career preferences as the factors of differences in the development of entrepreneurial potential of students. *Sustainability*, 11(20), Article 5693. <https://doi.org/10.3390/su11205693>.
61. Mueller, S. L. (2004). Gender gaps in potential for entrepreneurship across countries and cultures. *Journal of Developmental Entrepreneurship*, 9(3), 199–220.

62. Mueller, S. L., & Thomas, A. S. (2001). Culture and entrepreneurial potential: A nine country study of locus of control and innovativeness. *Journal of Business Venturing*, 16(1), 51–75. [https://doi.org/10.1016/S0883-9026\(99\)00039-7](https://doi.org/10.1016/S0883-9026(99)00039-7).
63. Nabi, G., & Holden, R. (2008). Graduate entrepreneurship: Intentions, education and training. *Education+ Training*, 50(7), 545–551. <https://doi.org/10.1108/00400910810909018>.
64. Nguyen, T. V., Bryant, S. E., Rose, J., Tseng, C. H., & Kapasuwan, S. (2009). Cultural values, market institutions, and entrepreneurship potential: A comparative study of the United States, Taiwan, and Vietnam. *Journal of Developmental Entrepreneurship*, 14(01), 21–37. <https://doi.org/10.1142/S1084946709001120>.
65. Norhaidah Abu Haris, M. A., & Abu Talib Othman, F. A. R. (2017). Exploring the entrepreneurial intention among information technology students. *Information Technology Journal*, 15(4), 116–122. <https://doi.org/10.3923/itj.2016.116.122>.
66. Ogunsade, A. I., Obembe, D., Woldesenbet, K., & Kolade, S. (2021). Entrepreneurial attitudes among university students: The role of institutional environments and cultural norms. *Entrepreneurship Education*, 4(2), 169–190. <https://doi.org/10.1007/s41959-021-00050-y>.
67. Palimaka, K., & Rodzinka, J. (2018). Students' attitudes towards starting a business, on the example of students at the University of Information Technology and Management in Rzeszów (Poland). *Financial Internet Quarterly*, 14(4), 90–103. <https://doi.org/10.2478/fiqf-2018-0030>.
68. Palmer, M. (1971). The application of psychological testing to entrepreneurial potential. *California Management Review*, 13(3), 32–38. <https://doi.org/10.2307/41164291>.
69. Pauli, U., & Osowska, R. (2019). Building entrepreneurial potential abroad–exploring return migrant experience. *International Journal of Entrepreneurial Behavior & Research*, 25(5), 936–954. <https://doi.org/10.1108/IJEBr-02-2018-0098>.
70. Pfeifer, S., Šarlija, N., & Zekić Sušac, M. (2016). Shaping the entrepreneurial mindset: Entrepreneurial intentions of business students in Croatia. *Journal of Small Business Management*, 54(1), 102–117. <https://doi.org/10.1111/jsbm.12133>.
71. Pinheiro, G. T., Moraes, G. H. S. M. D., & Fischer, B. B. (2023). Student entrepreneurship and perceptions on social norms and university environment: Evidence from a developing country. *Journal of Entrepreneurship in Emerging Economies*, 15(4), 746–765. <https://doi.org/10.1108/JEEE-03-2021-0121>.
72. Raab, G., Stedham, Y., & Neuner, M. (2005). Entrepreneurial potential: An exploratory study of business students in the US and Germany. *Journal of Business & Management*, 11(2), 71–88. <https://doi.org/10.1504/JBM.2005.141135>.
73. Rajković, J., Poštin, J., Konjikušić, M., Rusić, A. J., Stojković, H. S., & Nikolić, M. (2021). The enterprise potential, individual entrepreneurial orientation and entrepreneurial intentions of students in Serbia. *The European Journal of Applied Economics*, 18(1), 106–125. <https://doi.org/10.5937/EJAE18-27707>.
74. Rhodes, M. (1961). An analysis of creativity. *The Phi Delta Kappan*, 42(7), 305–310. <http://www.jstor.org/stable/20342603>.
75. Rotter, J. B. (1966). Generalized expectancies for internal versus external control of reinforcement. *Psychological Monographs: General and Applied*, 80(1), 1–28. <https://doi.org/10.1037/h0092976>.
76. Saeed, S., Yousafzai, S. Y., Yani-De-Soriano, M., & Muffatto, M. (2015). The role of perceived university support in the formation of students' entrepreneurial intention. *Journal of Small Business Management*, 53(4), 1127–1145. <https://doi.org/10.1111/jsbm.12090>.
77. Saif, H. A., & Ghania, U. (2020). Need for achievement as a predictor of entrepreneurial behavior: The mediating role of entrepreneurial passion for founding and entrepreneurial interest. *International Review of Management and Marketing*, 10(1), 40–53. <https://doi.org/10.32479/irmm.8949>.

78. Salamzadeh, A., Farjadian, A. A., Amirabadi, M., & Modarresi, M. (2014). Entrepreneurial characteristics: Insights from undergraduate students in Iran. *International Journal of Entrepreneurship and Small Business*, 21(2), 165–182. <https://doi.org/10.1504/IJESB.2014.059471>.
79. Samer Ali, A. S., & Rashid, A. A. (2024). The influencing factors of personality that affect entrepreneurship development among people with disabilities. *Journal of Enterprising Communities: People and Places in the Global Economy*, 18(3), 576–600. <https://doi.org/10.1108/JEC-09-2022-0138>.
80. Sánchez-López, A. M., & Pedraza, S. (2020). The resourceful academic-entrepreneur: How to build entrepreneurial potential with a limited budget. *Advances in Engineering Education*, 1–17.
81. Sanetra-Półgrabi, S. (2017). Entrepreneurship as a multifaceted factor of development in the border areas. In A. Sapiński, S. Ciupka, & I. Khlobystov (Eds.), *Human resources management – interdisciplinary perspective* (pp. 53–69). Odesa: Institute of Creative Technologies.
82. Santos, S. C., Caetano, A., & Curral, L. (2013). Psychosocial aspects of entrepreneurial potential. *Journal of Small Business & Entrepreneurship*, 26(6), 661–685. <https://doi.org/10.1080/08276331.2014.892313>.
83. Schjoedt, L., & Shaver, K. G. (2012). Development and validation of a locus of control scale for the entrepreneurship domain. *Small Business Economics*, 39, 713–726. <https://doi.org/10.1007/s11187-011-9357-0>.
84. Schuler, H., & Prochaska, M. (2000). *Leistungsmotivationsinventar (LMI)*. Göttingen: Hogrefe.
85. Schumpeter, J. A. (2004). *The theory of economic development*. New Brunswick & London: Transaction Publishers.
86. Sexton, D. L., & Bowman, N. (1983). Determining entrepreneurial potential of students. In *Academy of Management Proceedings* (Vol. 1983, No. 1, pp. 408–412). Briarcliff Manor, New York: Academy of Management. <https://doi.org/10.5465/ambpp.1983.4976385>.
87. Shane, S. A. (2003). *A general theory of entrepreneurship: The individual-opportunity nexus*. Cheltenham: Edward Elgar Publishing.
88. Shapero, A., & Sokol, L. (1982). The social dimensions of entrepreneurship. In C. A. Kent, D. L. Sexton, & K. H. Vesper (Eds.), *Encyclopedia of entrepreneurship* (pp. 72–90). Englewood Cliffs, New Jersey: Prentice-Hall.
89. Stewart Jr, W. H., & Roth, P. L. (2001). Risk propensity differences between entrepreneurs and managers: A meta-analytic review. *Journal of Applied Psychology*, 86(1), 145–153. <https://doi.org/10.1037/0021-9010.86.1.145>.
90. Swarupa, S. G., & Goyal, R. K. (2020). Entrepreneurial intentions of students: Review of academic literature. *International Journal of Scientific & Engineering Research*, 11(1), 1146–1168. <https://doi.org/10.14299/ijser.2020.01.02>.
91. Teixeira, A. A. (2008). Entrepreneurial potential in chemistry and pharmacy: Results from a large survey. *Journal of Business Chemistry*, 5(2), 48–63.
92. Thompson, J. L. (2004). The facets of the entrepreneur: Identifying entrepreneurial potential. *Management Decision*, 42(2), 243–258. <https://doi.org/10.1108/00251740410515861>.
93. Touré-Tillery, M., & Fishbach, A. (2014). How to measure motivation: A guide for the experimental social psychologist. *Social and Personality Psychology Compass*, 8(7), 328–341. <https://doi.org/10.1111/spc3.12110>.
94. Trojak, M., Hojda, P., & Roszkowska, S. (2023). Study-related determinants of university graduates' entrepreneurship. *International Entrepreneurship Review*, 9(2), 49–60. <https://doi.org/10.15678/IER.2023.0902.04>.
95. Turker, D., & Selcuk, S. S. (2009). Which factors affect entrepreneurial intention of university students? *Journal of European Industrial Training*, 33(2), 142–159. <https://doi.org/10.1108/03090590910939049>.

96. Varamäki, E., Joensuu, S., Tornikoski, E., & Viljamaa, A. (2015). The development of entrepreneurial potential among higher education students. *Journal of Small Business and Enterprise Development*, 22(3), 563–589. <https://doi.org/10.1108/JSBED-02-2012-0027>.
97. Virk, N., & Gambhir, J. (2024). The role of education in fostering entrepreneurial mindset. In S. Salman & A. Bhaumik (Eds.), *New practices for entrepreneurship innovation* (pp. 25–43). New York: IGI Global Scientific Publishing. <https://doi.org/10.4018/979-8-3693-5426-1.ch002>.
98. Wach, D., Gorgievski, M., & Wegge, J. (2017). Entrepreneurs' subjective assessment of success: Development of a multifaceted measure. In *Academy of Management Proceedings* (No. 1, p. 15063). <https://doi.org/10.5465/AMBPP.2017.15063abstract>.
99. Wang, J., Cui, R., Stolarz-Fantino, S., Fantino, E., & Liu, X. (2022). Differences in mood, optimism, and risk-taking behavior between American and Chinese college students. *Frontiers in Psychology*, 12, 1–8. <https://doi.org/10.3389/fpsyg.2021.781609>.
100. Ward, A., Hernández-Sánchez, B. R., & Sánchez-García, J. C. (2019). Entrepreneurial potential and gender effects: The role of personality traits in university students' entrepreneurial intentions. *Frontiers in Psychology*, 10, 1–18. <https://doi.org/10.3389/fpsyg.2019.02700>.
101. Wickelgren, W. A. (1977). Speed-accuracy tradeoff and information processing dynamics. *Acta Psychologica*, 41, 67–85. [https://doi.org/10.1016/0001-6918\(77\)90012-9](https://doi.org/10.1016/0001-6918(77)90012-9).
102. Wijaya, N. H. S., & Gracia, M. (2024). An empirical investigation of internal locus of control, entrepreneurial self-efficacy, entrepreneurial education, and entrepreneurial intention. *International Research Journal of Economics and Management Studies IRJEMS*, 3(8), 188–195. <https://doi.org/10.56472/25835238/IRJEMS-V3I8P123>.
103. Wilson, K. E. (2008). Chapter 5. Entrepreneurship education in Europe. In *Entrepreneurship and Higher Education*. Paris: OECD.
104. Wong, W. K., Cheung, H. M., & Venuvinod, P. K. (2005). Individual entrepreneurial characteristics and entrepreneurial success potential. *International Journal of Innovation and Technology Management*, 2(03), 277–292. <https://doi.org/10.1142/S0219877005000502>.
105. Yan, J. (2010). The impact of entrepreneurial personality traits on perception of new venture opportunity. *New England Journal of Entrepreneurship*, 13(2), 21–35. <https://doi.org/10.1108/NEJE-13-02-2010-B002>.
106. Yordanova, D. I., & Alexandrova-Boshnakova, M. I. (2011). Gender effects on risk-taking of entrepreneurs: Evidence from Bulgaria. *International Journal of Entrepreneurial Behavior & Research*, 17(3), 272–295. <https://doi.org/10.1108/13552551111130718>.
107. Zeffane, R. (2013). Need for achievement, personality and entrepreneurial potential: A study of young adults in the United Arab Emirates. *Journal of Enterprising Culture*, 21(01), 75–105. <https://doi.org/10.1142/S0218495813500040>.
108. Zhang, P., Wang, D. D., & Owen, C. L. (2015). A study of entrepreneurial intention of university students. *Entrepreneurship Research Journal*, 5(1), 61–82. <https://doi.org/10.1515/erj-2014-0004>.
109. Zhang, X., Chen, Y., Xu, Y., Yue, W., & Tang, C. (2023). Does regional cooperation constrain urban sprawl? Evidence from the Guangdong-Hong Kong-Macao Greater Bay Area. *Landscape and Urban Planning*, 235, Article 104742. <https://doi.org/10.1016/j.landurbplan.2023.104742>.
110. Zhao, H., & Seibert, S. E. (2006). The big five personality dimensions and entrepreneurial status: A meta-analytical review. *Journal of Applied Psychology*, 91(2), 259–271. <https://doi.org/10.1037/0021-9010.91.2.259>.

Consumer Behaviour in the Shared Accommodation Sector: Revealing the Performance in Slovakia

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Abstract

Over the past few decades, globalisation, digitalisation, and social transformation have fostered the emergence of the sharing economy as a new economic model. This article examines consumer behaviour in the Slovak sharing economy, with a particular emphasis on the accommodation sector. The main objective of the study is to map consumer behaviour in the area of the sharing economy in the Slovak Republic and to determine the factors influencing this consumer behaviour in the accommodation sector. A questionnaire survey of 385 respondents was used to conduct quantitative research, with statistical validation using Pearson's test and a proportional agreement test. According to the findings, the majority of consumers, particularly those in the younger and higher income groups, have positive experiences with shared accommodation platforms. The most influential elements in accommodation selection were found to be price, location, and user reviews. From a theoretical approach, the study contributes to the small body of research on sharing economy adoption in smaller European Union countries, highlighting the relevance of socioeconomic considerations in shaping consumer preferences. In managerial terms, the research underlines the need for platforms to improve trust, openness, and flexibility, particularly in terms of service quality and cancellation rules. Furthermore, the findings emphasise the need to increase public knowledge of the benefits of the sharing economy through focused media efforts and government backing. The study's novelty stems from its contextual focus on Slovakia and its integration of consumer satisfaction data with strategic recommendations for sustainable tourism development and regulatory legislation.

Key words

sharing economy, collaborative economy, travelling, shared accommodation.

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Introduction

In the 21st century, the rapid and dynamic development of the economy, as well as innovative business models, is evident. One important factor that affects how well a corporation performs is managerial decision-making (Kostrzewski et al., 2023). Typically, prevailing business models are for companies to produce goods or provide services that customers buy. Companies have started to invest more in the development of sustainable products and sustainable sourcing, according to the argument that customers today are drawn to sustainable products (Vatamanescu et al., 2021). The concept of

Corporate Social Responsibility (CSR) is gaining traction and is becoming increasingly relevant (Belas, 2023). In recent years, notable examples have emerged demonstrating efforts to tackle environmental, social, and economic challenges (Metzker, 2024). The traditional way of doing business has been complemented by a nontraditional business model that no longer emphasises ownership but rather the use of a product. In this model, goods or services are shared and rented by customers instead of being bought. There are countless examples of sharing products or services that have been around for some time. Nevertheless, with the advent of the Internet, telecommunications technologies, and online platforms, a new economic model called the sharing economy is emerging. This phenomenon is constantly gaining popularity and is becoming another pillar of the current economic transformation. The sharing economy is changing the way people create value, use resources, and trade services and goods. The paper is devoted to the analysis of consumer behaviour in the context of the sharing economy. This study is important in view of the ever-evolving dynamic economic environment, changing consumer preferences, and pressure for conventional service delivery. This study thus tries to point out these changes and find out to what extent consumers in the territory of the Slovak Republic accept this economic model. The sharing economy, which is becoming increasingly important in the current economic environment, brings new challenges and opportunities for consumers.

The main goal of this paper is to analyse the impact of the sharing economy on consumer decision-making and their preferences. In addition, the work is aimed at examining the level of awareness of this concept and the extent to which the shared economy in the accommodation sector is implemented on the territory of the Slovak Republic. The authors used a questionnaire survey to fulfil the goal of this study. Based on the data collected using a questionnaire survey, it was possible to analyse the facts found using mathematical and statistical methods.

Although there has been a growing interest in the sharing economy among academicians, there has been a lack of attention paid to the ways in which consumer behaviour develops in smaller EU economies that have emerged from the transition, such as Slovakia. The purpose of this study is to fill this gap by investigating the elements that play a significant role in decision-making, the levels of satisfaction, and the function that socio-demographic variables have in determining platform adoption. In doing so, it adds not only empirical insights from a setting that is underrepresented but also theoretical views on the applicability of models that are already in existence. The findings are anticipated to contribute to the advancement of academic debate as well as the practical strategies of stakeholders that are working towards the development of platform-based services that are both inclusive and sustainable. Although existing literature provides a variety of conceptual frameworks for collaborative consumption and the sharing economy (Botsman & Rogers, 2010), the majority of studies focus on Western European or worldwide markets. There is a scarcity of context-specific research focusing on minor Central and Eastern European countries such as Slovakia. According to Rathnayake et al. (2024) and Haqqani et al. (2022), the geographical gap hinders the broader applicability of theoretical models, particularly in nations where regulatory regimes and digital infrastructures are still growing. This study helps to bridge that gap by bringing sharing economy theoretical constructs, such as non-ownership consumption models, digital adoption behaviour, and trust-based decision-making to the Slovak environment. This research aims to extend the present conversation by investigating how consumer preferences align with (or deviate from) popular models. The findings add to current ideas by emphasising the importance of local knowledge, institutional preparation, and cultural factors in influencing involvement in the sharing economy.

The paper is divided as follows. The literature review section presents the current level of knowledge and describes the importance of the sharing economy, the sectors, and the benefits and risks of using this innovative type of economy. The methodology section delineates the procedure for conducting a questionnaire survey, as well as a description of the use of statistical verification of established hypotheses. The results describe the development of the sharing economy in the accommodation sector in the context of the COVID-19 pandemic, based on the results of a

questionnaire survey that was carried out in the Slovak Republic. Subsequently, in this section there is also a description of the results of the statistical verification by means of Pearson's χ^2 square test. The discussion section focuses on comparable studies conducted in this field. Finally, a summary of important findings and impending challenges and limitations that directly affect the research are presented in the conclusion section.

1. Literature review

The industrial production sector has seen significant transformations throughout the last few centuries, leading to significant effects on businesses and people's means of subsistence. The concepts of the three previous industrial revolutions served as the cornerstones for the concept of Industry 4.0, with the effects of one revolution on the other (Valaskova et al., 2024). Nowadays, digitisation is coming to the fore. Businesses now more than ever need to battle for their survival or market position in the dynamic and complex business environment of today, which is under the most pressure it has been in the past ten years due to the pandemic and other conflicts that have severely disrupted the economy (Gajdosikova et al., 2024a). The rate of change is unparalleled in terms of society, education, employment, and most crucially, production (Nagy et al., 2023). Globally, digitalisation and the ensuing digital divide are significant concerns affecting socioeconomic progress (Kovac et al., 2024). Globally, digitalization and the ensuing digital divide are significant concerns affecting socioeconomic progress (Kovac et al., 2024). In every country's economy, industry's main purpose is to process and turn natural resources into finished and semi-finished goods (Gajdosikova et al., 2024b). Business and economic management require large data and integrated enterprise output (Kliestik et al., 2024).

Currently, there is no clear and universal definition of the sharing economy that can be considered decisive. The authors Felson and Spaeth (1978) were the first to try to define the sharing economy and coined the term collaborative consumption for this designation. According to these authors, the prerequisites for collaborative consumption are the existence of assets (or services) and the willingness of the provider to mediate products or services for another consumer. Botsman and Rogers (2010) argue that the sharing economy as we know it today began to develop with the growth of the modern Internet in the late 1990s. During this period, online platforms also began to emerge, which enabled individuals to share various products, goods, or services. The sharing economy has progressed from an emerging business phenomenon to a widely implemented business practice in the modern economy. It enables more efficient use of resources by helping people share equipment, such as cars and bikes, and allows access to equipment that an individual may not be able to afford. In theory, they include the key features of a sustainable business model. If consumers switch from buying products to using products, this should have a positive impact on the financial, environmental, and social dimensions of sustainability.

There are many sectors in which online platforms mediate the connection between providers and customers of goods and services. The accommodation sector of the shared economy represents a modern approach to the provision and use of accommodation services. Platforms in the accommodation sector connect hosts with guests. The provider of accommodation can be a private owner of apartments, flats, or rooms, but it can also be a legal entity such as a boarding house. This approach provides an opportunity for hosts to use their existing spaces, whether they are spare rooms or entire unused apartments, and turn them into a source of profit (Kostkova, 2020). This model enables a direct connection between hosts and guests, thereby promoting social interaction and culture (Kuhzady et al., 2022). One of the most significant consequences of the sharing economy in accommodation is the reduction of prices. Sharing economy platforms provide a more affordable alternative to traditional hotels, making travel much more affordable (Zhang et al., 2023). Overall, the sharing economy accommodation sector offers a diverse and innovative approach to accommodation that caters to the evolving preferences of modern travellers looking for unique and affordable accommodation options. More broadly, clever solutions help manage tourism sustainably, which

helps reduce the use of natural resources and address environmental problems (David & El Archi, 2024).

Recent research establishes a robust theoretical framework for comprehending the sharing economy, presenting several definitions, conceptual models, and classifications that organize the domain. These assessments frequently include interdisciplinary viewpoints and analyse the complex character of the notion across several sectors. Nonetheless, despite the expanding corpus of theoretical literature, numerous research deficiencies persist. Academicians have seen an absence of conceptual coherence, resulting in diverse interpretations of the sharing economy. Moreover, several current research studies primarily emphasize economic factors, but social, environmental, and regulatory features remain relatively underexamined. There is a necessity for increased geographical diversity in research, especially for emerging and developing economies. These deficiencies underscore the necessity for additional theoretical refinement and more extensive empirical exploration (Rathnayake et al., 2024).

The sharing economy is gaining popularity, but its research interest is still dispersed and lacks a cohesive framework that can fully explain its ramifications and mechanisms. There are several important research gaps, such as inconsistent language, a lack of comprehensive frameworks that fully encompass the variety of economic, social, and technological factors, and insufficient agreement on classification schemes. Deeper empirical involvement is also still required, particularly in underrepresented industries and geographical areas. This suggests that additional refining and contextualization are still necessary even while theoretical consolidation is under progress (Haqqani et al., 2022).

One of the few areas in which scholars concur is the difficulty of defining the sharing economy and establishing distinct conceptual and empirical boundaries. The sharing economy has evolved into a comprehensive term with robust normative foundations. From the perspectives of economic, social, and environmental responsibility, sharing has the potential to contribute to sustainable development. Sharing can be viewed as a means of assuring the sustainability of products and the development of innovation from the perspective of economic responsibility (Kumar et al., 2018). For instance, sharing contributes to the improvement of supplier-customer relationships by sharing means of transportation, such as trucks and their cargo capacity, storage space, information about deliveries and orders, business contacts and references, or data about consumer opinions or cooperative advertising. This has a positive social multiplier effect (Acquier et al., 2017). It also enhances consumer relationships by sharing expertise. For instance, in the realm of social responsibility, the sharing of jobs, accommodation, cars, company catering, or household care can contribute to the enhancement of social responsibility and, among other things, serve as appealing employee benefits. In this sector, charitable sharing is also a significant factor, including sharing of vehicles, machinery, equipment, and materials, or the reduction of emissions, substantially contributes to the prevention of waste and the reduction of resource consumption in the context of environmental responsibility (Geissinger et al., 2019).

2. Methodology

Determining the mindset of Slovaks regarding the sharing of goods and services is another crucial element. Therefore, it is necessary to find out whether the concept of the shared economy in accommodation services is widespread in Slovakia, and if so, to what extent people use these services. Another important factor is how people perceive the sharing economy, what is their attitude towards it, how satisfied are they with its services, and what are their preferences when choosing accommodation. Taking all of this into account, the authors set out to create a questionnaire whose primary objectives were to ascertain whether Slovaks share and what their opinions are on the system of sharing economy. The authors also focused on finding out and collecting information about respondents' preferences when choosing a place to stay. These questions helped to obtain general information about respondents' travel and accommodation preferences. There were 19 questions in

the questionnaire overall, the first of which was designed to gather respondents' demographic information. Additional inquiries were made to determine people's interest in the goods, services, loans, and sharing aspects of the sharing economy. Between January 2024 and March 2024, the survey was carried out. 385 respondents in all used a Google form to electronically complete the survey. The second part of the questionnaire was focused on traveling for the purpose of vacation, entertainment or relaxation, and on finding out preferences when choosing accommodation. The last part focuses specifically on the accommodation sector within the sharing economy, where we investigated people's interest in these services and their satisfaction.

It is important to conduct a statistical verification of the qualitative results obtained from the questionnaire survey to ascertain the interdependence of the investigation's essential factors. In order to confirm any relationship between the variables, the Pearson's χ^2 square test was chosen. The authors consequently concentrated on the verification of these study hypotheses:

H1: There is a statistically significant relationship between the respondents' monthly income and frequency of travelling for entertainment, vacation, or relaxation.

H2: There is a statistically significant relationship between the age category of the respondents and whether they used accommodation through a sharing economy platform in the past.

H3: There is a statistically significant relationship between the respondents' monthly income and reasons for using accommodation platforms within the sharing economy.

The authors also employ the test of agreement of the mean value μ with the known constant μ_0 , on the basis of which other hypotheses are established.

H4: $\mu = 0.80$ (assuming that 80 % of respondents are satisfied with sharing economy services)

H0: $\mu_0 > 0.80$ (assuming more than 80 % of respondents are satisfied with sharing economy services)

$$\text{Test criterion } Z = \frac{p - \mu_0}{\sqrt{\frac{\mu_0(1 - \mu_0)}{n}}} \quad (1)$$

where sample proportion represents the character p in the sample, total size of the statistical file n , known constant μ_0 .

The obtained results must be compared in the following way:

$$\text{Critical domain in the form of the inequality: } Z > z_{2\alpha} \quad (2)$$

where Z represents test criterion, and $z_{2\alpha}$ represents the critical value of the normalized normal distribution $N(0,1)$.

The established hypotheses serve to provide a deeper understanding and verification of consumer preferences in the area of shared accommodation. The established hypotheses are chosen mainly to find out which specific factors depend on the use of the sharing economy, but also on overall travel habits and preferences. Moreover, such verification also has an added value, namely that it can provide traditional providers (hotels, motels, and guesthouses) with feedback on what factors are important to consumers and to what extent shared accommodation can be considered as competition for conventional accommodation services.

Consumer behavior under the framework of the sharing economy was investigated using a quantitative research design grounded on a structured questionnaire. This approach lets one methodically gather consistent data from a bigger sample and lets one statistically assess preferences and patterns of decision-making. The strategy is in line with other studies in the domains of digital platform use (Gössling et al., 2020; Zhang et al., 2023). Selected socio-demographic traits and consumer behavior were investigated for relationships using Pearson's χ^2 square test. In consumer and marketing research, this non-parametric test is often used to identify statistically significant connections between categorical variables (Codagnone et al., 2016). Furthermore, a test for

proportions was used to confirm the relevance of prominent answer categories, including important criteria for decision-making including price, location, internet reviews and other important criteria.

3. Research results

Accommodation has long been considered one of the largest and most widespread sectors within the tourism economy. Accommodation expenses represent the main part of total tourist expenses. According to Eurostat (2020) accommodation accounted for 35% of Europeans' travel spending, making it a significant part of total travel spending. At the end of 2019, the COVID-19 pandemic broke out, affecting people's lives and disrupting economies of many countries. COVID-19 and the various restrictions caused by it, quarantines, or people's fear of infection have also significantly affected the sectors of the shared economy and its platforms. One of the key factors that has affected sharing economy sectors and platforms during the pandemic is the level of physical interaction. The COVID-19 pandemic has caused Airbnb's gross nights, experience, and bookings to fall by more than 70 % in all countries where Airbnb operates overall (Nuttah et al., 2023). Despite the seriousness of the situation, the company found ways to help it overcome this period. Customers avoided making new bookings due to the pandemic and travel restrictions. Therefore, Airbnb decided to implement a new refund policy that allowed cancellation of the reservation in cases of urgent need and a full refund. This means that customers could cancel their booking completely risk-free in case of illness or other reason. In this way, it was possible to allay the fears of customers and convince those who were hesitant to proceed with their bookings. (Airbnb, 2023). After the pandemic, Airbnb is achieving the rapid growth it had outlined in the last few years before the pandemic. In 2022, after the easing of measures, Airbnb surpassed its record for booked nights and experience. In 2023, the growth continued, and the value of booked nights and experience climbed to a record 448.2 million bookings. Airbnb, but also the entire accommodation sector of the sharing economy, tends to continue to grow as the demand for accommodation continues to rise and more and more people become aware of the exceptionality of not only Airbnb but also other platforms (Figure 1).

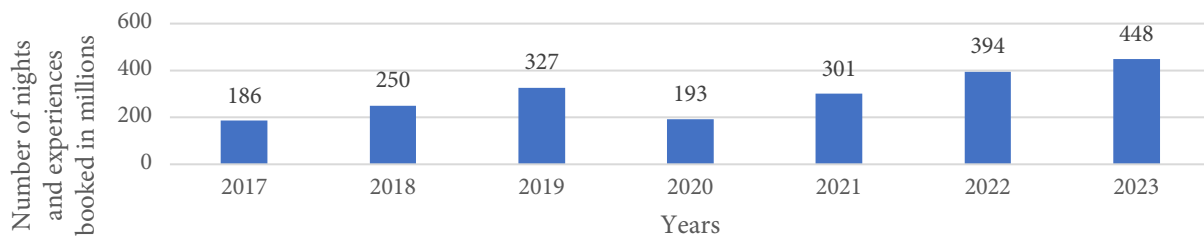


Figure 1. Number of nights and experience booked in Airbnb through time period.

Source: own processing according to the Statista portal (2024).

This research from secondary data is supplemented by data collection through a questionnaire. Based on the collected data, the authors decided to create a table (Table 1) for a better orientation and display of the gender and the age of the respondents.

Table 1. Gender and age groups of respondents.

Gender	Percentage expression (%)	Age group	Percentage expression (%)
Male	42.3	18-25 years	36.1
Female	57.7	26-40 years	19.0
-	-	41-55 years	27.2
-	-	51 and more years	17.7

Source: own calculations.

The authors supplemented the basic demographic data about the respondents with other demographic data (Table 2), which aimed to find out other data about the respondents, which could then be used in the verification of statistical hypotheses.

Table 2. Other demographic data about the respondents.

Status	Percentage expression (%)	Monthly income	Percentage expression (%)
Student	31.3	To 500 €	21.3
Employed	53.8	500 to 800 €	13.8
Unemployed	2.6	800 to 1,500 €	34.1
Pensioner	9.5	1,500 € and more	20.5
Parent on maternity/parental leave	2.8	without income	10.3
Education	Percentage expression (%)	Residence	Percentage expression (%)
Elementary	2.3	City	62.8
Secondary	40.0	Countryside	37.2
University degree	57.7	-	-

Source: own calculations.

In addition to the fundamental demographic characteristics (as indicated in Table 1), the authors' primary focus on the questionnaire survey data was on the utilization of the sharing economy system in the marketplace and specifically in travel, accommodation and shared accommodation. The majority of respondents travel at least once every six months (35.4%), and many respondents in the questionnaire marked the option of traveling at least once a year (32.4%). 20.2% of respondents travel several times a year for recreation. The smallest share (2.8%) of respondents do not travel for vacation, entertainment, or relaxation at all. The results of this question indicated the diversity of travel habits among the respondents.

41.5% of respondents prefer short trips that last less than 6 hours. 28.7% said that their trips last more than 6 hours and at the same time, less than 2 days. However, a significant part of the sample spends more time on the road. 29.8% of respondents declare that their trips last more than 2 days. The questionnaire survey shows that the respondents mostly prefer shorter journey times to the destination. The authors considered it important to examine the factors based on which the respondents would decide or decide when choosing accommodation. They decided to summarize the degree of importance into four categories: most important, important, less important, and not important. The monitored factors when choosing accommodation and their importance, as well as the number of respondents' answers, are shown in the figure below (Figure 2). The price of accommodation can be considered the most important factor among others, as its importance is emphasized by the most respondents. On average, the location of the accommodation and reviews were also very important for the respondents. Photos are important to many respondents, but from the survey, many respondents also assigned less importance to this factor. Recommendations, equipment, and dining options were given similar importance by the respondents, where the most respondents chose the option "important".

It is important to examine the respondents' experience with accommodation through the sharing economy platform. 23.6% of respondents said that they had no problem and had a very positive experience with shared accommodation. Up to 60.1% of respondents have positive experience. Another 14.3% respondents expressed themselves neutrally, which indicates that they did not have significantly positive or negative experience, or on the contrary, they had both positive and negative experience. Negative evaluations make up only a minimal part. Only 1% of respondents reported negative experience, while another 1% rated their experience as very negative.

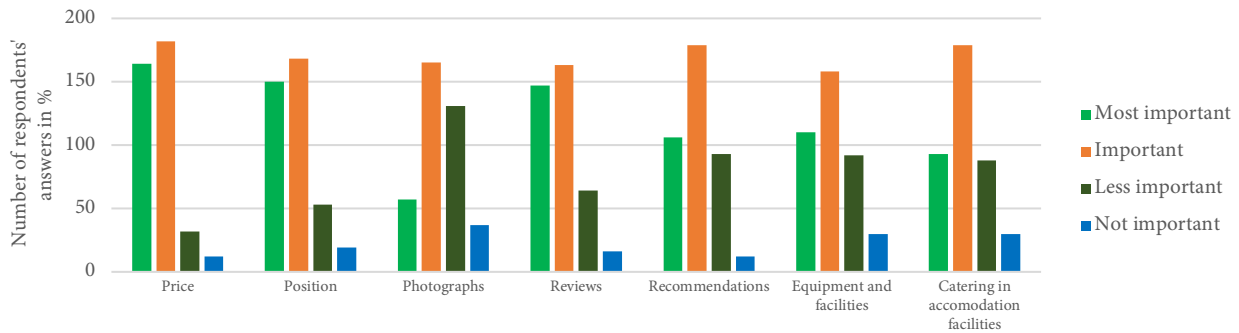


Figure 2. Factors influencing the choice of accommodation.

Source: own processing.

The respondents also answered the question, which of the stated reasons would most convince them to use sharing economy accommodation platforms if they were interested. A large part of respondents (38.9%) indicated that they would be motivated by lower costs associated with accommodation compared to traditional accommodation facilities. Ease and speed of booking would convince 25% of respondents. Sharing economy platforms offer many accommodation facilities from which interested parties can choose. 20.9% of respondents stated that the factor of a wide selection of accommodation facilities would motivate them the most when choosing accommodation. For 6.8% of respondents, it is crucial not only to find accommodation according to their preferences, but also to experience authentic local culture and interact with residents or other hosts. For these respondents, accommodation is more than just a place to sleep, it can be an opportunity to enter the world of locals and experience everyday life in a given place. For 6.4% of respondents, it is important to support the local economy and sustainability. The sharing economy is known for saving the environment by sharing surplus resources or resources that the owner does not use. Environmental protection would convince only 2% of respondents to use sharing economy accommodation platforms.

These results should also be verified statistically. Among the selected qualitative factors obtained from the questionnaire survey, it is determined whether they have a certain relationship or dependence between them. To verify the connection between the monitored variables, the authors used Pearson's χ^2 square test. To begin with, the authors decided to examine the relationship between the respondents' monthly income and how often respondents travel for entertainment, vacation or relaxation. By filtering the data based on the contingency table, authors found up to 390 answers that the respondents chose. The significance level for accepting/rejecting the hypothesis was set at 0.05. The results of the test indicate that there is no statistically significant dependence between the monitored variables and thus there is no statistically significant dependence between the respondents' monthly income and how often they travel for entertainment, vacation or relaxation (Table 3).

Table 3. Investigating the (in)dependence of various factors influencing the use of the accommodation sector of the shared economy.

	Significance level	p-value χ^2 test	Hypothesis	Cramer's p-value	Cramer's V coefficient
Monthly income and travelling for vacation or relaxation	0.05	0.134	H1 rejected	-	-
Age and use of shared accommodation	0.05	< 0.05	H2 accepted	< 0.05	0.375
Monthly income and reasons for using accommodation platforms	0.05	0.0156	H3 accepted	0.0156	0.167

Source: own calculations.

The authors also continued by statistically verifying the dependence between the age of the respondents and whether they had used accommodation through the sharing economy platform in the past. The calculated p-value is less than the set significance level of 0.05, and it can therefore be concluded that there is a statistically significant relationship between the age of the respondents and

whether they have used accommodation through the sharing economy platform in the past. Furthermore, attention was also focused based on this established dependence, the authors determined the strength of this statistical dependence. Based on Cramer's coefficient V, it can be declared that the dependence between the age of the respondents and the use of accommodation through the sharing economy platform is moderately strong. This dependence may be because younger people are often more technologically savvy and ready to accept new accommodation options. Younger people are more inclined towards sharing economic trends, while older generations rely more on traditional accommodation options (Table 3).

Finally, the authors decided to verify the dependence between the respondents' monthly income and the reasons for using accommodation platforms within the sharing economy. When examining the relationship between these variables, it is crucial to note that only those who indicated "yes" when asked if they had previously used accommodation within the sharing economy provided an explanation for their use of these platforms. The calculated p-value is less than the set significance level of 0.05, and it can therefore be concluded that there is a statistically significant relationship between the respondents' monthly income and reasons for using accommodation platforms within the sharing economy system. Furthermore, attention was also focused based on this established dependence, the authors also determined the strength of this statistical dependence. Based on Cramer's coefficient V, it can be declared that the dependence between the respondents' monthly income and reasons for using accommodation platforms within the sharing economy system is weak. People of different income levels have different preferences and lifestyles, which affects their reasons for using sharing economy accommodation platforms. For example, respondents with a higher monthly income can afford to use sharing economy services more often or prefer higher comfort and convenience than respondents with a lower income (Table 3).

From the perspective of the results, it is imperative to state that the authors were able to ascertain the significance of each individual factor when selecting a accommodation and the price, location, and reviews of the lodging establishments are the most crucial factors. It is possible to evaluate, on the basis of this testing, the statistical dependence between the significant relationship between the age category of the respondents and whether they used accommodation through a sharing economy platform in the past. It was also possible to verify the statistical dependence between the respondents' monthly income and reasons for using accommodation platforms within the sharing economy. In both cases, according to Cramer's coefficient, a weak degree of dependence between the studied variables is demonstrated. From the point of view of the economic environment of the Slovak Republic, the facts found may indicate that younger individuals are frequently more accepting of new housing options and more tech adept. While older generations rely more on conventional lodging options, younger people are more likely to share economic trends. People with varying income levels use sharing economy accommodation platforms for different reasons since they have varied lives and preferences. For instance, compared to respondents with lower incomes, those with higher monthly incomes can afford to use sharing economy services more frequently or prefer greater comfort and convenience.

Almost 300 respondents responded to the questionnaire by indicating that they had previously encountered the sharing economy and had positive experiences with it. This finding should be statistically verified by the test of agreement of the mean value μ with the known constant μ_0 . The authors chose the following hypotheses to verify the fact that more than 80 % of respondents are satisfied with sharing economy services (Table 4).

Table 4. Criterion verification.

Significance level	Test criterion	Critical domain on the form of inequality	Hypothesis
0.05	-1.7205	1.6449	H4 accepted

Source: own calculations.

The failure of the inequality indicates insufficient information to substantiate the alternative hypothesis, thus precluding the assertion that over 80 % of individuals have utilized sharing economy services in any capacity (Table 4).

4. Discussion

The utilization of the market is enhanced through the sharing of resources among the numerous participants, thereby expanding the potential of free markets. The only way for there to be a link between customers and suppliers that is both effective and efficient is for there to be enormous development made in digital networks while the social trust climate is generally favourable. People's perspectives on ownership are shifting as a result of the sharing business model. It highlights the fact that the sharing economy can be tied to liberalization and adjustment of restrictions, emphasising that using rather than simply owning is the focus.

The sharing economy has changed, embracing digital revolution and responding to issues such as the COVID-19 epidemic, moving away from a narrow concentration on collaborative consumption and toward a more diverse strategy. Trust, technology, and sustainability have always been important factors. Modern digital technologies have an internal and external impact on the organization, enabling the development of new business models and revolutionizing the clientele's experience. The incumbents are aware of the necessity of strategically changing in order to create new value chains and networks (Novackova & Wefersova, 2021). Accommodations can offer distinctive experience at much reduced prices. However, private rules do not compel adherence to state laws, which may result in the host failing to fulfil their tax obligations. The mismatch between governmental and private legislation regarding the sharing economy is the reason for the significant variations in practices observed in the Slovak Republic. State laws control the leasing of private accommodations. These laws impact the facilities of the lodging facility and demand exorbitant fees and drawn-out procedures even prior to the commencement of the rental. However, renting through Airbnb is more cost-effective and time-efficient because it requires no registration fees. Prices for lodging are far lower and can offer distinctive experience. Private regulations, on the other hand, do not compel adherence to state laws, which may result in situations like tax evasion. It is appropriate to categorize the sharing economy as a legitimate economic sector (Gogolova et al., 2022; Liang et al., 2018). The situation in sharing economy in Slovakia seems to be different from that of the Western European countries. In terms of sharing economy usage, Slovakia is not a leader (Gubalova et al., 2021). Though it is a small nation, the Slovak Republic has the ability to advance the sharing economy and benefit people in the process. This phenomenon is only at the beginning in Slovakia (Garbarova & Holla Bachanova, 2018). The largest platform that allows consumers to book private accommodations is Airbnb. The Airbnb platform offers accommodation services primarily in four types of locations in Slovakia. There are large cities like Bratislava and Košice (Gregorova, 2020).

Because externalities and exogenous effects might change at any time, it is challenging to forecast the trend toward sharing. Even in the sharing domain, one can only anticipate due to factors like global conflicts, political pressures, the state of economies in many nations, and the uncontrollably spreading viruses and diseases. The contrasts between enterprises that had the capital to handle this circumstance, bridge the unfavourable situation, or adapt were further highlighted and intensified by the COVID-19 pandemic. These distinctions pertained to advancement and the utilization of existing goods, products, and services. One of the main reasons cited by clients for using sharing economy platforms is sustainability, in addition to financial benefits, social experience or life quality. More studies are required on this subject because the sharing economy promotes sustainable growth with few drawbacks (Curtis & Mont, 2020). As it has received the least attention, research needs to concentrate on the environmental aspect of sustainability. Renting accommodation through the Airbnb platform has enormous potential to meet the needs of tourists. The sharing economy concept is very much in line with the circular economy, which utilizes unused houses rented out in entirety or partially (Musthofa & Rijanta, 2023). In addition to providing financial advantages to its members,

the sharing economy fosters entrepreneurship, innovation, sustainability, and cheaper costs by fostering competition. One significant factor driving hotel demand in the lodging sector may be the sharing economy. Classic hotels are facing competition from the sharing economy. Expected effects include a decline in hotel revenue and a shift in customs and visitor behaviour (Srovnalíková et al., 2020)

The second way identified advancements that followed these rules or nations that viewed this system as a substitute for the linear economic environment that is now understood. Technological maturity and the inherent evolution of society demonstrate that economic sector stagnation is an extremely undesirable phenomenon. It is important to remember that all nations need rules, regulations, the legal system, and law enforcement since it is unrealistic to expect everyone to behave in an honourable and moral manner. But technological advancements demonstrate that they can support people in a variety of ways. Regardless of the nation they are in, smart applications, computers, laptops, tablets, and smartphones have initiated a common system. The theoretical difficulties are the main emphasis of the current work. Maintaining its commitment to sustainable methods and the creation of novel business models, the industry has branched out into different forms of consumption, such as ride-sharing and lodging. In a constantly changing and technologically advanced environment, this evolution highlights the industry's adaptability, resilience, and unwavering pursuit of responsible and effective resource utilization (Faraji et al., 2023; Juracka et al., 2023) It is important to note that the sharing economy is a paradigm shift in favour of greener practices because it is influencing consumer behaviour. People are choosing temporary access over ownership in this new trend, which is definitely good for the sustainability of the environment (Soltysova & Modrak, 2020).

The European Commission recognizes the advantages of the sharing economy and puts a focus on the fact that European nations ought to be receptive to the new opportunities that the sharing economy delivers. Within the European Union, the sharing economy is a significant contributor to the creation of new jobs and the expansion of the economy (Gössling et al., 2020). With regard to the European consumer market, it has been discovered that the number of individuals who make use of online collaborative economy platforms varies from nation to country. Due to the presence of numerous small actors and online platforms that serve the collaborative economy within the legal framework that governs services in the Single Market and ecosystems, this indicates that the collaborative consumption economy is gradually altering social and societal relations. This is evidenced by the fact that more and more small actors and platforms are serving the collaborative economy. Physical commodities, transportation services, peer-to-peer accommodation, and on-demand household services are the four key areas of the collaborative economy, and there is a correlation between the revenues of European service providers and these four sectors (Gerlich, 2023).

The research by Jelinkova et al. (2021) also demonstrates that the younger and older generations viewed the advantages of sharing in terms of economic, social, and environmental responsibility to be equivalent in the majority of cases in the neighbouring country of Slovakia - the Czech Republic. The study by Panniello et al. (2022) found, that larger use of food-related services and a larger offer in the accommodation and household services are common practices in countries that are characterized by a high level of both demand and supply of, such as Spain, France, or the Netherlands, where labour and touristic dynamics may contribute to sustain the development of these services. In particular, these practices are common in countries where there is an elevated level of both demand and supply of sharing economy. On the other hand, large-scale utilization of collaborative services that are functioning in less popular areas (the collaborative banking sector) does not have the same favourable influence on the formation and growth of both the demand and supply sides of sharing economy. One more intriguing discovery is that the growth of the supply and demand sides of the sharing economy phenomena is contingent upon the fact that the major value offer of the sharing economy phenomenon, which is the acquisition of services at a reduced cost or for free, is in

accordance with the primary market need. Having flexible working hours, for example, is an example of a secondary value proposition that is viewed as relevant by the market. On the other hand, the expansion of sharing economy platforms is less noticeable when only secondary value propositions are considered relevant. In other words, the surge in the number of search engine optimization platforms is consistent in situations when cost-cutting incentives are particularly seen as being relevant. It appears that this is a characteristic that is shared by both industrialized countries and emerging countries.

According to the study by Grybaitė et al. (2022), the initial observation of each region, it is evident that Western Europe is the dominant region.

While this study sheds light on consumer satisfaction with Slovak sharing economy platforms, regulation remains a significant issue, its growth and sustainability are heavily influenced by institutional frameworks, legal clarity, and governmental attitudes (Gössling et al., 2020). The European Commission (2016) recognizes the sharing economy's potential to generate growth and employment, but highlights the need for balanced regulation to address issues such as consumer protection, fair competition, and labor standards. However, Slovakia, like many other EU nations, lacks a comprehensive and well-defined policy for regulating the sharing economy. According to research, policy fragmentation and a lack of targeted national regulation may limit the sector's potential (Codagnone et al., 2016). Furthermore, there has been little research into how Slovak regulatory authorities address platforms like as Airbnb, Uber, and Bolt compared to countries like France and Germany, where particular legislative frameworks have been formed. Future study should not just analyse user satisfaction or economic impact but also offer personalized policy actions that consider the local economic, legal, and social contexts. This will ensure that the sharing economy promotes long-term development while reducing dangers associated with informality, taxation, and social inequality.

Conclusions

Various internet articles, newspaper articles or media can help the growth of the sharing economy. But still, many people have never used this alternative type of accommodation before, they don't even know it. However, it is necessary that the government also supports this economic model and presents it to the public as an alternative accommodation option. In this way, people will gain a better overview of the possibilities of the shared economy and the demand for these services will also increase. On the other hand, the supply will also increase. This means not only more offered services, but also their better availability and quality. Government support can also lead to greater consumer confidence in sharing economy platforms and their providers. The lower price compared to traditional accommodation received the largest representation. For many people, price is an important factor when choosing accommodation. Hosts on platforms provide their accommodation cheaper than traditional hotels or guesthouses. Therefore, sharing economy platforms are an alternative when choosing accommodation when traveling. Another important factor is the ease and speed of booking accommodation, or a wide selection of accommodation facilities. With the help of a few clicks, a potential guest can book accommodation from a wide range of accommodation facilities thanks to clear websites and mobile applications.

However, there are also barriers due to which many people avoid using accommodation services in the sharing economy. Our questionnaire survey shows that the respondents are most concerned that the description or photos of the accommodation will not match reality. This aspect creates considerable uncertainty and risk for many potential guests. Therefore, accommodation providers who provide little or unreliable information can lose potential guests and considerable income. This phenomenon will also affect the reputation and income of the platforms. Therefore, we suggest that the platforms indicate trusted hosts that can be relied upon and provide trustworthy information. These designations may be provided based on good reviews and ratings. This initiative would give hosts the opportunity to build a good reputation among potential guests, increasing confidence in

their offering and the platform. An important problem of the shared economy in the area of accommodation is for the respondents insufficient hygiene, dirty accommodation and concern about the quality and comfort of accommodation. One of the important factor's respondents declare sharing economy accommodation providers could improve is providing more flexibility in cancelling bookings. This aspect is important for guests who may encounter unexpected events or changes in plans due to which they must cancel or postpone their reservations. A lack of flexibility in cancelling a reservation can cause unnecessary inconvenience and financial loss for guests, negatively impacting their experience of staying in the sharing economy.

While economic concerns continue to influence consumer decisions, environmental and social motivations remain secondary. This challenges certain overarching assumptions in sharing economy literature that strongly associate involvement with environmental considerations. Instead, it appears that Slovak consumers value price and convenience over ethical or environmental concerns.

In the established hypotheses statistical significance was not confirmed in only one case and thus it can be declared that between the age of the respondents and whether they have used accommodation through the sharing economy platform in the past, and between the respondents' monthly income and reasons for using accommodation platforms within the sharing economy system. The article's objective can be deemed accomplished from this perspective.

The research contributes to the expansion of existing models from a theoretical perspective by incorporating contextual factors such as trust in online reviews, understanding the sharing economy, and the influence of local legislation. In a practical sense, the findings indicate that platform providers should raise their level of transparency, strengthen their review mechanisms, and customize their message to the specific needs of Slovak consumers. In conclusion, this study emphasizes the significance of increasing knowledge through the media and public involvement, and it promotes additional research on the regulatory environment and comparisons between different countries. These insights are particularly pertinent in light of the fact that digital platforms are continuing to transform tourism and accommodation in the post-pandemic period, particularly in developing economies such as Slovakia.

The main limitation of this study is the analysis of the sharing economy in only one country (Slovakia) and the focus mainly on the accommodation sector. To determine the implications of the sharing economy, future study should quantify the effects of this phenomenon on the gross domestic products of the respective national economies. Additionally, focusing on the legal modifications, platform risk, and uncertainty related to the external effects of globalization would be advantageous.

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Reference

1. Acquier, A., Daudigeos, T., & Pinkse, J. (2017). Promises and paradoxes of the sharing economy: An organizing framework. *Technological Forecasting and Social Change*, 125, 1–10. <https://doi.org/10.1016/j.techfore.2017.07.006>.
2. Airbnb. (2023). About us. <https://news.airbnb.com/about-us/>.
3. Belas, J. (2023). Are there differences in the approach to CSR according to the most important business sectors in the SME segment? Empirical research in the V4 countries, *Ekonomicko-manazerske spektrum*, 17(2), 86–95. <https://doi.org/10.26552/ems.2023.2.86-95>.
4. Botsman, R., & Rogers, R. (2010). *What's Mine Is Yours: The Rise of Collaborative Consumption*. Harper Business.
5. Codagnone, C., Abadie, F., & Biagi, F. (2016). The Passions and the Interests: Unpacking the 'Sharing Economy'. *JRC Science for Policy Report*. European Commission. <https://dx.doi.org/10.2791/474555>
6. Curtis, S. K., & Mont, O. (2020). Sharing economy business models for sustainability. *Journal of Cleaner Production*, 266, Article 121519. <https://doi.org/10.1016/j.jclepro.2020.121519>.
7. David, L. D., & El Archi, Y. (2024). Beyond boundaries: Navigating smart economy through the lens of tourism. *Oeconomia Copernicana*, 15(1), 15–25. <https://doi.org/10.24136/oc.2978>.
8. European Commission. (2016). A European agenda for the collaborative economy. <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52016DC0356>.
9. Eurostat. (2020). Are you part of the collaborative economy? <https://ec.europa.eu/eurostat/en/web/products-eurostat-news/-/ddn-20200205-1>.
10. Faraji, M., Seifdar, M. H., & Amiri, B. (2023). Sharing economy for sustainability: A review. *Journal of Cleaner Production*, Article 140065. <https://doi.org/10.1016/j.jclepro.2023.140065>.
11. Felson, M., & Spaeth, J. L. (1978). Community Structure and Collaborative Consumption: A Routine Activity Approach. *American Behavioral Scientist*, 21(4), 614–624. <https://doi.org/10.1177/000276427802100411>.
12. Gajdosikova, D., Valaskova, K., & Lazaroïu, G. (2024a). The relevance of sectoral clustering in corporate debt policy: the case study of Slovak enterprises. *Administrative Sciences*, 14(2), Article 26. <https://doi.org/10.3390/admsci14020026>.
13. Gajdosikova, D., Valaskova, K., Lopatka, A., & Lazaroïu, G. (2024b). Corporate Debt Dynamics: Sectoral Clustering Analysis Using NACE Classification in Slovakia. *Journal of Business Sectors*, 2(1), 32–46. <https://doi.org/10.62222/FYUX6733>.
14. Garbarova, M., & Holla Bachanova, P. (2018). Sharing economy as a new form of business in global environment. In 18th International Scientific Conference *Globalization and its Socio-Economic Consequences: proceedings*.
15. Geissinger, A., Laurell, C., Öberg, C., & Sandström, C. (2019). How sustainable is the sharing economy? On the sustainability connotations of sharing economy platforms. *Journal of Cleaner Production*, 206, 419–429. <https://doi.org/10.1016/j.jclepro.2018.09.196>.
16. Gerlich, M. (2023). The Rise of Collaborative Consumption in EU Member States: Exploring the Impact of Collaborative Economy Platforms on Consumer Behavior and Sustainable Consumption. *Sustainability*, 15(21), Article 15491. <https://doi.org/10.3390/su152115491>.
17. Gogolova, M., Kovalova, E., & Lizbetinova, L. (2022). The sharing economy and the use of the Airbnb platform in Slovakia. *Ekonomicko-manazerske spektrum*, 16(2), 91–101. <https://doi.org/10.26552/ems.2022.2.91-101>.
18. Gössling, S., Hall, C. M., & Ehnis, D. (2020). European perspectives on participation in the sharing economy. *Sustainability Science*, 15(6), 1439–1451. <https://doi.org/10.1007/s11625-020-00842-6>.
19. Gregorova, B. (2020). Spatial analysis of airbnb supply in Slovakia. *Acta Geographica Universitatis Comenianae*, 64(1), 73–89.

20. Grybaitė, V., Stankevičienė, J., Lapinskienė, G., & Podvezko, A. (2022). Comparison of the environment of EU countries for sharing economy state by modern multiple criteria methods. *Amfiteatru Economic*, 24(59), 194–213. <https://doi.org/10.24818/EA/2022/59/194>.
21. Gubalova, J., Capkova, S., & Kokavcova, D. (2021). Socio-Economical Aspects of the Collaborative Economy in Slovakia. In *The Collaborative Economy in Action: European Perspectives* (pp. 285-298).
22. Haqqani, A. A. H., Elomri, A., & Kerbach, L. (2022). Sharing economy: A systematic review of definitions, drivers, applications, industry status and business models. *IFAC-PapersOnLine*, 55(10), 490–495. <https://doi.org/10.1016/j.ifacol.2022.09.441>.
23. Jelinkova, M., Tetrevova, L., Vavra, J., & Munzarova, S. (2021). The sharing economy in the context of sustainable development and social responsibility: The example of the Czech Republic. *Sustainability*, 13(17), Article 9886. <https://doi.org/10.3390/su13179886>.
24. Juracka, D., Valaskova, K., & Janoskova, K. (2023). Sharing Economy as Unconventional Alternative to Traditional Transport Services. *Management Dynamics in the Knowledge Economy*, 11(4), 338–351. <https://doi.org/10.2478/mdke-2023-0021>.
25. Klietnik, T., Kral, P., Bugaj, M., & Durana, P. (2024). Generative artificial intelligence of things systems, multisensory immersive extended reality technologies, and algorithmic big data simulation and modelling tools in digital twin industrial metaverse. *Equilibrium. Quarterly Journal of Economics and Economic Policy*, 19(2), 429–461. <https://doi.org/10.24136/eq.3108>.
26. Kostkova, M. (2020). Shared accommodation as a globalization trend in tourism. *SHS Web of Conferences*, 74, Article 03002. <https://doi.org/10.1051/shsconf/20207403002>.
27. Kostrzewski, M., Vojtekova, S., & Vlckova, M. (2023). Bankruptcy prediction for the manufacturing sector in V4 countries. *Ekonomicko-manazerske spektrum*, 17(2), 48–64. <https://doi.org/10.26552/ems.2023.2.48-64>.
28. Kovac, N., Žmija, K., Kumar, R. J., Kusa, R., & Duda, J. (2024). Digital divide and digitalization in Europe: A bibliometric analysis. *Equilibrium. Quarterly Journal of Economics and Economic Policy*, 19(2), 463–520. <https://doi.org/10.24136/eq.2899>.
29. Kuhzady, S., Seyfi, L., & Beal, L. (2022). Peer-to-peer (P2P) accommodation in the sharing economy: a review. *Current Issue in Tourism*, 25(19), 3115–3130. <https://doi.org/10.1080/13683500.2020.1786505>.
30. Kumar, V., Lahiri, A., & Dogan, O. B. (2018). A strategic framework for a profitable business model in the sharing economy. *Industrial Marketing Management*, 69, 147–160. <https://doi.org/10.1016/j.indmarman.2017.08.021>.
31. Liang, L. J., Choi, H. C., & Joppe, M. (2018). Understanding repurchase intention of Airbnb consumers: Perceived authenticity, electronic word-of-mouth, and price sensitivity. *Journal of Travel & Tourism Marketing*, 35(1), 73–89. <https://doi.org/10.1080/10548408.2016.1224750>.
32. Metzker, Z. (2024). Selected demographic determinants of CSR, financial & environmental management and business ethics in SMEs. *Journal of Business Sectors*, 2(1), 79-88. <https://doi.org/10.62222/FEND1256>.
33. Musthofa, A., & Rijanta, R. (2023). How Can Renting Accommodation Contribute To The Circular Economy? A Case Study of Airbnb Accommodation in Yogyakarta. *Journal of World Trade Studies*, 7(2), 14–26. <https://doi.org/10.22146/jwts.v7i2.6614>.
34. Nagy, M., Lazaroiu, G., & Valaskova, K. (2023). Machine intelligence and autonomous robotic technologies in the corporate context of SMEs: Deep learning and virtual simulation algorithms, cyber-physical production networks, and Industry 4.0-based manufacturing systems. *Applied Sciences*, 13(3), Article 1681. <https://doi.org/10.3390/app13031681>.
35. Novackova, D., & Wefersova, J. (2021). Use of digital technologies in business in Slovakia. *Developments in Information & Knowledge Management for Business Applications*, 2, 335–355. <https://doi.org/10.1007/978-3-030-76632-0>.

36. Nuttah, M. N., Roma, P., Lo Nigro, G., & Perrone, G. (2023). The Short-and Long-Term Impacts of COVID-19 Pandemic on the Sharing Economy: Distinguishing Between “Symptomatic” and “Asymptomatic” Platforms. *Journal of the Knowledge Economy*, 1–50. <https://doi.org/10.1007/s13132-023-01449-9>.
37. Panniello, U., Ardito, L., & Petruzzelli, A. M. (2022). Scoping the state of the sharing economy and its antecedents at the country level: Cross-country differences in Europe. *Geoforum*, 133, 140–152. <https://doi.org/10.1016/j.geoforum.2022.05.013>.
38. Rathnayake, I., Ochoa, J. J., Gu, N., Rameezdeen, R., Statsenko, L., & Sandhu, S. (2024). A critical review of the key aspects of sharing economy: A systematic literature review and research framework. *Journal of Cleaner Production*, 434, Article 140378. <https://doi.org/10.1016/j.jclepro.2023.140378>.
39. Soltysova, Z., & Modrak, V. (2020). Challenges of the sharing economy for SMEs: A literature review. *Sustainability*, 12(16), Article 6504. <https://doi.org/10.3390/su12166504>.
40. Srovnalíková, P., Semionovaitė, E., Baranskaitė, E., & Labanauskaitė, D. (2020). Evaluation of the impact of sharing economy on hotel business. *Journal of Tourism and Services*, 11(20), 150–169. <https://doi.org/10.29036/jots.v11i20.145>.
41. Statista. (2024). Nights and experiences booked with Airbnb from 2017 to 2023. <https://www.statista.com/statistics/1193532/airbnb-nights-experiences-booked-worldwide>.
42. Valaskova, K., Nagy, M., & Grecu, G. (2024). Digital twin simulation modeling, artificial intelligence-based Internet of Manufacturing Things systems, and virtual machine and cognitive computing algorithms in the Industry 4.0-based Slovak labor market. *Oeconomia Copernicana*, 15(1), 95–143. <https://doi.org/10.24136/oc.2814>.
43. Vatamanescu, E. M., Dabija, D. C., Gazzola, P., Cegarro-Navarro, J. G., & Buzzi, T. (2021). Before and after the outbreak of covid-19: Linking fashion companies' corporate social responsibility approach to consumers' demand for sustainable products. *Journal of Cleaner Production*, 321, Article 128945. <https://doi.org/10.1016/j.jclepro.2021.128945>.
44. Zhang, Y., Li, L., Sadiq, M., & Chien, F. S. (2023). Impact of a sharing economy on sustainable development and energy efficiency: evidence from the top ten Asian economies. *Journal of Innovation & Knowledge*, 8(1), Article 100320. <https://doi.org/10.1016/j.jik.2023.100320>.

How Tourism Offerings and Soft Skills Drive Repeat Purchases: A Study of the Moravian-Silesian Region, Czech Republic

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Abstract

Repeat visitation is a critical measure of success in tourism. While prior studies have examined service quality and staff behaviour separately, their combined effect on visitor loyalty remains underexplored. This study investigates how service offerings and selected employee soft skills influence repeat visits to tourism establishments in the Moravian-Silesian Region of the Czech Republic. The research was conducted under the auspices of two institutional projects on regional tourism trends (2017–2022). Primary data were collected from 698 residents of the region through a structured questionnaire across 73 tourism businesses. The survey was carried out between 2018 and 2021 to capture pre-pandemic, pandemic, and post-pandemic trends. Respondents rated 10 service and behavioural attributes using a five-point Likert scale. Systematic random sampling ensured representativeness. The data were analysed using chi-square tests (SPSS), with two hypotheses tested regarding the moderating roles of gender (H1) and education (H2). The findings confirm that attractive service offerings combined with strong soft skills – such as communication, teamwork, and customer service – significantly affect repeat visitation. The statistical results show $\chi^2(3) = 1.050$ ($p = 0.789$) for H1, leading to rejection of the gender moderation hypothesis, and $\chi^2(6) = 14.982$ ($p = 0.020$) for H2, confirming education as a moderating factor. Thus, educational background influences the relationship between product knowledge and repurchasing behaviour, whereas gender does not. This study contributes to the literature by integrating service quality and human capital perspectives and emphasising the underexplored interaction between offerings, soft skills, and visitor loyalty. For practice, the results highlight the need for continuous staff development in soft skills and innovation in service design, which are vital for improving competitiveness and fostering sustainable tourism growth in the Moravian-Silesian Region and similar destinations.

Key words

repeat visits, tourism establishments, tourism product, customer experience, soft skills, moravian-silesian region.

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Introduction

Tourism plays a critical role in the socioeconomic advancement of regions and nations throughout the world. As destinations strive to attract a growing number of visitors, understanding the factors that influence tourists' decisions to return to specific establishments within a region becomes paramount (Chi & Qu, 2008; Prayag & Ryan, 2012). This study addresses a research gap by investigating the combined effect of service offerings and employee soft skills, which has been underexplored in prior literature, particularly in the Moravian-Silesian Region. The objective and

significance of this study are explicitly to evaluate these dual factors and provide region-specific managerial insights.

The European Union's tourism industry is currently experiencing a resilient resurgence following the consequences of the COVID-19 pandemic. During the first half of 2023, the volume of nights spent in tourist accommodation reached its highest point in the past decade, indicating a significant resurgence in the industry's performance across several countries. In the first six months of 2023, a total of 1,193 million nights were occupied in tourist accommodation, reflecting an increase of nearly 11 million compared to the same period in 2019 (1,182 million, +0.9%). Furthermore, there were 136 million more overnight stays compared to the first half of 2022 (1,057 million, +12.9%). In contrast to 2021 (406.8 million), this year witnessed a notable surge of 786 million additional overnight stays, and compared to 2020 (474.7 million), there were 718 million more overnight stays recorded (Eurostat, 2023).

In this context, it is essential to place greater emphasis on management, as effective leadership has a major impact on strategic management of service quality, employee professional development, and overall customer satisfaction (Zeithaml et al., 1996). Strong management can contribute to raising standards and innovation in tourism, but its success depends on the ability to balance economic objectives with the quality of the experience provided.

1. Literature review

Globalisation and rising competition have created a dynamic and turbulent environment for businesses worldwide, including those in the tourism sector. The ability of organisations to understand prevalent trends and consumer behaviour is critical to their survival and success (Daño et al., 2024; Korcsmáros et al., 2024; Srovnalíková, 2024). In tourism specifically, globalisation has expanded market opportunities but also intensified competition between destinations and service providers (Dabija et al., 2022). The pressure to differentiate places and experiences is particularly acute when competing against destinations offering lower-cost services (Leonova, 2021; Obstfeld, 2020; Sun et al., 2022).

Consumer behaviour in tourism is shaped by a multitude of factors, including culture, technology, economic conditions, and environmental concerns (Bilan et al., 2023; Drábik et al., 2020; Solomon et al., 2002). Tourists are increasingly sensitive to sustainability issues, and recent studies emphasise that environmental and green practices are becoming decisive in shaping travel choices (Watson & McCracken, 2002; Valachis & Tachmatzidis, 2023). However, previous research often treats sustainability separately from service quality and staff skills, overlooking the ways in which soft skills and green practices interact in shaping visitors' perceptions. Furthermore, sustainable and green practices are insufficiently addressed in prior studies. We extend this perspective by linking environmental sustainability with tourism services and the soft skills of staff, positioning this integration as a key contribution of our study.

Service offerings such as accessibility, amenities, and attractions play a central role in shaping tourist decisions (Puciato et al., 2023; Tsao, 2019). Yet, the success of these offerings is often determined by the quality of human interaction. Soft skills, including communication, empathy, and professionalism, are consistently identified as being crucial in tourism and hospitality services (Motah, 2007; Pai et al., 2020; Shabir & Sharma, 2019). While previous studies confirm their importance, they rarely explain how these competencies translate into repeat visitation and customer loyalty (Carlisle et al., 2023; Tankovič et al., 2021). This lack of integration between service design, sustainability, and human interaction constitutes a gap that our research seeks to address.

Recent research further emphasises that consumer behaviour in tourism is uncertain and strongly influenced by emotional and social value (Horvath et al., 2021; Keller et al., 2023; Vinerean, 2013). Tourists perceive risks in their choices due to imperfect information, and soft skills can play a mediating role in reducing this uncertainty by creating trust and satisfaction. At the same time,

sustainable practices are insufficiently addressed in many prior studies, despite evidence that green strategies enhance perceived value and long-term competitiveness (Valachis & Tachmatzidis, 2023).

The Moravian–Silesian Region in the Czech Republic provides a relevant case study for exploring these dynamics. The region combines industrial heritage with natural and cultural attractions, yet it also faces structural challenges such as the need for service quality improvements and workforce upskilling (Kajzar, 2018; Kajzar & Mura, 2023; Mura & Kajzar, 2018). It represents an ideal setting for examining how tangible service offerings and the soft skills of employees interact to influence repeat visitation. Therefore, this study contributes to the literature by:

- linking globalisation, consumer behaviour, sustainability, and soft skills directly to tourism challenges;
- emphasising the underexplored interaction between green practices and soft skills in shaping visitor loyalty; and
- offering region-specific insights into how these factors influence repeat visitation in the Moravian–Silesian Region.

2. Methodology

The study was conducted within the institutional projects Tourism Trends in the Moravian–Silesian Region (MSR) 2017–2019 and Trends and Innovations in Tourism in the Czech Republic 2020–2022. Data were collected between February 2018 and December 2021. This window deliberately spans a pre-pandemic baseline (2018–2019) and the pandemic/early-recovery period (2020–2021), enabling us to observe whether the drivers of repeat visitation are stable under markedly different market conditions and to mitigate seasonality by covering multiple seasons across four calendar years.

Systematic sampling, also known as systematic random sampling, was used to obtain the primary data from the chosen tourism enterprises; Each Nth member of the tourism enterprises is chosen to be included in the study. "Every Kth item is selected to produce a sample of size n from a number of tourism enterprises of N," according to the statement made on systematic sampling. For a priori, systematic sampling needs an approximated frame, not the entire list.

The survey was designed to assess how service offerings and selected employee soft skills influence visitors' intentions to make repeat visits to tourism establishments in the MSR. Consistent with this aim, we also tested heterogeneity across key socio-demographic groups (gender, education), as reflected in the hypotheses H1–H4.

The survey involved representatives from 44 catering establishments, 10 tour operators, and 19 tourism agencies, and on the other hand, 698 participants from MSR.

The respondent had to meet several requirements, including being a resident of the MSR and at least 18 years of age. According to Kozel et al. (2006), a formula was used to choose a sample size of responders based on their unknown composition after the conditions were fulfilled.

$$n \geq (z^2 \times p \times q) / \Delta^2 \quad (1)$$

where: n – the survey's minimum number of participants; p – the percentage of survey respondents who are likely to choose option one; q – the percentage of respondents to the survey who favoured option two; z – the test significance level and Δ is the maximum error tolerance. $Z=1.96$ at a 95% confidence interval.

Based on this, research questions were formulated:

RQ1: How do the offerings and services provided by tourism establishments in the Moravian–Silesian region influence the decision-making process of visitors in choosing to make repeat visits?

RQ2: What is the influence of the soft skills exhibited by the staff at these establishments on visitor decisions to return for subsequent visits in the Moravian–Silesian Region.

This study used international journals and professional publications as secondary sources. Primary sources were processed using the Statistical Package for the Social Sciences (SPSS) and the Chi-square test. Based on statistical hypotheses, it was possible to determine whether or not customers would repurchase the tourism product based on the differences in responses to surveys regarding service quality characteristics from the perspectives of selected enterprises and customers.

To find out if there is a significant association between two nominal (categorical) variables, apply the chi-square test of independence. How to manually compute the chi-square statistic. The expected values of the two nominal variables must first be determined. Using the following formula, we can determine the expected values of the two nominal variables:

The Chi-square is denoted by χ^2 (equation 2):

$$\chi^2 = \sum (O_i - E_i)^2 / E_i \quad (2)$$

where O_i – observed value (actual value); E_i – expected value.

The respondents were asked to rank 10 selected characteristics in order of significance on a five-point rating scale, where 1 = not important and 5 = very important. The authors of this research concentrated exclusively on the factors that most influence the selection of an international tourism establishment. Table 1 displays the responses and their findings. This is how the rating was completed: The points were totalled for each factor after being multiplied by the number of responses. For example, if 10 respondents marked something as unimportant, $10 \times 1 = 10$.

Table 1. The importance of selected factors in the repeat purchase of a selected product in tourism from a customer's point of view.

Rank	Factor	Points	Points %
1	Atmosphere in tourism enterprises	1,998	14.87
2	Opinions of friends	1,980	14.74
3	Right choice of music	1,934	14.39
4	Location	1,881	14.00
5	Reviews by tripadvisor, booking,...	1,774	13.20
6	Complex facilities	1,697	12.63
7	New service	1,640	12.21
8	Parking	1,589	11.83
9	Possibility of payment by card	1,499	11.16
10	Membership cards	1,432	10.66

Source: Developed by authors.

A total of 403 women and 295 men participated in the study. Among the 698 study participants, 401 participants had completed their secondary education and graduated, 165 participants had merely their secondary education and 132 had earned a university degree.

The following hypotheses were formulated:

H3: The impact of professional behaviour on repeat purchases of tourism products varies between genders.

H4: Education moderates the relationship between knowledge of tourism products and repeat purchases.

3. Research results

According to the survey, customers are more inclined to select a tourism establishment that offers a pleasant atmosphere, is conveniently located, and has received favourable feedback from other customers. Additionally, customers appreciate having a variety of amenities at their disposal, such as parking and card payment options. This implies that word-of-mouth advertising remains a successful

strategy to connect with potential clients. The highest and least important criteria had ratings that differed by more than 500 points (4.21%). In summary, the survey findings offer a significant understanding of the variables that influence the selection of MSR tourist facilities by customers. This information can be used by tourism-related companies to create consumer attraction and retention strategies.

Figure 1 shows that this study highlights the importance of consumers giving significant factors a careful thought before deciding to make additional purchases from tour operators and travel agencies.

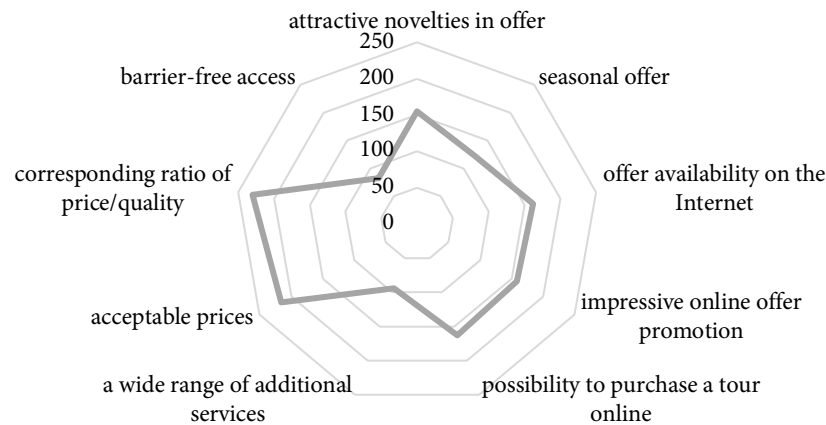


Figure 1. Considerable elements that affect the decision to repurchase a package tour from Tourism operators (Travel agencies) from the point of view of selected tourism enterprises.

Source: Developed by authors.

These components are necessary to attract and retain customers. Customers frequently search for reasonably priced excursions. Maintaining a balance between the experience's cost and quality is essential. Recurring business and customer loyalty are nurtured when expectations are fulfilled or surpassed. Pricing plays a critical role in the decision-making process of customers. When tour packages are offered at competitive and affordable prices, customers are more likely to find them attractive and make more reservations with the company. Finding the optimal ratio between price and quality is essential. Providing a seamless on-line booking experience is also essential. For many travellers, making online reservations is more convenient. Encouraging repeat business can also be achieved by ensuring that customers can easily explore, choose, and complete their reservations online. Online tour packages are a vital requirement in the digital age.

From the vantage point of tourism business management, it is imperative to maintain a strategic equilibrium among pricing, service quality, and customer expectations to achieve sustained success over time. Managers are required to implement data-informed pricing methodologies that not only ensure market competitiveness but also uphold profitability. The allocation of resources toward the development of efficient digital infrastructure, particularly in the realm of user-centric online booking platforms, is vital for the enhancement of the customer experience and the promotion of repeat patronage. Furthermore, effective management necessitates ongoing market analysis to modify service offerings in accordance with the shifting preferences of consumers and advancements in technology. The fortification of customer relationships through tailored services, loyalty initiatives, and engagement following purchases significantly enhances customer retention and drives business expansion within the intensely competitive tourism industry.

Figure 2 shows the importance of selected soft skills in repeat purchase. Customers' decisions to make repeat purchases are significantly influenced by the professionalism of the staff's behaviour.

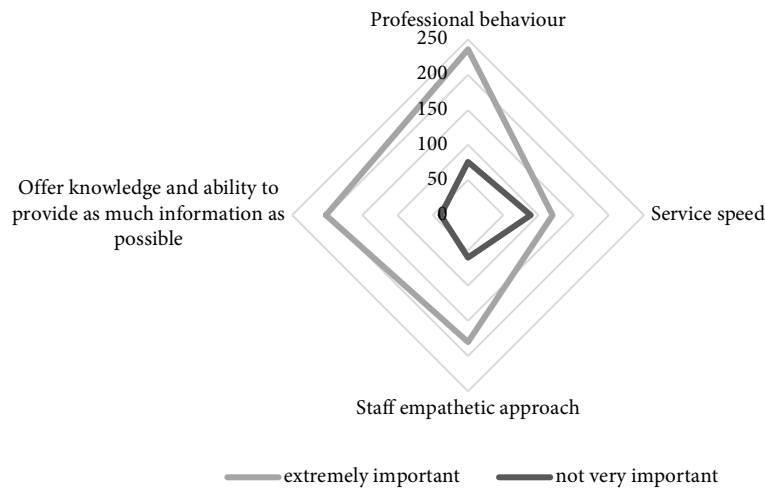


Figure 2. Importance of selected soft skills that affect the decision to repurchase a package tour from tourism operators (travel agencies) from the point of view of selected tourism enterprises.

Source: Developed by authors.

Customers appreciate working with well-trained and polite employees who can successfully handle their requirements and problems. Customers are more likely to return when the travel agency is presented in a professional manner that builds confidence in it. According to the chosen tourism enterprises, another crucial element is the sympathetic and understanding demeanour of the staff, which is crucial to building rapport with the clients. Customers frequently ask for one-on-one support and attention, particularly when they run into unforeseen problems. Sympathetic staff members can create a great experience from a potentially bad one, which promotes customer loyalty and repeat business. Knowledge and the ability to provide as much information as possible is another factor that influences customers. Decision making is greatly aided by competent and informed staff who can provide complete information about travel packages, locations, and activities. When it comes to making informed decisions, customers value having access to comprehensive information. Providing information and responding to inquiries enhances the client experience and encourages return business.

Effective leadership within tourism enterprises should emphasize the cultivation of fundamental soft skills among personnel to augment customer satisfaction and loyalty. Ongoing training initiatives centered on professionalism, empathy, and comprehensive product knowledge are instrumental in enhancing service quality. Allocating resources towards employee development not only fortifies brand reputation but also cultivates customer trust. Furthermore, management is obligated to establish explicit service standards and conduct performance assessments to guarantee uniformity in customer experiences. A proficiently trained and motivated workforce represents a competitive advantage in the tourism sector, directly influencing elevated customer retention and repeat patronage.

From the perspective of catering customers, it has also been found that a pleasant customer experience is largely dependent on the atmosphere and comfort of the tourism establishment. When visiting a tourism business, customers want to feel at ease and welcome. Any tourism business must have effective communication and cohesive cooperation to be successful. A smooth and pleasant experience requires that employees be able to interact successfully with both customers and with each other. This can be achieved through a variety of methods, including clear and concise communication, training and development, and a positive work environment.

From the point of view of catering establishments, speed of service and reasonable price/quality are the most important factor that affects repurchase of tourist product. Speed of service is an important factor for businesses in any industry, but it is especially important for tourism enterprises.

Businesses can improve their speed of service by streamlining their processes, using technology to automate tasks, and also training employees on how to prioritize tasks. A reasonable price/quality ratio is also an important factor for businesses not only in tourism industry and hospitality. Customers want to get the most for their money, and they are more likely to return to a business that offers good value for money. Businesses can improve their price/quality ratio, for example, by offering competitive pricing and using high-quality products and services.

The strategic management of the company should also focus on ensuring an attractive price/quality ratio, for example through competitive pricing and the use of quality raw materials and services. Strong and proactive leadership is key to maintaining customer loyalty, improving the efficiency of business processes and long-term sustainability in the competitive environment of the tourism and catering industry.

This part of the research focuses on the testing and confirmation of hypotheses through the use of SPSS.

H1: Professional behaviour has the same impact on repeat purchases of tourism products for the genders.

H2: Professional behaviour has a different impact on repeat purchases of tourism products for the genders.

According to the result (Table 2), the H1 hypothesis cannot be rejected and that means that professional behaviour has the same impact on repeat purchases of tourism products for men and women.

Table 2. Chi-square tests (Professional behaviour impact).

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	1.050a	3	0.789
Likelihood Ratio	1.071	3	0.784
Linear-by-Linear Association	0.086	1	0.769
N of Valid Cases	698		

Note: a. 3 cells (37.5%) have expected count less than 5. The minimum expected count is 2.54; $\chi^2(3) = 1.050$, $p = 0.789$, $0.789 > 0.05$.

Source: Developed by authors.

The findings substantiate that professional conduct is instrumental in influencing repeat purchases of tourism-related products, irrespective of gender considerations. In light of its considerable effect on visitor satisfaction and the calibre of service, it is imperative that management prioritizes the establishment and enforcement of standards pertaining to professional conduct within tourism enterprises.

To realize this objective, management ought to institute systematic training programs that centre on professionalism, customer service, and ethical behaviour. Regular assessment and performance monitoring are also critical to ensure that personnel comply with elevated service standards. Furthermore, cultivating a corporate culture that esteems professionalism may enhance employee engagement and motivation, which in turn can lead to improved customer retention.

Robust leadership and strategic management are pivotal in entrenching professional conduct as a fundamental value within the organization. By accentuating high service quality and staff professionalism, tourism enterprises can fortify their market position, cultivate customer trust, and augment repeat patronage, thereby ensuring long-term viability in an intensely competitive sector.

H3: Education does not moderate the relationship between knowledge of tourism products and repeat purchases.

H4: Education moderates the relationship between knowledge of tourism products and repeat purchases.

Based on the result (Table 3), the H3 hypothesis is rejected and the H4 hypothesis was approved, education moderates the relationship between knowledge of tourism products and repeat purchases.

Table 3. Chi-square tests (Education impact).

	Value	df	Asymptotic Significance (2-sided)
Pearson Chi-Square	14.982a	6	0.020
Likelihood Ratio	16.239	6	0.013
Linear-by-Linear Association	0.020	1	0.887
N of Valid Cases	698		

Note: a. 4 cells (33,3%) have expected count less than 5. The minimum expected count is 0.76; $\chi^2(6) = 14.982$, $p = 0.020$; $0.020 < 0,05$.

Source: Developed by authors.

The research findings elucidate the pivotal significance of education and product knowledge in shaping the propensity for repeat purchases of tourism services, thereby accentuating the necessity of strategic management in the cultivation of customer experiences. To leverage this correlation, entities within the tourism sector must allocate resources toward the implementation of efficacious customer education and information dissemination methodologies.

From a managerial standpoint, it is imperative to furnish clear, comprehensive, and readily accessible information regarding tourism products, destinations, and services. This objective can be realized through the development of meticulously designed websites, thorough travel guides, interactive content, and well-informed frontline personnel capable of effectively articulating essential details to clientele. Moreover, the provision of educational workshops, webinars, or tailored consultations can significantly augment customer awareness and engagement.

In addition, training initiatives for employees ought to prioritize not only product knowledge but also proficient communication abilities, thereby ensuring that staff can relay valuable information in an engaging and customer-centric fashion. By nurturing an informed customer demographic, tourism enterprises can enhance customer satisfaction, cultivate trust, and ultimately promote repeat purchases, thereby contributing to the long-term sustainability and competitive edge of businesses within the tourism industry.

4. Discussion

Based on the results of the research, it was found that long-term success in the fiercely competitive and dynamic tourist sector depends on the retention and happiness of clients. In addition to being valuable assets, loyal consumers also act as strong brand ambassadors, spreading good word of mouth and recommendations. To encourage return business, tourism suppliers must pay equal attention to the calibre of their offerings and the skills of their staff. This is consistent with the findings of Yoon and Uysal (2005), who highlighted the central role of customer satisfaction in fostering loyalty and repeat visits, with satisfied customers being more likely to recommend destinations to others. Our findings confirm prior literature but also reveal contrasts. For example, while Yoon and Uysal (2005) emphasized emotions in loyalty, our study highlights the measurable role of staff professionalism and product diversity. This represents a novel contribution to the field.

For the first research question (RQ1), it was found that the decisions made by tourists in the Moravian-Silesian region about whether or not to return are greatly influenced by the products and services offered by these companies. This effect is influenced by a number of things, including:

Variety and Diversity of Experiences and Activities: The area provides a wide choice of experiences and activities to suit different interests and tastes, allowing travellers to customize their travels to their own requirements and preferences. This diversity makes it more likely that guests will discover things to do that they enjoy enhancing their overall experience and increasing the likelihood of repeat visits. Yoon and Uysal (2005) found that providing diverse offerings tailored to tourists' preferences significantly enhances their satisfaction, thus encouraging repeat visits. **Excellence of Services:** Travelers look for excellent services that are provided in a timely, professional, and detail-oriented manner. This covers elements such as friendliness, promptness, proactive communication of staff members, and problem-solving skills, all of which are crucial for customer retention. Additionally,

Widayati et al. (2021) emphasized that excellent service directly influences the likelihood of repeat business in tourism.

Value for Money and Affordability: Customers value reasonable prices that provide excellent value. This implies that the total cost of vacation, which includes lodging, travel, meals, and activities, should be based on the perceived value of the experiences that are provided. Oppermann (2000) similarly argued that tourists are more likely to return when they perceive good value for their money, particularly when pricing aligns with the quality of the experience. Reasonable prices can increase the chance of repeat business and help create a favorable impression of the location. Reasonably priced excursions are a common request from customers. It is crucial to strike a balance between the price and quality of the experience. When expectations are met or exceeded, repeat business and consumer loyalty are promoted. Customers consider pricing to be very important when making decisions. Customers are more likely to find tour packages intriguing and make more reservations with the company when they are offered at competitive and reasonable costs. Determining the ideal balance between cost and value is crucial.

For the second research question (RQ2), it was found that the soft skills of staff in the Moravian-Silesian significantly impact tourists' decisions to return to future visits. Soft skills such as communication, empathy, problem-solving, and professionalism create positive experiences that enhance customer satisfaction and loyalty. Sumihar et al. (2019) have emphasized the importance of these soft skills in the tourism industry, noting that employees who demonstrate effective communication and empathy are more likely to foster customer loyalty. Kajzar (2022) further supports this, stating that soft skills like problem-solving and interpersonal communication are vital for creating memorable customer experiences, which in turn increase the likelihood of repeat visits.

Creating a Positive First Impression. Visitors who have a positive first impression of the staff are more likely to have a positive overall experience and return. Sharma et al. (2020) found that first impressions play a critical role in shaping overall satisfaction, with well-trained staff often making the difference between a one-time visitor and a repeat customer.

Increasing Customer Satisfaction. The soft skills of the staff help to increase customer satisfaction by providing personalized service and solving problems effectively. Mohammed (2017) similarly found that staff empathy and problem-solving abilities were critical in enhancing satisfaction and ensuring that visitors had a positive experience.

Professionalism and Customer Loyalty. Staff professionalism, including clear communication and adherence to company policies, is key in creating a positive impression and encouraging repeat visits. This aligns with the findings of Kajzar (2022), who concluded that the professional demeanour of staff significantly influences tourists' decision to return to a destination.

Employers of tourism establishments in the Moravian-Silesian region should invest in developing the soft skills of their staff, as these skills directly affect the quality of the customer experience and, ultimately, customer loyalty. This can be achieved through training, mentoring, and other development activities. This approach is supported by Sharma et al. (2020) and Kajzar (2022), who both highlighted the importance of continuous staff training to ensure that employees are equipped with the interpersonal skills necessary for exceptional service.

From the perspective of tourism management, it is crucial that strategies aimed at retaining customers and increasing customer satisfaction are implemented systematically and effectively. Long-term success in the competitive and dynamic tourism sector requires not only a quality service offering but also well-trained staff with developed soft skills.

Conclusions

This study investigated the impact of service offerings and employee soft skills on repeat visitation to selected tourist facilities in the Moravian-Silesian Region. The findings confirm that the long-term success and competitiveness of tourism enterprises significantly depend on two interrelated factors:

the attractiveness and value of tourism offerings, and the professional behaviour of staff, especially in terms of soft skills.

From a scientific standpoint, the research contributes to the growing body of knowledge that emphasizes the dual influence of product value and human capital in shaping customer satisfaction and loyalty in tourism. It confirms that professional behaviour – characterized by effective communication, teamwork, problem-solving abilities, and ethical conduct – plays a pivotal role in encouraging repeat visits. In the context of tourism establishments such as hotels, restaurants, and travel agencies, these skills translate into tangible outcomes: communication skills allow staff to provide clear information and resolve visitor concerns; teamwork ensures smooth and coordinated service delivery across departments; problem-solving enables quick handling of unexpected issues such as booking errors or service disruptions; and ethical conduct fosters trust, transparency, and a sense of security for guests. Together, these mechanisms enhance the visitor experience and directly increase the likelihood of repeat visits.

From a practical perspective, the findings underscore the need for tourism businesses to invest in continuous staff development, especially in soft skills training, and to enhance the quality and diversity of their offerings. Doing so can significantly improve customer experience, foster loyalty, and enhance the overall competitiveness of the region. Tourism managers and policymakers should prioritize strategic initiatives aimed at both product innovation and employee skill enhancement to ensure sustainable growth.

The added value of this research lies in its comprehensive examination of the synergistic effect between service attributes and human resource competencies on tourist behaviour. By applying this framework to the context of the Moravian-Silesian Region, the study provides a region-specific understanding that can be adapted for broader application in similar destinations. To achieve long-term success and maintain a competitive edge, tourism enterprises must prioritize human capital development and continuous service innovation. Investments in employee training and the enhancement of product offerings are essential strategies to foster customer loyalty and increase repeat visits – contributing not only to individual business performance but also to the sustainable development of the tourism sector in the Moravian-Silesian Region and beyond. The regional focus may reduce generalizability, and reliance on self-reported data may introduce bias. Future research should expand cross-regional comparisons and include longitudinal analyses.

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Reference

1. Bilan, Y., Karyuk, V., Grishnova, O., & Mishchuk, H. (2023). The attractiveness of tourism in the conditions of modern challenges: methodology, assessment, prospects. *Intellectual Economics*, 17(1), 152–177. <https://doi.org/10.13165/IE-23-17-1-08>.
2. Carlisle, S., Ivanov, S., & Espeso-Molinero, P. (2023). Delivering the European Skills Agenda: the importance of social skills for a sustainable tourism and hospitality industry. *Tourism & Management Studies*, 19(3), 23–40. <https://doi.org/10.18089/tms.2023.190302>.

3. Chi, C. G.-Q., & Qu, H. (2008). Examining the structural relationships of destination image, tourist satisfaction and destination loyalty: An integrated approach. *Tourism Management*, 29(4), 624–636. <https://doi.org/10.1016/j.tourman.2007.06.007>.
4. Dabija, D. C., Câmpian, V., Pop, A.-R., & Băbuț, R. (2022). Generating loyalty towards fast fashion stores: a cross-generational approach based on store attributes and socio-environmental responsibility. *Oeconomia Copernicana*, 13(3), 891–934. <https://doi.org/10.24136/oc.2022.026>.
5. Daňo, F., Drábik, P., Rehák, R., Vernerová, D., & Čvirík, M. (2024). Models for Perceived Importance and Satisfaction of Outsourcing Factors: Evidence from Slovakia. *Acta Polytechnica Hungarica*, 21(11), 99–114. <https://doi.org/10.12700/APH.21.11.2024.11.6>.
6. Drábik, P., Rehák, R., Vernerová, D., & Kukura, M. (2020). Rational consumer in the context of environmental protection. *Ekonomicky casopis*, 68(10), 1081–1104. <https://doi.org/10.31577/ekoncas.2020.10.06>.
7. Eurostat. (2023). EU tourism at a decade high in the first half of 2023. <https://ec.europa.eu/eurostat/web/products-eurostat-news/w/ddn-20230915-1>
8. Horvath, J., Gavurova, B., Bacik, R., & Fedorko, R. (2021). Identification of Uncertainty Factors in the Consumer Behavior of the New Generation of Customers at the E-commerce Level. *Journal of Tourism and Services*, 22(12), 168–183. <https://doi.org/10.29036/jots.v12i22.263>.
9. Kajzar, P. (2018). Tourism trends and development of selected economic indicators in the Moravian – Silesian region between 2006–2016. *Acta Oeconomica Universitatis Selye*, 7(1), 46–57. [http://acta.fei.ujs.sk/uploads/papers/finalpdf/AOUS_7\(1\)_from46to57.pdf](http://acta.fei.ujs.sk/uploads/papers/finalpdf/AOUS_7(1)_from46to57.pdf)
10. Kajzar, P. (2022). The Impact of Different Factors on Repeat Visits to Selected International Tourism Enterprises: A Case Study From Czechia. *Frontiers in Psychology*, 13, 1–9. <https://doi.org/10.3389/fpsyg.2022.881319>.
11. Kajzar, P., & Mura, L. (2023). Survey of Consumer Behaviour in Selected International Catering Establishments in Czechia. *Communication Today*, 14(2), 196–209. <https://doi.org/10.34135/communicationtoday.2023.Vol.14.No.2.13>.
12. Keller, V., Printz-Markó, E., & Szabó, Zs. R. (2023). Social media communication of the spa industry during the four waves of the COVID-19 pandemic. *Journal of International Studies*, 16(4), 97–116. <https://doi.org/10.14254/20718330.2023/16-4/7>.
13. Korcsmáros, E., Huszárik, E. S., Kosár, S. T., Mura, L., & Csinger, B. (2024). The Impact of the Coronavirus Pandemic on SMEs in Term of Customer Centricity in Slovakia and Hungary. *Lecture Notes on Data Engineering and Communications Technologies*, 213, 163–180. https://doi.org/10.1007/978-3-031-62213-7_8
14. Kozel, R., Mynářová, L., & Svobodová, H. (2006). *Moderní metody a techniky marketingového výzkumu*. Grada Publishing.
15. Leonova, O. (2021). The Globalization of the "New Wave". *Journal of Chinese Philosophy*, 48(2), 211–221. <https://doi.org/10.1163/15406253-12340013>.
16. Mohammed, E. (2017). The Role of Tourism and Hotels Faculties in Developing Soft Skills for Undergraduate Students in Egypt. *International Journal of Heritage, Tourism and Hospitality*, 11(2), 286–301. <https://doi.org/10.21608/IJHHTH.2017.30215>.
17. Motah, M. (2007). Study of the influence of multiple intelligences and the use of soft skills in project write-up among IT and non-IT students: A research paper. In *Proceedings of the 2007 Informing Science and IT Education Joint Conference* (pp. 71–83). Informing Science Institute. <https://doi.org/10.28945/3096>.
18. Mura, L., & Kajzar, P. (2018). Entrepreneurship in Tourism Sector in Central European Country: Hospitality Trends in the Czech Republic in 2007–2016, *Journal of Environmental Management and Tourism*, 9(6), 1351–1360. [https://doi.org/10.14505/jemt.v9.6\(30\).26](https://doi.org/10.14505/jemt.v9.6(30).26).
19. Obstfeld, M. (2020). Globalization Cycles. *Italian Economic Journal*, 6(1), 1–12. <https://doi.org/10.1007/s40797-020-00121-4>.

20. Oppermann, M. (2000). Tourism Destination Loyalty. *Journal of Travel Research*, 39(1), 78–84. <https://doi.org/10.1177/004728750003900110>
21. Pai, A., Manjunath, M., Kowshik, S. C. S., Aydee, N., Malarout, N., & Naik, N. (2020). Soft skills as a key competency for the future leaders of the hospitality industry. *Palarch's Journal of Archaeology of Egypt/Egyptology*, 17(9), 4341–4355. https://www.researchgate.net/publication/348160728_Soft_Skills_as_a_Key_Competency_for_the_Future_Leaders_of_the_Hospitality_Industry
22. Prayag, G., & Ryan, C. (2012). Antecedents of tourists' loyalty to Mauritius: The role and influence of destination image, place attachment, personal involvement, and satisfaction. *Journal of Travel Research*, 51(3), 342–356. <https://doi.org/10.1177/0047287511410321>.
23. Puciato, D., Szromek, A. R., & Bugdol, M. (2023). Willingness to pay for sustainable hotel services as a perspective of pro-environmental behaviors of hotel guests. *Economics and Sociology*, 16(1), 106–122. <https://doi.org/10.14254/2071789X.2023/16-1/8>.
24. Shabir, S., & Sharma, R. (2019). Role of Soft Skills in Tourism Industry in Saudi Arabia. *International Journal of Engineering and Management Research*, 9(4), 87–92. <https://doi.org/10.31033/IJEMR.9.4.14>.
25. Sharma, A., Gupta, J., Gera, L., Sati, M., & Sharma, S. (2020). Relationship between Customer Satisfaction and Loyalty. *Social Science Research Network*, 1–12. <http://dx.doi.org/10.2139/ssrn.3913161>
26. Solomon, M. R., Barmossy, G., & Askegaard, S. (2002). *Consumer behavior: A European perspective*. 2nd Edn. Harlow: Pearson Prentice Hall.
27. Srovnalíková, P. (2024). Crisis Management, in Family Enterprises, from a Personnel Management Perspective. *Acta Polytechnica Hungarica*, 21(6), 285–301. <https://doi.org/10.12700/aph.21.6.2024.6.15>.
28. Sumihar, S., Sitompul, F. I. D., Dalimunthe, H. I., & Syahputra, M. (2019). The Importance of the Soft Skill Influence for the Tourism Community for the Satisfaction of Tourists at Parbaba Beach In Samosir Island. *Proceedings of the 1st International Conference One Belt, One Road, One Tourism*, 68–73. <https://doi.org/10.2991/ICOBOROT-18.2019.25>.
29. Sun, S., Xu, H., He, M., Xiao Y., & Niu, H. (2022) An Alternative Globalization Barometer for Investigating the Trend of Globalization. *Applied Sciences*, 12(15), Article 7896. <https://doi.org/10.3390/app12157896>.
30. Tankovič, A. Č., Kapeš, J., & Krajlič, V. (2021). Importace of Soft Skills and Communication Skills in Tourism: Viewpoint from Tourists and Future Tourism Employees. *ToSEE – Tourism in Southern and Eastern Europe*, 6, 167–185. https://tosee.fthm.hr/images/proceedings/2021/12-ID_31_Tosee-Cuic.
31. Tsao, W.-Yu, (2019). Building the long bridge between visitors and customers through online general reviews. *Online Information Review*, 43(2), 201–218. <https://doi.org/10.1108/OIR-01-2016-0028>.
32. Valachis, I., & Tachmatzidis, D. (2023). Employees' metacognitive knowledge and skills assessment in tourism and hospitality. *Journal of Tourism Management Research*, 10(2), 123–139. <https://doi.org/10.18488/31.v10i2.3418>.
33. Vinerean, A. (2013). Consumer behavior in tourism and the influencing factors of the decision making process. *Revista Economica*, 65(2), 186–198. <http://oldeconomice.ulbsibiu.ro/revista.economica/archive/65214vinerean.pdf>
34. Watson, S., & McCracken, M. (2002). No attraction in strategic thinking: perceptions on current and future skills needs for visitor attraction managers. *International Journal of Tourism Research*, 4(5), 367–378. <https://doi.org/10.1002/IJTR.386>.
35. Widayati, C. C., Raharjo, D. S., Yuwono, W. A., & Setiawan, M. R (2021). The Influence of Destination Attributes and Quality of Experience on Return Visit Interest. *Journal of Tourism, Hospitality & Sports*, 59, 20–30. <https://doi.org/10.7176/JTHS/59-03>

36. Yoon, Y., & Uysal, M. (2005). An examination of the effects of motivation and satisfaction on destination loyalty: a structural model. *Tourism Management*, 26(1), 45–56. <https://doi.org/10.1016/j.tourman.2003.08.016>
37. Zeithaml, V. A., Berry, L. L., & Parasuraman, A. (1996). The behavioral consequences of service quality. *Journal of Marketing*, 60(2), 31–46. <https://doi.org/10.1177/002224299606000203>.

Heuristic Approaches to Studying the Dynamics of Economic Development for Resource Allocation in Crisis Management

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Abstract

Economic systems operating under high uncertainty, particularly during wartime disruptions, require robust analytical and forecasting instruments to support objective and timely resource allocation decisions within crisis management. This study aims to improve the methodological approaches and analytical toolkit for forecasting and analysing the dynamics of economic development in order to substantiate resource allocation decisions at the level of an economic entity. The research is based on statistical data describing the performance of the analysed object over the pre-war and wartime period of 2006–2024. The methodological framework integrates principles of systems analysis, multivariate statistical techniques for data collection, structuring and processing, expert judgement, and heuristic reasoning to establish the system–logical relationships among the parameters used to construct the initial analytical database. Expert assessments and a set of coefficients (indicators) were developed to operationalise the taxonomic method, enabling the calculation of an integral criterion of economic development. Furthermore, a correlation–regression forecasting model was developed to quantify the strength of relationships among factors and to rank their significance in explaining variations in the economic development index. The findings demonstrate that the proposed modelling framework provides a consistent analytical basis for forecasting economic development dynamics as a function of internal changes in liquidity, solvency, profitability and financial stability indicators, thereby increasing the objectivity and resilience of managerial decisions on resource allocation. The study contributes to the literature by advancing heuristic and data-driven approaches to modelling economic development dynamics under crisis conditions, with particular emphasis on the integration of taxonomic analysis, expert-based indicator construction, and econometric forecasting. The proposed tools may be applied in the practice of crisis management to enhance decision-making in resource distribution and may serve as a foundation for further research incorporating stochastic components and scenario-based analysis.

Key words

forecasting, analysis, economic development, crisis, taxonomy, model, resources.

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Introduction

Assessing the current state and prospects of Ukraine's European integration, it should be acknowledged that the sustainable development of the national economy largely depends on the depth of structural transformations in the economic and technological sphere, the rationality of regional and sectoral division of labour, and the level of human capital capacity (Rohoza et al., 2019). Under conditions of expanding external economic relations and intensifying competition, issues related to improving the effectiveness of economic systems management and ensuring their adaptability to a changing environment become particularly relevant.

The utilisation and enhancement of the potential of economic entities is primarily oriented towards stimulating not only high-technology, export-oriented production, but also the modernisation of industrial sectors in general, taking into account the influence of external environmental factors in both the operational and strategic horizons. In this context, the development of management systems, the application of innovative big data analytical instruments under the digital transformation of the economy, as well as business process optimisation, are considered key elements in strengthening the competitiveness and economic security of business entities. These circumstances determine the necessity of continuous scholarly reflection and further improvement of analytical and forecasting methods employed within management systems.

Accordingly, the role of systemic analysis principles increases in addressing research and forecasting tasks related to the dynamics of socio-economic processes, as well as in substantiating managerial decisions. Contemporary development of systemic analysis implies its rational integration with heuristic hypotheses, enabling the combination of human expert capabilities with advanced computational tools. The scholarly literature emphasises the importance of heuristic approaches grounded in professional intuition, experience, and expert knowledge, which is particularly critical for solving tasks characterised by goal ambiguity and inconsistency, uncertainty, and incompleteness and inaccuracy of initial information. Heuristic methods make it possible to complement missing data through the formulation of well-grounded hypotheses, thereby enabling solutions to a wide range of systemic tasks, including the analysis and forecasting of critical and emergency situations in technological, environmental, and socio-economic processes. A practical instrument for addressing such tasks is the use of expert knowledge to establish priorities, assess influencing factors, and anticipate possible scenarios of future developments.

The relevance of investigating heuristic approaches to forecasting and analysing the dynamics of economic development in the context of substantiating resource allocation decisions is explained by the fact that the effective functioning of economic systems under turbulence and high uncertainty largely depends on the reliability of development forecasts. In the presence of military risks and systemic shocks, the need increases for instruments that enhance the validity and resilience of managerial decisions related to the distribution of scarce resources. Within this study, a methodological approach is proposed that combines expert assessments in constructing a system of parameters (indicators) reflecting the interrelations of key financial and economic performance measures with the development of an economic-mathematical forecasting model based on correlation–regression analysis. The application of this integrated toolkit enables the identification of the strength and direction of factor impacts on the economic development index of the analysed entity, thereby improving the quality of managerial decision-making.

Additionally, it should be noted that under a market economy, further intensified by the heightened uncertainty of wartime conditions, the analysis of performance outcomes and their forecasting require a comprehensive application of methods for modelling the dynamics of economic development. Addressing this task is complicated by the instability of both the external and internal environment, which necessitated the examination of an extended retrospective period covering both pre-war and wartime stages (2006–2024). This made it possible to form the initial data matrix and to calculate the integrated Economic Development Index of the analysed economic entity.

The structure of the article comprises several interconnected sections. The Literature Review analyses contemporary scholarly approaches to examining economic development dynamics and substantiating resource allocation decisions under uncertainty; the identified research gaps provided the basis for formulating the aim and objectives of the present study. The Methodology section outlines the logic of the proposed methodological toolkit, including the justification of the indicator system and the sequence of applying expert judgement, the taxonomic approach, and correlation–regression modelling. The Research Results section presents the outcomes of calculating the integrated Economic Development Index, assessing the influence of key factors, and forecasting the development dynamics of the object under study. The Discussion section interprets the obtained results, specifies the study limitations, and considers possible avenues for addressing them. Finally, the Conclusions section summarises the main findings, outlines practical implications, and identifies directions for further research aimed at advancing the proposed approach.

1. Literature review

Within the scope of this study, approaches to revealing the essence of heuristic methods for forecasting and analysing the dynamics of economic development are examined in the context of substantiating resource allocation decisions under crisis management conditions. The application of heuristic approaches in managing growth and development processes of economic entities remains a methodologically complex task due to the multifactorial nature of socio-economic systems, the inherent contradictions in management objectives, the incompleteness and inaccuracy of initial information, as well as the turbulence of the external environment. This актуализует the need to systematise research addressing the role of innovative and technological development in shaping economic process transformations, as well as to identify effective methods for the formation and evaluation of managerial decisions, including project-based approaches.

Contemporary research on the management of complex socio-economic systems demonstrates a steady trend towards expanding the methodological toolkit applied for diagnosis, forecasting, and substantiation of managerial decision-making. In particular, a number of studies emphasise the importance of developing indicator systems and determining threshold values of security-related parameters, which provides the basis for strategic planning under uncertainty and crisis challenges (Kharazishvili & Kwilinski, 2022; Kharazishvili et al., 2025a, 2025b). Overall, the existing scientific literature outlines several key research streams that are directly relevant to the topic of this article.

Heuristic methods are commonly interpreted as an analytical toolkit aimed at obtaining well-grounded decisions in weakly structured situations where the construction of a strict deterministic model is infeasible or where complete baseline data are unavailable. Methodologically, the heuristic approach implies the active use of expert knowledge, iterative refinement procedures, and flexible combinations of formalised and non-formalised methods. Management research highlights that under uncertainty the effectiveness of decision-making increases when methods of systemic analysis are rationally integrated with heuristic assumptions.

A comparison between idiographic and nomothetic approaches to scientific inquiry in management confirms the necessity of combined research strategies that simultaneously account for the unique features of an object and identify patterns of a more general nature (Dzwigol, 2022). In the context of enterprise development, the application of iterative signal processing and forecasting procedures is of particular importance, enabling anticipatory management of industrial enterprise development (Kamińska, 2018). Consequently, heuristic approaches provide a methodological foundation for forming decisions under conditions of incomplete information and high environmental dynamism.

A distinct strand of the literature is associated with the development and advancement of time-series forecasting methods, including cases with seasonality, trends, and instability in indicator behaviour. Classical exponential smoothing models are regarded as fundamental instruments for forecasting seasonal components and trends, maintaining their relevance both for applied tasks and

as a baseline level for model comparison (Holt, 2004). At the same time, contemporary studies increasingly focus on the robustness of forecasts under abrupt deviations and large forecast errors, which is particularly typical of crisis periods (Castle et al., 2025).

A substantial body of research has evolved around integrating econometric approaches with deep learning methods in order to improve the predictive accuracy of financial and economic indicators. In particular, comparisons between deep learning and econometric techniques in forecasting daily returns demonstrate the potential of machine learning when the forecasting problem is correctly specified and appropriate evaluation criteria are applied (Berger, 2026). This has contributed to the formation of a methodological basis for constructing forecasting models of economic development dynamics using historical data while explicitly accounting for instability factors.

Research on the application of artificial neural networks (ANNs) in forecasting and managerial decision support represents one of the most rapidly developing directions. Early studies demonstrated the value of neural network models for forecasting and decision-making tasks, highlighting their advantages in capturing non-linearities and complex dependencies (Hill et al., 1994). Subsequently, the state of the art in ANN-based forecasting was synthesised, including a systematic discussion of architectures, training procedures, and practical limitations of implementation (Zhang et al., 1998).

In contemporary practice, artificial intelligence (AI) and machine learning methods are also applied to assess resource security and the sustainability of enterprise functioning. In particular, modelling enterprise resource security using ANNs demonstrates the feasibility of integrating digital methods into managerial analytics of resources and risks (Pankova et al., 2023). Studies forecasting entrepreneurial and employability opportunities based on the analysis of government financial parameters likewise confirm the relevance of AI-based approaches for examining the development dynamics of socio-economic systems (Gherbi et al., 2024). Under post-crisis recovery conditions and in ensuring supply chain resilience, particular attention is paid to machine learning methods as instruments for strengthening resilience and accelerating the recovery of operational processes (Sakthi Balan et al., 2025; Salamian et al., 2024).

A significant group of studies focuses on the construction of indicator systems and the methodology for determining threshold values of security-related parameters, enabling the quantitative assessment of stability and admissible operational boundaries of socio-economic systems. The methodology for identifying threshold values of national security indicators using AI methods enhances the formalisation of expert assessments and improves the reproducibility of results (Kharazishvili & Kwilinski, 2022). The expansion of indicator systems for the environmental component of sustainable development in the security dimension provides an analytical basis for integrated assessment of systemic changes and risk monitoring (Kharazishvili et al., 2025b).

Within the analysis of macro-level factors, particular interest is associated with studies that quantitatively assess the impact of innovation-driven supply factors on economic growth and innovation-development security, demonstrating both the magnitude of effects and their significance for ensuring resilience (Kharazishvili et al., 2025a). Related research emphasises the non-linear nature of the impact of digital technological development on CO₂ reduction, thereby confirming the need to account for non-linearities and structural shifts when modelling development dynamics (Kwilinski, 2024). In a broader context, the integration of AI into the analysis of energy-system security highlights paradoxical and non-linear development patterns under sustainability conditions (Kwilinski, 2025).

Resource allocation issues are addressed in contemporary literature as a key element for enhancing efficiency and ensuring sustainable development, particularly under external shocks. Empirical research on resource allocation efficiency in infrastructure projects confirms that the effectiveness of economic development largely depends on the quality of coordination of investment flows and managerial mechanisms for allocating scarce resources (Bu et al., 2021). At the enterprise level, a systemic understanding of linkages between operational processes and financial outcomes becomes essential, as it strengthens economic sustainability and supports managerial decision-making oriented towards long-term performance (Jin et al., 2017).

From the perspective of organisational sustainability under external disturbances, the challenge of resource management becomes increasingly salient as a determinant of adaptation and competitiveness preservation. Specifically, evidence on the influence of external shocks on organisational resources indicates that development resilience largely depends on a firm's ability to transform innovation and digital competences into actionable managerial solutions (Soluk, 2022). Under post-crisis recovery conditions and supply chain disruptions, the role of data-driven analytical instruments increases, as they support resilience maintenance, risk assessment, and enhanced effectiveness of process recovery (Salamian et al., 2024; Sakthi Balan et al., 2025). This reinforces the need to develop methodological tools capable of integrating resource assessment, development dynamics, and external environmental uncertainty.

The substantiation of resource allocation decisions is closely linked to project-oriented development management logic and the formation of competitive business models. Studies on growth strategies and competitive advantage demonstrate that innovativeness in marketing and business plans determines the quality of managerial decisions regarding development directions and resource distribution (Vaníčková & Szczepańska-Woszczyzna, 2020). Similarly, business model development in retail is considered a process in which resource allocation across model components requires systematic optimisation and adaptive management (Kita et al., 2023).

Further advancement of this problem field is associated with rethinking sustainable growth models in the context of the circular economy. A review of methodologies for assessing circular economy business models emphasises that life-cycle and life-cycle-based approaches expand the toolkit for evaluating decision consequences and refining the efficiency criteria for resource allocation (Filippi et al., 2025). However, the majority of the reviewed studies predominantly focus on institutional or applied aspects of project and business model management, whereas the methodological integration of indicator-based assessments of economic development with forecasting models designed to support resource allocation under crisis conditions remains insufficiently addressed.

For the construction of integrated indices of economic development, the advancement of multidimensional analysis and observation classification methodology is of substantial importance, as it enables the systematisation of indicators and the formation of a robust informational basis for analytical calculations. Classical approaches to multidimensional classification emphasise the significance of appropriate feature selection, normalisation procedures, and data aggregation techniques when constructing composite indicators (Aivazian et al., 1974). These methodological principles provide the foundation for the subsequent application of taxonomic methods and the development of economic development indices based on an indicator system.

At the same time, in practice the formation of the indicator base requires a heuristic component—namely, expert-driven specification of the indicator set and their weights, ensuring the substantive interpretability of the resulting integrated criterion. This approach is consistent with studies focused on determining threshold values of security-related indicators and constructing indicator systems that reflect the complex nature of sustainable development and economic security (Kharazishvili & Kwilinski, 2022; Kharazishvili et al., 2025b).

Contemporary research on uncertainty in resource management tasks demonstrates significant progress in optimisation methods that incorporate interval, fuzzy, stochastic, and probabilistic constraints. One approach to decision formation in weakly structured conditions involves the application of selection criteria oriented towards minimising time, maximising income, or other target performance measures, which implies formulating an optimisation problem and selecting an appropriate mathematical form of the objective function. Under high uncertainty, hybrid formalisations are frequently employed, combining probabilistic elements with heuristic criteria.

A representative example is the use of the Hurwicz criterion in two-stage resource management planning models, which enables risk and uncertainty to be incorporated into managerial decision-making (Zeng et al., 2014). Interval double-sided chance-constrained modelling approaches are likewise applied to assess development sustainability under uncertainty and to support decision-

making based on spatial analysis (Jia et al., 2020). Despite the substantial methodological value of these studies, most contributions are oriented towards sector-specific tasks (in particular, natural resource management), whereas methodologically comparable logic for substantiating resource allocation decisions in relation to the economic development of business entities remains insufficiently elaborated.

An additional methodological dimension of the problem under consideration is associated with the selection of statistical and modelling tools that ensure the validity of interpreting relationships between latent and observed variables. In forecasting and socio-economic analysis research, the choice between alternative approaches to structural modelling—particularly covariance-based structural equation modelling (CB-SEM) and partial least squares structural equation modelling (PLS-SEM)—remains subject to discussion. Comparative analyses of these methods demonstrate differences in underlying assumptions, data requirements, and the admissibility of their application to socio-economic research and technological forecasting tasks, thereby establishing a methodological basis for the justified selection of tools when constructing analytical and forecasting models (Dash & Paul, 2021). This is particularly relevant for tasks aimed at developing robust managerial decisions under uncertainty, where it is necessary to align measurement quality, information completeness, and method applicability to empirical datasets.

From a methodological perspective, it is important to emphasise that heuristics as a research principle are widely applied not only in economics and management, but also across applied disciplines where process formalisation is constrained by dynamic complexity and multiple limitations. The use of heuristic reasoning as a means of simplifying and interpreting complex patterns is demonstrated in a number of fundamental works, in which heuristics serve as a basis for constructing explanatory models and formulating hypotheses in the analysis of complex processes (Hassani, 2017). Similarly, in engineering problems of trajectory planning and the optimisation of system development management, heuristics-oriented approaches are employed that combine formal dynamic models with empirically grounded rules to achieve objectives under resource and power constraints (Ordóñez et al., 2025). Accordingly, the heuristic approach may be regarded as an interdisciplinary methodological resource relevant to crisis management and decision support under conditions of limited data availability and high turbulence.

In parallel, a research stream is developing that focuses on universal algorithmic instruments and data structures that enable scalable solutions for information processing and the design of analytical procedures. Considering heuristics as part of algorithmic support and decision-making procedures confirms the applicability of heuristic design principles to modelling and forecasting tasks, where computational complexity and the processing of large data volumes constitute critical constraints (Wiener, 2022). This aspect becomes particularly important when integrating expert assessments, multidimensional indicators, and econometric procedures within a unified analytical mechanism designed to support resource allocation decisions.

A research stream substantively close to the topic of this article concerns the efficiency and determinants of sustainable productivity, particularly in the context of “green” total factor productivity. Identifying key drivers and quantitatively assessing the determinants of efficiency confirms the importance of multifactor analysis, which is methodologically consistent with the logic of correlation–regression modelling and ranking factors by the strength of their effects on the outcome development indicator (Xu et al., 2024). Accordingly, these studies provide both empirical and methodological foundations for refining procedures used to evaluate factor impacts on an integrated Economic Development Index in tasks aimed at substantiating resource allocation decisions.

Overall, the literature review indicates that contemporary research offers a broad spectrum of tools for modelling, forecasting, and optimising decisions under risk and uncertainty, including structural modelling approaches, interdisciplinary heuristic principles, and multifactor efficiency assessment. However, existing approaches generally do not provide a coherent methodological integration of (i)

expert-based indicator formation, (ii) construction of an integrated development index (particularly of a taxonomic nature), and (iii) econometric modelling of influencing factors within a unified logic of substantiating managerial decisions on resource allocation in crisis management. This limitation strengthens the relevance of developing the integrated heuristic–analytical toolkit proposed in this article.

The synthesis of the reviewed literature makes it possible to identify several research gaps that remain relevant in the field. First, despite substantial progress in forecasting and modelling socio-economic dynamics—including both classical smoothing methods and contemporary econometric and deep learning approaches (Holt, 2004; Berger, 2026; Castle et al., 2025)—the practical integration of forecasting procedures with economic development indicator systems directly oriented towards resource allocation tasks and the robustness of managerial decisions under crisis conditions remains insufficiently explored.

Second, studies on artificial intelligence and neural-network forecasting confirm their capability to detect non-linearities and complex relationships in data (Hill et al., 1994; Zhang et al., 1998; Pankova et al., 2023). Nevertheless, the academic literature provides limited comprehensive methodological solutions that combine expert-driven indicator construction, the calculation of an integrated development criterion (including multidimensional aggregation), and subsequent econometric modelling of factor influences within the decision-support logic for resource allocation management. Moreover, the problem of selecting and aligning appropriate analytical instruments—including the comparability of measurement models, the validity of relationship estimation, and data requirements—remains debatable and requires further methodological justification (Dash & Paul, 2021).

Third, studies addressing resource allocation efficiency, project-based approaches, and business model development provide a substantial contribution to understanding organisational and institutional mechanisms of growth and competitiveness (Bu et al., 2021; Jin et al., 2017; Vaníčková & Szczepańska-Woszczyńska, 2020; Kita et al., 2023; Filippi et al., 2025), while also confirming the role of the factor structure of efficiency and the determinants of sustainable development (Xu et al., 2024). However, these studies generally do not offer a universal integrated instrument that simultaneously combines heuristic principles of parameter formation, indicator-based taxonomic assessment of economic development dynamics, and formalised forecasting of influencing factors to support resource allocation decisions in crisis management.

In addition, although heuristic reasoning is widely applied in interdisciplinary tasks related to complex system management and decision optimisation (Hassani, 2017; Ordonez et al., 2025), and is also regarded as an important element of algorithmic design and computational implementation of analytical procedures (Wiener, 2022), its integration into economic-mathematical models for resource decision-making under high uncertainty remains methodologically insufficiently developed.

Therefore, despite the substantial number of studies addressing individual aspects of forecasting, indicator-based analysis, and the substantiation of managerial decisions, the research field continues to lack a comprehensive heuristic–analytical toolkit ensuring coherent integration of the following components: (1) expert-driven construction of an indicator system reflecting key characteristics of the socio-economic system's functioning; (2) calculation of an integrated Economic Development Index based on a taxonomic approach and multidimensional aggregation procedures; (3) development of correlation–regression models for quantitative assessment of factor impacts and forecasting of development dynamics; and (4) utilisation of the obtained estimates and forecasts as a formalised basis for substantiating resource allocation decisions under adaptive and crisis management conditions. The absence of a methodologically consistent integration of these elements reduces the reproducibility of analytical procedures and limits the practical applicability of individual methods in managerial decision-making under high uncertainty and environmental turbulence.

The identified research limitations determined the aim of the present study, which consists in improving approaches and instruments for forecasting and analysing the dynamics of economic

development in order to substantiate resource allocation decisions in the management of an economic entity, taking into account the analysis and synthesis of the initial conditions of the socio-economic system, as well as the uncertainty of dynamic equations arising from disturbances in its functioning under high instability of the external and internal environment. Particular attention is devoted to adapting both the proposed and existing methods to enhance forecasting accuracy and strengthen the robustness of managerial decisions through the integration of stochastic elements and the application of scenario analysis.

2. Methodology

In the analytical procedures, the objects under study (such as enterprises) were conceptualised as multidimensional entities. Therefore, the following were employed to examine and assess their processes: methods of multivariate analysis; principles of systems analysis; multivariate statistical approaches for designing optimal plans for the collection, systematisation, and processing of multidimensional statistical data aimed at identifying the nature and structure of interrelationships among the components of the multidimensional system under investigation in order to support the allocation and use of development resources; expert knowledge and judgement; and heuristic approaches. The integration of these capabilities was aimed at developing heuristic approaches to forecasting and analysing the dynamics of economic development for substantiating resource-allocation decisions, based on a rational combination of systems analysis principles, expert judgement, modern computational tools, and multivariate analytical methods. This also justifies the application of the taxonomy method of comparative multivariate analysis, which provides a basis for the systematisation of complex systems with a hierarchical structure.

To develop heuristic approaches to forecasting and analysing the dynamics of economic development for substantiating resource-allocation decisions in the management of operational activity and economic development processes (which may be regarded as innovation-oriented), the objectives of the entity (enterprise) should be divided into several directions that, by their nature, comprise both external and internal dimensions. The management tasks of the analysed enterprise included those related to: (i) information and analytical support for managerial decision-making; (ii) working capital formation and renewal of fixed assets; (iii) diagnosing the growth of net revenue; (iv) monitoring inventories of finished goods; (v) asset growth; (vi) changes in current assets, accounts payable, and non-current assets; (vii) the relationship between income growth and the growth rate of expenses; (viii) working capital turnover; (ix) settlements with debtors/accounts receivable; (x) growth of liabilities; and (xi) growth of production inventories.

For a comprehensive assessment and diagnostics, heuristic-type approaches were proposed, implying a combined use of expert elicitation and the taxonomy method. This combination enabled the determination of an integral criterion referred to as the enterprise's economic development index, based on the results of the analysis of the economic object over the period 2006–2024. In other words, by constructing a system of heuristic approaches for the effective study, analysis, and utilisation of information and financial resources, as well as liabilities—which constitutes one of the necessary conditions for successful operation and development in a competitive environment—the study addressed the following objectives in solving the tasks of forecasting and analysing the economic development dynamics of the investigated entity:

- to structure the research tasks in accordance with a systems approach to the development and application of heuristic-type procedures;
- to elicit expert assessments based on specialists' experience;
- to identify and form a system of coefficients (indicators) for constructing the baseline dataset required for the taxonomy method;
- to conduct a taxonomic analysis in order to determine the integral criterion of economic development;

- to substantiate the system-logical relationships among the analysed parameters for calculating the baseline dataset for the taxonomy-based assessment of development;
- to develop a correlation–regression forecasting model of development;
- to assess the strength of relationships among the variables included in the developed correlation–regression model to substantiate resource-allocation decisions by ranking the factors according to their contribution to the economic development index of the investigated entity.

Within the proposed research approach, both theoretical–methodological foundations and applied analytical issues required thorough conceptualisation and resolution in order to enable forecasting of the enterprise's economic development dynamics. In the course of the study, it was considered appropriate to develop a system of coefficients, the number and content of which were determined on the basis of expert assessments. The primary purpose of these coefficients was to characterise the relationships among the key financial and economic indicators of the analysed entity over time. This provided a general methodological and analytical basis for constructing economic and mathematical models using correlation–regression analysis, aimed at identifying the specific effects of individual factors on the economic development index of the enterprise and applying the obtained forecasting results in managerial decision-making, with due regard to the relevant components of the socio-economic system.

However, the ambiguity and inherent risk associated with the mutual influence of socio-economic factors on the economic processes of the analysed entity necessitate the use of a systems approach when developing forecasting frameworks. The complexity of forecasting the development of a socio-economic system (the object of study) is manifested in the impossibility of unambiguously defining inputs and outputs, as the system's response is not necessarily directly linked to an initial stimulus; rather, the system may influence its subsequent changes. In economic systems, the resulting output is affected by factors determined by the internal state of the system, which may be partially unobservable, indicating that system behaviour cannot be explained solely as a reaction to an external input.

Accordingly, when designing approaches to forecasting and analysing the dynamics of economic development for substantiating resource-allocation decisions in management, it is also necessary to account for the fact that a structurally balanced system activates self-organisation mechanisms that enhance its economic resilience. Depending on the selected analytical framework, this may serve as a basis for economic stabilisation of the entity through structural harmonisation associated with the redistribution of the relative influence (weights) of structural elements characterised by different spatio-temporal localisation. Such processes affect the maintenance of a balanced state and may require additional mobilisation and redistribution of resources, as well as material and information costs. This, in turn, necessitates the use of economic and mathematical tools to substantiate the allocation of resources among subsystems when forecasting the development trajectory of the business entity.

The development of an economic entity requires forecasting approaches, analysis of the dynamics of economic development, and substantiation of managerial decisions regarding resource allocation under dynamic and internally contradictory operating conditions. Analytical and information support aimed at achieving forecasting objectives is closely linked to managerial decision-making processes based on diagnostics, assessment of the analytical capacity, forecasting, and planning. The experience of previous studies in the analytical and information dimension of diagnostics and decision-making was used to formulate tasks for experts in order to achieve development forecasting objectives. This made it possible to structure and systematise functional tasks, according to their purpose, into information-related, diagnostic, analytical, forecasting, planning, and decision-making categories. In addition, by applying the principles and approaches of systems analysis to construct the baseline dataset required for conducting a taxonomy-based assessment of economic development, the object of analysis was conceptualised as a system comprising a set of interrelated processes. The

outcomes of this approach provided a new interpretative basis through structural analysis, expressed as the relationships between the dynamics of key financial and economic indicators of the socio-economic system's functioning across time and space. Elaboration of the methodological relationships between the dynamics of the elements of the socio-economic system, using statistical performance data for the analysed reporting periods, enables the identification of regularities in resource allocation patterns within anti-crisis management.

The selection of components for the integral indicator required for the taxonomy method was based on the principles of systematicity, comprehensiveness, adequacy, and objectivity. This ensures the identification and evaluation of the influence arising from interrelations among operational parameters on the economic development dynamics, taking into account trends in liquidity, solvency, profitability, and financial stability of the socio-economic system. To this end, approaches to the development of the socio-economic system in accordance with market requirements were analysed. Expert assessments were formed by identifying early manifestations of insufficient provision of material resources within operational turnover, the emergence and deepening of liquidity crisis symptoms, and the need to implement adequate measures to restore liquidity in settlements with debtors/accounts receivable. In this way, factors acting as stabilisers or destabilisers were distinguished across different stages of the socio-economic system's life cycle.

The development of the socio-economic system in accordance with market needs can be traced using the lead-lag coefficient comparing the growth rate of net revenue with the growth rate of finished goods inventories. The emergence of stagnant (slow-moving) products is primarily driven by the mismatch between expanding production volumes and the growth rate of the sales market, which may result from inconsistencies in product assortment, pricing, and quality; a decline in consumers' effective demand; loss of market niches due to competitive pressures; or economically unjustified over-procurement under constrained sales opportunities for various reasons.

At the onset of a liquidity crisis, overproduction becomes a characteristic phenomenon. It initially manifests itself as a more intensive increase in finished goods (merchandise) inventories relative to the growth rate of sales revenue, i.e.:

$$g_I > g_R > 100\% \quad (1)$$

where g_I denotes the growth rate of inventories of finished goods and/or merchandise; g_R denotes the growth rate of sales revenue.

This relationship results from production growth exceeding the growth in sales volumes. In practical terms, this implies that the economic system "produces for stock" due to shortcomings in marketing policy and demand assessment. If appropriate measures aimed at eliminating the causes of sales difficulties are not undertaken at this stage, the decline in the growth rate of net sales revenue gradually transforms into an absolute reduction. At the same time, the tendency for inventories to increase may persist, or their decline may remain insufficiently pronounced.

Such features are typical for the escalation stage of the liquidity crisis and can be formalised as follows:

$$g_I > 100\% > g_R \text{ or } 100\% > g_I > g_R \quad (2)$$

provided that

$$1 > K_{R/I} = \frac{g_R}{g_I} > 0.5 \quad (3)$$

where $K_{R/I}$ is the lead-lag coefficient comparing sales revenue growth to inventory growth.

A further state of this criterion at the stage of crisis unfolding is the situation in which the inventory growth rate exceeds the growth rate of sales revenue by more than two times, i.e.:

$$K_{R/I} = \frac{g_R}{g_I} < 0.5 \quad (4)$$

The onset of a liquidity crisis is characterised by inventory congestion and the attainment of the peak phase of the overproduction crisis. Quantitatively, these phenomena are reflected in a high proportion of stagnant (slow-moving) products (exceeding 50%), as well as in a ratio of the growth rate of sold output to the growth rate of produced output that is below unity. The stabilisation of the overproduction crisis should be achieved through reducing finished goods inventories by entering new sales markets, partial write-offs, reprocessing, utilisation, and other measures. At the same time, re-profiling activities should be implemented in order to align the financial and production potential of the socio-economic system with market demand. As a consequence of such measures, inventories of finished goods (merchandise) decrease while sales volumes increase, which can be formalised by the following condition:

$$K_{R/I} = \frac{g_R}{g_I} > 1 \quad (5)$$

Once an optimal level of inventory is reached—serving as a sales reserve to support stable growth in sales volume—the liquidity crisis may be considered eliminated. Such a state of the socio-economic system is characterised by the following inequality:

$$g_R > g_P > g_I > 100\% \quad (6)$$

where g_P denotes the growth rate of produced output.

Early manifestations of insufficient provision of material resources in operational turnover include: first, a situation in which the growth of current assets due to the prolongation of the production cycle exceeds the growth rate of output; and second, a tendency towards a reduction in working capital resources, primarily in the component of production inventories, even under conditions of increasing work-in-progress. At the same time, at the onset stage of a liquidity crisis, a slowdown in the growth of business activity is observed, which, in the absence of adequate preventive measures, subsequently transforms into a declining trend. Thus, the stage of liquidity crisis build-up is characterised by the following inequality:

$$g_P < g_{Wcm} < 100\% \quad (7)$$

where g_{Wcm} denotes the growth rate of material working capital.

This comparison indicates that the intensity of the downward dynamics of business activity exceeds the rate of reduction in working capital funds. Moreover, within the latter, not only production inventories but also work-in-progress are reduced. Depending on the duration of the production process, output may temporarily be maintained due to the completion of existing work-in-progress. In the absence of, or with only negligible reserves of, this buffer, output volumes will decline.

It should be noted that at this stage an alternative scenario of liquidity crisis development is possible: while production inventories and/or livestock for fattening decrease, work-in-progress may increase substantially due to shortages of specific types of raw materials or inputs (spare parts, components, semi-finished products, etc.) required to complete production. In such a case, a reduction in business activity will also be observed. Nevertheless, in both scenarios, the above inequality remains valid.

A deepening of the liquidity crisis is reflected in the following relationship between the growth rate of business activity (output) and the dynamics of material working capital:

$$K_{P/WCm} = \frac{g_P}{g_{WCm}} < 0.5 \quad (8)$$

where $K_{P/WCm}$ is the lead-lag coefficient comparing the growth rate of business activity to the relative change in material working capital resources. If the intensity of decline in business activity exceeds the reduction in material working capital by more than a factor of two, the socio-economic system is considered to be at the crisis unfolding stage.

Insufficient provision of operational turnover with the minimum required normative level of inventories characterises the peak stage of the liquidity crisis. This state is evidenced by negligible remaining inventories or their complete absence, lack of work-in-progress, and either incomplete capacity utilisation or full production shutdown, as well as a significant contraction of business activity.

The stabilisation of a liquidity crisis begins with a slowdown in the contraction of material resources in operational turnover and business activity, or with an increase in the latter, i.e.:

$$100\% > g_P > g_{WCm} \text{ or } g_P > 100\% > g_{WCm} \quad (9)$$

As a consequence, an optimal relationship emerges between the rate of change in business activity and material resources in turnover, exceeding unity. This constitutes a basis for restoring the replenishment of the material working-capital base of operations. At this stage, an increase in production output is not a necessary condition; however, such a state of the socio-economic system should not persist for a prolonged period. It may be considered a temporary phenomenon associated with an “injection” of working capital at the initial stage of restoring operational turnover. Subsequently, the following inequality should hold:

$$g_P > g_{WCm} > 100\% \quad (10)$$

This indicates efficient utilisation of the resources invested in operational turnover and corresponds to the features of liquidity crisis elimination.

A key component of an enterprise's current assets is funds tied up in settlements with debtors (accounts receivable). The degree of their mobility determines the enterprise's ability to settle with creditors, affects the volume of net cash flow, and influences the overall liquidity of assets. The examination of the quality of this resource group was therefore selected as the next criterion for assessing a liquidity crisis. It involves identifying the preconditions for the emergence and dynamics of accounts receivable balances that are not repaid within the contractual timeframe (overdue receivables).

An indicator of the onset stage of a liquidity crisis may be defined by the following inequality:

$$g_{AR} > g_R > 100\% \quad (11)$$

where g_{AR} denotes the growth rate of accounts receivable. This implies that the prerequisite for the accumulation of overdue debtor obligations is the fact that the growth of total receivables from customers and clients exceeds the growth in net sales revenue. A decline in net sales revenue is also a plausible scenario. The economic logic of this relationship is that, when accounts receivable grow at a higher rate than sales, the share of trade credit provided increases. This leads to greater dependence of the socio-economic system's functioning on the financial condition of its debtors, while an unjustified expansion of sales through deferred payments reduces the current liquidity of working capital as a whole. Moreover, total receivables increase, thereby raising the potential volume of overdue debt.

The build-up stage of the liquidity crisis is characterised by the fulfilment of one of the following two inequalities:

$$g_R < g_{AR} < 100\% \text{ or } g_{AR} > 100\% > g_R \quad (12)$$

provided that

$$0.5 < K_{R/AR} = \frac{g_R}{g_{AR}} < 1 \quad (13)$$

where $K_{R/AR}$ is the lead-lag coefficient of net sales revenue growth relative to the change in accounts receivable. A common condition in both cases is a reduction in sales revenue. The difference lies in whether accounts receivable increase or decrease simultaneously. A more intensive contraction of sales relative to the decline in receivables is explained by the existence of a persistent (structurally stable) outstanding debt volume, which reduces the mobility of this resource group.

If the first case is characterised by a relative synchrony between fluctuations in sales and debtor obligations, the second variant is less favourable for the enterprise. Specifically, a reduction in net sales revenue accompanied by an increase in accounts receivable indicates a decline in the liquidity of current settlements due to a high share of unpaid deliveries within total shipments, alongside chronic non-payment of debts accumulated in previous periods.

An intensive divergence between the growth dynamics of sales revenue and accounts receivable leads to a relationship in which the lead-lag coefficient falls below 0.5, i.e.:

$$K_{R/AR} = \frac{g_R}{g_{AR}} < 0.5 \quad (14)$$

Such a state of the socio-economic system corresponds to the unfolding stage of the liquidity crisis. If the enterprise does not take active measures to halt the development of the liquidity crisis, mere observation results in the concentration of a dominant share of working capital in overdue accounts receivable (exceeding 50%). Consequently, the liquidity crisis materialises with a characteristic deterioration in the quality of funds tied up in settlements with debtors, as these resources cannot be released into circulation in a timely manner. For a more comprehensive understanding of the reasons for such a situation, it is important to assess the effectiveness of the enterprise's legal claim and litigation management procedures.

The effectiveness of preventive and corrective measures aimed at avoiding liquidity deterioration or restoring the liquidity of funds in receivables may be assessed using the lead-lag coefficient comparing the growth rate of sales revenue with the dynamics of accounts receivable. Specifically, if the following condition holds:

$$K_{R/AR} = \frac{g_R}{g_{AR}} > 1 \quad (15)$$

The transition of the liquidity crisis to the stabilisation (abating) stage is considered complete. It should be noted that this relationship may remain valid even when sales revenue decreases, provided that the decline in accounts receivable is more intensive. This implies that the principal instrument for overcoming this type of crisis is the intensification of debt restructuring efforts and the active management of debtor obligations.

A necessary condition for the lead-lag coefficient is that the following relationship holds:

$$K_{R/AR} = \frac{g_R}{g_{AR}} > 1 \quad (16)$$

which is ensured by satisfying the inequality:

$$g_R > 100\% > g_{AR} \quad (17)$$

This inequality should be maintained until overdue debts are fully eliminated from the accounts receivable structure. Thereafter, the socio-economic system enters the stage of liquidity crisis elimination, which is characterised by the fulfilment of the following condition:

$$g_R > g_{AR} > 100\% \quad (18)$$

At this stage, strict compliance with settlement quality control requirements is essential in order to ensure timely identification of problematic debts and to monitor the causes of accounts receivable growth. When the socio-economic system is at the liquidity crisis elimination stage, an increase in debtor obligations is admissible as a natural outcome of sales market diversification.

A negative phenomenon in the functioning of a socio-economic system is a tendency towards resource contraction, as this indicates the emergence of preconditions for operational decline. Therefore, it is necessary to monitor the dynamics of total assets simultaneously with changes in net sales revenue. The first stage of a liquidity crisis is accompanied by a slowdown in the growth of resources or their decline. Typical causes include depreciation of fixed assets in the absence of their expanded reproduction, depletion of working capital due to inventory consumption without regular replenishment, breaches of contractual obligations by suppliers and customers, and similar factors. At the same time, sales revenue may still display positive dynamics; however, when comparing consecutive growth rates, a substantial deceleration in growth intensity becomes evident. Gradually, this dynamic transforms into a decline in net sales revenue while the tendency towards contraction in the book value of assets persists. These characteristics are typical of an economic system operating at the stage of liquidity crisis build-up.

Changes in this criterion throughout the liquidity crisis cycle may be described through the following inequalities:

1) Stage of emergence:

$$g_R > g_A > 100\% \text{ or } g_A < 100\% < g_R \quad (19)$$

provided that

$$K_{acc/dec}^R < 1 \text{ and } K_{acc/dec}^A < 1 \quad (20)$$

where g_A – growth rate of the enterprise's total assets; $K_{acc/dec}^R$ – coefficient of acceleration (deceleration) of the growth rate of sales revenue; $K_{acc/dec}^A$ – coefficient of acceleration (deceleration) of the growth rate of the book value of assets (balance-sheet value).

2) Stage of escalation:

$$g_A < g_R < 100\% \quad (21)$$

The deepening of the crisis process manifests itself in the fact that the decline in sales revenue becomes more intensive than the reduction in assets, i.e.:

$$100\% > g_A > g_R \quad (22)$$

In this case, it is necessary to calculate the coefficient of lead/lag of the sales revenue growth rate relative to the asset growth rate. Under the specified conditions, its value is lower than 1 but not below 0.5. Within this interval, the liquidity crisis enters the escalation phase, namely:

$$0.5 < K_{R/A} = \frac{g_R}{g_A} < 1 \quad (23)$$

where g_R – growth rate of sales revenue; g_A – growth rate of total assets; $K_{R/A}$ – lead/lag coefficient of sales revenue growth relative to asset growth.

A prolonged persistence of the downward trend in resources, accompanied by a simultaneous contraction in the scale of activity, results in the onset of a liquidity crisis. Such a state of the socio-economic system is characterised by the simultaneous fulfilment of the following inequalities:

$$K_{R/A} < 0.5 \quad (24)$$

which corresponds to

$$100\% > g_A > g_R \quad (25)$$

An indicator of the stabilisation stage of a liquidity crisis is the formation of a positive resource dynamics under accelerated growth in sales revenue, i.e.:

$$0.5 < K_{R/A} < 1 \quad (26)$$

which is achieved when either

$$g_A > g_R > 100\%, \text{ or } g_A > 100\% > g_R \quad (27)$$

Depending on the intensity with which the results of anti-crisis measures manifest themselves, the recovery of the growth trend in business activity may precede the restoration of asset growth. In such a case, the stabilisation stage of the liquidity crisis is described by the following inequalities:

$$g_R > 100\% > g_A \quad (28)$$

given that

$$K_{acc/dec}^R > 1 \quad (29)$$

Provided that resource growth is restored alongside stable expansion of business activity

$$K_{acc/dec}^R > 1, K_{acc/dec}^A > 1 \quad (30)$$

the following inequality holds:

$$g_R > g_A > 100\% \quad (31)$$

which indicates the elimination of the liquidity crisis.

The overall level of solvency of a socio-economic system is characterised by the value of the coverage ratio. This indicator reflects the extent to which current liabilities can be settled using current assets, as well as the proportion of current assets that remains available to ensure the continued functioning of the socio-economic system. The recommended benchmark value of the coverage ratio is set at 1.5. A value below this threshold is considered one of the key signs of critical insolvency. Accordingly, we propose to treat the current liquidity ratio as a criterion for assessing the

solvency crisis. The initial stage of a solvency crisis is characterised by a decline in the coverage ratio, driven by a faster increase in current liabilities relative to the growth of current assets:

$$100\% < T_{CA} < T_{CL} \quad (32)$$

given that

$$K_{cov} > 1.5 \quad (33)$$

where K_{cov} – coverage ratio (current ratio); T_{CA} – growth rate of current assets; T_{CL} – growth rate of current liabilities.

A further decline in the overall solvency level below the threshold value, caused by a reduction in current assets and an increase in current liabilities (or their less intensive decrease), corresponds to the stage of crisis escalation. Thus, the condition

$$K_{cov} < 1.5 \quad (34)$$

holds when:

$$0.5 < K_{CA/CL} = \frac{T_{CA}}{T_{CL}} < 1 \quad (35)$$

as a result of either:

$$T_{CL} > 100\% > T_{CA}, \text{ or } 100\% > T_{CL} > T_{CA} \quad (36)$$

where $K_{CA/CL}$ – lead-lag coefficient reflecting the relative change in current assets compared with the change in current liabilities; T_{CA} – growth rate of current assets; T_{CL} – growth rate of current liabilities; K_{cov} – coverage ratio (current ratio).

An acceleration in the development of the solvency crisis is characterised by a coverage ratio below 1, indicating that current assets are insufficient to settle current liabilities. In such a situation, settlements are typically ensured through partial disposal of fixed assets and other non-current assets. A distinctive feature of this stage is a sharp contraction in current assets accompanied by a slow decline in current liabilities or, even worse, the persistence of their growth. Therefore, the transition of the solvency crisis to the escalation stage is evidenced by the following inequalities:

$$K_{cov} < 1.0 \text{ when } K_{CA/CL} < 0.5 \quad (37)$$

If the above trends continue to develop without obstruction, they create grounds for initiating bankruptcy proceedings in the form of overdue accounts payable. This legitimately indicates the onset of a solvency crisis. It is important to note that overdue accounts payable may arise at any value of the coverage ratio. However, this does not imply that being at the escalation or unfolding stage of a solvency crisis necessarily leads to formal (legal) bankruptcy. Therefore, the solvency position of an economic system should be recognised as unsatisfactory specifically at the stage when the crisis actually materialises. The implementation of measures approved by the court or through pre-trial restructuring (sanation) will primarily be aimed at satisfying creditors' claims. Hence, the stabilisation stage of the solvency crisis is characterised by an increase in the coverage ratio. A necessary condition for securing this positive trend is:

$$K_{CA/CL} > 1.0 \quad (38)$$

which is achieved when one of the following inequalities holds:

$$100\% > T_{CA} > T_{CL} \text{ or } T_{CL} < 100\% < T_{CA} \quad (39)$$

where $K_{CA/CL}$ – lead-lag coefficient reflecting the relative change in current assets compared with the change in current liabilities; T_{CA} – growth rate of current assets; T_{CL} – growth rate of current liabilities; the value 100% corresponds to a zero-growth threshold.

The repayment process of overdue accounts payable begins at the stabilisation stage of the solvency crisis; however, it may not be completed simultaneously with this stage and may therefore extend into part of the crisis elimination stage. The transition to this stage is characterised by the following inequality:

$$T_{CA} > T_{CL} > 100\% \quad (40)$$

Nevertheless, the mandatory conditions for overcoming the solvency crisis are: (i) the absence of overdue liabilities to creditors; (ii) the coverage ratio (current ratio) being within the range of normative values, where the lower bound is the regulatory threshold of 1.5, while the upper bound is the normal current liquidity ratio (K_N), which is determined either individually or, alternatively, the optimal limit of 2 established by international standards may be applied. Hence, the condition is:

$$1.5 \leq K_{cov} \leq K_N \quad (41)$$

Compliance with the upper bound is justified by the fact that an excessively high level of overall solvency is not necessarily accompanied by an adequate level of liquidity of working (current) resources. For example, the economically unjustified growth of current assets driven by excessive inventories of finished goods or merchandise that are not in demand in the market, or by unreasonably large volumes of trade credit under a non-payment crisis, is particularly problematic. In such circumstances, a seemingly sufficient volume of working resources may prove to be illiquid, which, in turn, results in the inability of the socio-economic system to fulfil its obligations in practice without disrupting the normal operating cycle. This condition is consistent with the requirement to maintain a rational structure of resources, which is defined as an indicator of liquidity crisis elimination, and its implementation is associated with the transition of the solvency crisis to the stabilisation stage.

A sign of growing problems in the area of payment discipline with creditors is an increase in the amount of creditor indebtedness while net sales revenue decreases or grows less intensively. This is explained by the fact that the emergence of a solvency crisis occurs simultaneously with the escalation of the liquidity crisis, the common feature of which is a reduction in revenue or a slowdown in its growth. At the initial stage of the solvency crisis, the following inequalities are typical:

$$g_R < 100\% < g_{CL} \text{ or } g_{CL} > g_R > 100\% \quad (42)$$

provided that

$$0.5 < K_{R/CL} = \frac{g_R}{g_{CL}} < 1 \quad (43)$$

where g_{CL} – growth rate of accounts payable (creditor indebtedness); $K_{R/CL}$ – lead-lag coefficient reflecting the growth rate of net sales revenue relative to the growth rate of accounts payable.

This indicates that, in the course of business operations, the enterprise does not ensure effective use of the resources attracted from creditors, which results in a gradual expansion of the “debt trap.”

The escalation of the solvency crisis is accompanied by a transition from a slowdown in revenue growth to a downward trend in revenue, while accounts payable continue to increase steadily. The simultaneous impact of these factors causes a substantial imbalance between the growth rate of net sales revenue and the growth rate of accounts payable. If

$$K_{R/CL} < 0.5 \quad (44)$$

i.e., when the revenue growth rate is two times lower than the growth rate of accounts payable, the economic system is assessed as being at the stage of escalation of the solvency crisis.

An indicator of a further deterioration in payment discipline with creditors is the situation where the growth rate of overdue accounts payable exceeds the relative change in total accounts payable, while revenue from sales decreases:

$$g_R < 100\% < g_{CL} < g_{CL}^{OD} \text{ or } g_R < g_{CL} < 100\% < g_{CL}^{OD} \quad (45)$$

provided that

$$0.5 < K_{CL/CL^{OD}} = \frac{g_{CL}}{g_{CL}^{OD}} \quad (46)$$

where g_{CL}^{OD} – growth rate of overdue accounts payable; $K_{CL/CL^{OD}}$ – lead-lag coefficient reflecting the growth rate of total accounts payable relative to the growth rate of overdue accounts payable.

The essence of this relationship is that, by analysing only the dynamics of the total amount of accounts payable, it is impossible to draw a positive conclusion, because within its structure an intensive transformation of previously accumulated current payables into overdue liabilities takes place as contractual payment deadlines become due. Such a situation provokes a decline in business activity, which first of all is manifested through a reduction in sales revenue.

At the peak of the adverse relationship between the growth rate of accounts payable and the growth rate of overdue accounts payable, the lead-lag coefficient falls below 0.5. If, in addition, the structure of accounts payable includes overdue debts in an amount sufficient to initiate bankruptcy proceedings, the socio-economic system is assessed as having entered the stage of solvency crisis onset.

An improvement in the quality of settlements with creditors can be traced through a downward trend in overdue accounts payable, even if the total amount of accounts payable continues to grow. However, to draw a positive conclusion, an increase in net sales revenue is a mandatory condition. Thus, the stage of stabilisation of the solvency crisis is indicated by the fulfilment of the following conditions:

$$K_{R/CL} > 1 \text{ when } g_{CL}^{OD} < 100\% \quad (47)$$

where $K_{R/CL}$ – lead-lag coefficient reflecting the relative change in net sales revenue compared with accounts payable.

The full repayment of overdue debt obligations is completed only at the stage of elimination of the solvency crisis. An additional condition is the validity of one of the following inequalities:

$$g_R > g_{CL} > 100\% \text{ or } g_R > 100\% > g_{CL} \quad (48)$$

These inequalities reflect the activation of business turnover, which is manifested in a higher intensity of revenue growth compared with the growth rate of resources attracted from creditors. This means that the role of own financial resources increases in financing current operations, while the use

of borrowed funds ensures a sufficient level of operational efficiency required for timely settlements with creditors.

One of the key characteristics of economic development is the profitability factor. It is a summarising indicator that reflects the final performance result and allows assessment of both absolute and relative efficiency. The presence of profit ensures compliance with the fundamental principles of business activity–self-sufficiency and self-financing. Therefore, the consequences of a profitability crisis affect reproduction processes and the resource potential of the socio-economic system.

A slowdown in turnover results in the formation of additional funds involved in circulation, the source of which–under low profitability–are creditors' resources. Consequently, liabilities and costs increase with each operating cycle, which leads to a decline in solvency and a decrease in profitability.

The escalation of a profitability crisis is characterised by a reduction in the amount of funds released from circulation or, conversely, by the emergence (increase) of additionally attracted funds, accompanied by a slowdown in their turnover:

$$K_{acc/dec} = \frac{g_{P1}^T}{g_{P0}^T} < 1 \quad (49)$$

where $K_{acc/dec}$ – coefficient reflecting acceleration/deceleration of working-capital turnover; g_{P1}^T – growth rate of the working-capital turnover period in period 1; g_{P0}^T – growth rate of the working-capital turnover period in period 0 (base period).

An increase in the turnover period of working capital leads to a decrease in revenue, whereas additional external financing results in rising costs. As a consequence, gross profit decreases to a level that is insufficient to cover other operating costs. Thus, operating losses occur:

$$OP_0 > 0; OP_1 < 0 \quad (50)$$

where OP_0 – operating profit in the base period; OP_1 – operating profit in the subsequent period.

At the stage of escalation of the profitability crisis, gross losses are formed while the following trends persist:

$$g_{GL} > 100\%, K_{acc/dec} < 1, g_{OL} > 100\% \quad (51)$$

where g_{GL} – growth rate of gross losses; $K_{acc/dec}$ – coefficient of acceleration/deceleration of working-capital turnover; g_{OL} – growth rate of operating losses;

provided that:

$$g_T^{WC} < 100\% \quad (52)$$

Second, an acceleration of working-capital turnover occurs due to a more intensive reduction in its average balance compared to the rate of revenue decline, namely:

$$K_{acc/dec} > 1 \quad (53)$$

as a result of:

$$1 > K_{Q/acc} = \frac{g_{Q1}}{g_{Q0}} > K_{OA/acc} = \frac{g_{OA1}}{g_{OA0}} \quad (54)$$

where $K_{acc/dec}$ – coefficient of acceleration/deceleration of working-capital turnover; $K_{Q/acc}$ – coefficient of acceleration/deceleration of the revenue growth rate; g_{Q1}, g_{Q0} – growth rates of revenue

in the current and base periods, respectively; g_{OA1}, g_{OA0} – growth rates of average working-capital balances in the current and base periods, respectively.

Stage of stabilisation of the profitability crisis is characterised by:

- a) overcoming the gross loss threshold;
- b) recovery of growth in net sales revenue and, on this basis, an increase in the turnover ratio of current assets even if their amount decreases:

$$g_R > 100\% \text{ due to } K_{R/CA} \quad (55)$$

where g_R – growth rate of net sales revenue; $K_{R/CA}$ – lead-lag coefficient reflecting the ratio of the growth rate of net sales revenue to the growth rate of current assets;

- c) formation of the amount of funds released from circulation;
- d) reduction of operating losses or reaching the operating break-even point.

Elimination of the profitability crisis has the following features:

- a) growth of gross profit and operating profit;
- b) acceleration of current assets turnover under:

$$K_{R/CA} > 1 \quad (56)$$

- c) increase in the amount of current assets released from circulation.

We characterise the stages of the profitability crisis based on the dynamics of the enterprise's net profit (loss). If, in the reporting period compared with the base period, a decrease in net profit is observed, it may be concluded that prerequisites for the development of a profitability crisis have emerged. The reasons for the reduction in net profit consist in either a higher growth rate of total expenses compared with total revenues, or a more intensive decline in the latter. Thus, the inequality

$$T_{pNP} < 100\% \quad (57)$$

is determined by the condition when

$$T_{pE} > T_{pR} > 100\% \text{ or } 100\% > T_{pE} > T_{pR} \quad (58)$$

where T_{pNP} is the growth rate of net profit; T_{pE} is the growth rate of total expenses; and T_{pR} is the growth rate of total revenues. The described changes are accompanied by a slowdown in the growth of retained earnings.

A characteristic feature of the development of a profitability crisis is the emergence of losses. The stage of crisis escalation is determined by a transition from a decreasing profitability trend to loss-making performance. If, in the reporting period, the economic system operated with a profit, but in the subsequent period incurred a loss, this indicates that the crisis is escalating. It should be noted that at this stage the formation of losses is intensified due to a decline in total revenues, especially from the core activity. Therefore, the indicators of this stage are:

$$NP_0 > 0, L_1 < 0 \text{ under the condition } T_{pE} > 100\% > T_{pR} \quad (59)$$

where NP_0 – is the amount of net profit in the base period; L_1 – is the amount of loss in the reporting period.

The unfolding of the profitability crisis is evidenced by an increase in the amount of loss resulting from the persistent maintenance of a negative difference in the intensity and directions of changes in

expenses and revenues. When the lead-lag coefficient (reflecting the relative change in revenues compared with the change in expenses), $K_{B/B}^{R/E}$ is stably lower than 1, a growth in the amount of current losses is observed.

With a chronic nature of current loss-making activity, the resource and asset structure reflects an accumulated amount of uncovered losses. The cumulative growth of uncovered losses gradually exhausts equity and becomes the main factor leading to a deficit of net assets. Given the severe consequences of this phenomenon, the onset of the crisis should be associated with the very appearance of uncovered losses in the balance sheet. Their accumulation indicates a deepening profitability crisis and the socio-economic system approaching a loss of financial stability. Anti-crisis measures should therefore be aimed at mobilising internal resources in order to generate restructuring (rehabilitation) profit to cover balance-sheet losses.

A slowdown in growth or a decrease in the amount of uncovered losses indicates the easing (stabilisation) of the profitability crisis. This can be achieved through the generation of restructuring profit and/or the recovery of current profitability, provided that

$$K_{B/B}^{R/E} = \frac{T_{pR}}{T_{pE}} > 1 \quad (60)$$

The complete elimination of uncovered losses from the balance sheet, ensured by a sustained increase in net profit based on higher growth rates of total revenues compared with the intensity of expense growth (or even through cost savings), implies the overcoming of the profitability crisis.

Among the first manifestations of the threat of losing financial stability is a decrease in the investment ratio due to a slowdown in growth or a reduction in equity compared with the intensity of the increase in non-current assets. The fulfilment of the inequalities

$$K_{inv} > 1, \text{ but } T_{p\ inv} < 100\% \quad (61)$$

under either

$$100\% < T_{p\ EC} < T_{p\ NCA} \text{ or } T_{p\ NCA} > 100\% > T_{p\ EC} \quad (62)$$

where K_{inv} – investment ratio (investment coefficient); $T_{p\ inv}$ – growth rate of the investment ratio; $T_{p\ EC}$ – growth rate of equity; $T_{p\ NCA}$ – growth rate of non-current assets, characterises the emergence stage of the financial stability crisis.

As a result of the development of current loss-making activity formed at the stage of unfolding of the profitability crisis, equity decreases through a reduction in retained earnings. Consequently, factors causing a more intensive decline in the investment ratio are formed. At the stage of escalation of the threat of losing financial stability, the tendency of decreasing this indicator persists even when

$$K_{inv} > 1 \quad (63)$$

however, destructive processes deepen, generating its negative dynamics, namely:

$$T_{p\ EC} < T_{p\ NCA} < 100\% \quad (64)$$

Unimpeded development of these trends leads to

$$0 < K_{inv} < 1 \quad (65)$$

which reflects the phenomenon of a deficit of own working capital. The emergence of such trends takes place at the stage of unfolding of the financial stability crisis. At the same time, the speed of crisis tendencies increases. Their quantitative assessment may be performed using the lead-lag coefficient (advance/lag) of the equity growth rate relative to the growth rate of non-current assets, namely:

$$K_{B/B}^{EC/NCA} = \frac{T_{pEC}}{T_{pNCA}} < 1 \quad (66)$$

where $K_{B/B}^{EC/NCA}$ – lead-lag coefficient reflecting the relative change in equity compared with the change in non-current assets; T_{pEC} – growth rate of equity; T_{pNCA} – growth rate of non-current assets.

The acquisition of a negative value by the investment ratio, accompanied by a tendency toward its increase, corresponds to the stage of the onset of a threat to financial sustainability, as it indicates the emergence of a deep disturbance in financial equilibrium, under which the enterprise has no net assets. At this stage, the development of the crisis imbalance may be caused by one of the following inequalities:

$$T_{pEC}^{DEF} > T_{pNCA} > 100\% \quad \text{or} \quad T_{pEC}^{DEF} > 100\% > T_{pNCA} \quad (67)$$

where T_{pEC}^{DEF} denotes the growth rate of the deficit of equity.

Overcoming the crisis of financial sustainability is a long-term process. Its catalyst can only be the mobilisation of internal resources. Therefore, the enterprise's rehabilitation capacity in fact represents a combination of production, financial, and marketing potential, which should be utilised to enable the enterprise to overcome the crisis while preserving the owners' capital and ensuring economic independence. Signs of stabilisation of the financial sustainability crisis include a decrease in the absolute value of the negative investment ratio, followed by reaching a positive value and restoring its upward trend based on:

$$K_{B/B}^{EC/NCA} = \frac{T_{pEC}}{T_{pNCA}} > 1 \quad (68)$$

An indicator of the complete elimination of the threat of losing the owners' capital is maintaining the investment ratio within the optimal range (above 1) with stable growth of its value as a result of:

$$T_{pEC} > T_{pNCA} > 100\% \quad \text{or} \quad T_{pEC} > 100\% > T_{pNCA} \quad (69)$$

The study of the interrelationship between trends in profitability development, self-financing, and the value of equity makes it possible to differentiate the stages of the development of a financial sustainability crisis. The enterprise's financial result obtained in the current period determines the amount of increase or decrease in retained earnings in the balance sheet. In the case of chronic current losses, a tendency toward a decline in retained earnings is formed; when this trend transforms into the accumulation of uncovered losses, it causes a reduction in the company's own working capital, followed by the emergence of its deficit. An uncontrolled crisis process ultimately leads to the loss of the invested capital by the owners. This occurs when the amount of liabilities exceeds the value of assets, which indicates a legitimate transfer to creditors of decisive voting power in determining the future fate of the debtor.

As a criterion for assessing the threat of loss of financial sustainability, we choose the liabilities concentration ratio. The economic meaning of this indicator reflects the share of borrowed capital in the total value of funding sources used to form the assets. The optimal value of this ratio should be lower than 0.5; that is, the share of liabilities in the total amount of capital should not exceed 50%. As

its value increases, the risk of the economic system losing financial autonomy in resolving key operational and strategic issues also increases.

Prerequisites for the emergence of a financial sustainability crisis include a more intensive growth of capital formed from borrowed sources compared with the rate of increase in the value of the enterprise's assets. The value of the liabilities concentration ratio remains within the normative range ($K_{conc} < 0.5$), but it demonstrates an upward trend ($T_{p\ conc} > 100\%$) under the influence of the condition:

$$T_{p\ L} > T_{p\ A} > 100\% \quad (70)$$

where $T_{p\ L}$ – growth rate of liabilities (total obligations); $T_{p\ A}$ – growth rate of total assets.

Long-term persistence of this condition leads to exceeding the optimal level of the liabilities concentration ratio, i.e.,

$$1 > K_{conc} > 0.5 \quad (71)$$

which indicates that the crisis development is entering the escalation stage. It should be noted that a temporary reason for an increase in the concentration ratio at the early stages of the financial sustainability crisis may also be the following relationship:

$$100\% > T_{p\ L} > T_{p\ A} \quad (72)$$

The threat of losing financial stability is intensified by a reduction in assets under the conditions of stable growth in borrowed capital. If the inequality

$$T_{pA} < 100\% < T_{pZOB} \quad (73)$$

where T_{pA} – growth rate of total assets; T_{pZOB} – growth rate of total liabilities (obligations), holds, and the value of the liabilities concentration coefficient remains within the range from 0.5 to 1, then the socio-economic system is at the stage of crisis escalation. Reaching a critical value of the liabilities concentration coefficient—above 1—while maintaining a tendency to further increase, characterises the peak of the threat of losing financial stability. This is because the excess of liabilities over the value of assets indicates an insufficient amount of the latter to cover the total indebtedness.

The reduction and return of the share of liabilities to the interval from 50% to 100% is achieved by establishing the lead–lag coefficient (advance/lag) of the asset growth rate compared to the growth rate of liabilities at a level above 1, i.e.,

$$K_{B/B}^{A/ZOB} = \frac{T_{pA}}{T_{pZOB}} > 1 \quad (74)$$

where $K_{B/B}^{A/ZOB}$ – lead–lag coefficient reflecting the relative change in assets compared with the change in liabilities.

These conditions characterise the stage of stabilisation of the financial stability crisis: maintaining the inequality

$$K_{B/B}^{A/ZOB} > 1 \quad (75)$$

while the liabilities concentration coefficient reaches a value below 0.5 indicates the elimination of the threat of owners losing their capital and the preservation of the economic independence of the socio-economic system.

In addition, defining the analysed object as a system enabled the experts to identify a set of interrelated elements and the characteristics that should be included in the database for applying the taxonomy method. Therefore, a systemic and logical relationship among the studied parameters was constructed, and a system of coefficients was developed to calculate the initial database for the comprehensive taxonomy approach. Based on expert judgement, ten coefficients were selected; these coefficients describe the relationships between key financial and economic indicators of the object of analysis over time (in dynamics). A pivotal element in forming the initial database for analytical research using the taxonomy method was the lead-lag coefficient, which, by its purpose, characterises the ratio between the rates of change of two indicators. The choice of this methodological instrument is justified by the fact that it allows determining the extent to which one indicator changes faster or slower than another (Table 1).

Table 1. System of Coefficients for Calculating the Initial Database for Analytical Research Using the Taxonomy Method.

Name of the lead-lag coefficient	Symbol
Lead-lag coefficient of the growth rate of net revenue compared to the growth rate of closing inventory of finished goods and commodities	K_1
Lead-lag coefficient of the growth rate of net revenue from sales relative to the growth rate of resources	K_2
Lead-lag coefficient of the growth rate of current assets compared to the growth rate of current liabilities	K_3
Lead-lag coefficient of the growth rate of net revenue from sales compared to the growth rate of accounts payable	K_4
Lead-lag coefficient of the growth rate of equity compared to the growth rate of non-current assets	K_5
Lead-lag coefficient of the growth rate of income compared to the growth rate of expenses	K_6
Coefficient of acceleration (deceleration) of working capital turnover	K_7
Lead-lag coefficient of the growth rate of net revenue from sales compared to the relative change in the amount of funds in settlements with debtors (accounts receivable)	K_8
Lead-lag coefficient of the growth rate of assets compared to the growth rate of liabilities	K_9
Lead-lag coefficient of the growth rate of net revenue from sales relative to the growth rate of inventories	K_{10}

Source: Developed by the authors.

To ensure a systematic analysis and a deeper understanding of theoretical and methodological approaches as well as applied issues related to analysing the activity of the object under study—which provides the basis for forecasting the dynamics of its economic development—the economic meaning of each lead-lag coefficient reflecting the relationship between key financial and economic indicators of the object of analysis over time (K_1 – K_{10}) was characterised.

Coefficient K_1 reflects the relationship between the growth rate of net revenue and the growth rate of inventory balances of finished goods and commodities. If the actual value of this indicator exceeds 1, it indicates that the expansion of production corresponds to market demand, as stockpiling in warehouses is not observed. Conversely, when this coefficient is below 1, it signals a disruption in the sales of finished products. This may occur due to various reasons, such as the narrowing or loss of a market niche, displacement by competitors, production disruptions, termination of supply contracts, customer refusals, etc.

Coefficient K_2 characterises the relationship between the growth rate of net revenue from sales and the growth rate of resources. If this coefficient exceeds 1, the enterprise's development is considered to have a positive dynamic. This is explained by the fact that net revenue represents the primary internal source for capital replenishment and asset expansion. If external financial sources begin to dominate in enterprise activity, this trend becomes unfavourable for financial independence when the coefficient falls below 1—especially when net revenue decreases while assets increase, which may result from the accumulation of liabilities to creditors.

Coefficient K_3 reflects the relationship between the growth rate of current assets and the growth rate of current liabilities. Accelerated growth of current assets compared to current liabilities indicates a tendency to form, maintain and/or restore the enterprise's solvency. In the opposite case, it becomes the fundamental prerequisite for a solvency crisis. When the coefficient exceeds 1, the enterprise's development is recognised as positive, since the turnover of working capital ensures repayment of debt obligations to creditors attracted into business activity. If the amount of funds advanced into circulation decreases, it will no longer ensure full settlement of current creditor claims, resulting in the formation of overdue accounts payable.

Coefficient K_4 further specifies the dynamic state of solvency through the relationship between the growth rate of net revenue from sales and the growth rate of accounts payable. If the coefficient value is below 1, this indicates the deepening of the problem of untimely debt repayment to creditors and an increase in the overdue portion of liabilities. Conversely, a value above the threshold of 1 indicates stable solvency or its recovery. If the coefficient fluctuates, this implies that anti-crisis measures are being implemented; however, their unstable effectiveness generates a volatile trajectory of coefficient K_4 .

Coefficient K_5 provides insight into the dynamics of formation or depletion of the internal source of self-financing, namely own working capital. Its formation is ensured when the growth rate of equity exceeds the growth rate of non-current assets. If the opposite tendency is observed, manifested in the sustained situation where $K_5 < 1$, the business is approaching a deficit of own working capital or already increasing it. The availability and stable growth of own working capital is an essential feature of a financially stable enterprise over time and one that is resilient to external threats.

Coefficient K_6 is a key instrument for identifying the underlying causes of profitability in one business and losses in another. One of the earliest indications that an enterprise is moving into a loss-making zone is a faster acceleration of costs relative to the intensity of revenue growth. When the value of K_6 falls below 1, this means that revenues are still increasing, yet at a slower rate than the relative increase in costs. If this transition of K_6 below the threshold of 1 is identified in a timely manner, the enterprise gains time to determine the drivers and prerequisites of emerging unprofitability.

Coefficient K_7 characterises the ability of a business to “generate” profit or, alternatively, reveals the reasons for the accumulation of losses. Each operating cycle should yield profit; the greater the number of turnover cycles, the higher the total profit. However, if managerial miscalculations occur—for example, in pricing—then losses may accumulate even under accelerated turnover of working capital. Hence, working capital turnover acts as a catalyst either for business profitability or, conversely, for loss-making activity.

Coefficient K_8 represents the lead/lag coefficient of the growth rate of net revenue from sales compared with the relative change in the amount of funds tied up in receivables. The calculation of K_8 is necessary to identify a potential threat of a liquidity crisis arising from a persistent increase in non-payments among consumers and counterparties. Once net revenue from sales begins to lag behind the expansion of receivables (in percentage-point terms), particular attention should be given to payment discipline through systematic monitoring and strengthened control over contractual compliance, enabling early identification of the causes of non-compliance. Conversely, when $K_8 > 1$, the dynamics of sales activity may be considered liquid and income-generating.

Coefficient K_9 and its estimation provide the basis for assessing progressive (when its value exceeds 1) or regressive (when $K_9 < 1$) changes in the dynamics of a firm's financial stability. To ensure stable financial sustainability or to restore it, the growth rate of assets must outpace the growth rate of liabilities. Under the opposite trend, the enterprise's financial autonomy will be weakened over time, and if such a trend persists, financial sustainability may ultimately be lost.

Coefficient K_{10} reflects the enterprise's ability to ensure production rhythm and continuity. In the presence of idle capacity, supply chain disruptions, or miscalculations in raw-material logistics, the growth rate of net revenue from sales will lag behind the growth rate of production inventories. Stable

and uninterrupted production is associated with $K_{10} > 1$, indicating the absence of excessive inventories that generate additional storage costs and quality deterioration over time, as well as the adequacy of production capacity to meet market demand.

In the course of the study and application of the proposed methodology, the authors used primary data (survey results) and secondary data (reporting databases for 2006–2024). Furthermore, the stages of generating the initial dataset and the sequential transformation of the initial data matrix were established to compute an aggregated indicator of the comprehensive assessment of the level of economic development of the analysed object (illustrated by “Dominik Co” LLC). The dynamics of this indicator within the firm’s financial and economic cycle were examined using the taxonomic method, including the construction of a benchmark (reference) vector, calculation of distances to the benchmark, and derivation of an integral measure in the form of a taxonomic index of economic development. In addition, a correlation–regression model was proposed for forecasting the dynamics of economic development in the socio-economic system.

3. Research results

The difficulties associated with conducting economic research using statistical methods that rely on the distribution of a multidimensional random variable are primarily linked to the number of available observations contained in the dataset. In many cases, this number is insufficient for solving the problem of ordering multidimensional objects or processes relative to a predetermined benchmark (reference) vector. This circumstance substantiated the relevance of applying the taxonomic method (Wu, 2020).

The use of taxonomy provides opportunities to construct a generalised assessment of a complex object or process. Its application is also driven by the intrinsic complexity of the economic phenomena and processes under study, their multidimensional nature, and the ambiguity of causal relationships. The use of a system of heterogeneous indicators through their structuring and analytical interpretation for managerial decision-making is closely associated with taxonomy as a methodological approach. In particular, the taxonomic method offers a powerful set of systematisation algorithms and is capable of addressing the problem of evaluating the dynamics of economic development within a socio-economic system.

Accordingly, to achieve the research objective, the taxonomic method was employed. It is based on calculating the distance between the actual value of an indicator and its benchmark value, where the benchmark is defined as the maximum value within the time series for a stimulating factor and the minimum value within the time series for a destimulating factor.

At the initial stage, the proposed coefficients forming the analytical basis for the taxonomic study are calculated. Table 2 presents the computed indicators for the period 2006–2024, based on the case of “Dominik Co” LLC (hereinafter referred to as the object of analysis).

Table 2. Initial Data Matrix for Calculating the Economic Development Index of the Analysed Object (“Dominik Co” LLC) for 2006–2024.

As at 1 January	K ₁	K ₂	K ₃	K ₄	K ₅	K ₆	K ₇	K ₈	K ₉	K ₁₀
2006	1.0450	1.0526	1.1432	1.1521	1.0822	0.9791	0.9836	0.9908	1.1028	1.2489
2007	0.8847	0.9081	0.8603	0.7291	1.0578	0.9987	0.8374	0.7169	0.8065	0.7407
2008	1.2383	0.9485	0.7971	0.8765	0.8795	0.9867	1.1775	1.0147	0.8374	0.966
2009	1.1102	1.0657	1.2305	1.5583	1.0981	1.0096	1.0439	0.9768	1.1796	1.2457
2010	1.0173	0.8150	1.1259	0.7061	0.9803	1.0092	0.8201	0.8260	1.1824	0.8423
2011	2.7865	0.9246	0.798	0.7886	0.9942	0.9648	1.0388	0.8770	0.7689	0.9103
2012	2.6111	1.0168	1.0613	1.0300	1.1076	1.0100	1.0835	0.8831	1.0007	1.1538
2013	2.3188	0.9093	1.1532	1.1280	0.9801	1.0025	0.9885	0.9566	1.1859	0.8727
2014	9.3082	0.8905	1.1838	0.9462	1.0088	0.9868	0.9630	0.9460	1.2203	0.5675
2015	0.0063	1.0890	1.0560	1.0368	1.1453	1.0566	1.1019	1.4049	0.9784	1.1491
2016	1.4849	1.2336	1.3122	1.4444	1.3330	1.0159	1.0997	1.2662	1.1754	1.2997
2017	1.4696	0.9759	1.0960	1.0946	0.9578	0.9854	0.9042	0.8673	1.1215	0.7269

2018	1.703	0.9484	0.9156	1.0565	0.6964	0.9949	1.1560	1.1242	1.1146	1.5608
2019	1.1443	0.8281	1.4743	1.1917	1.1060	0.9810	0.6856	0.9982	1.3146	0.6963
2020	1.1902	0.8453	1.1858	0.8987	1.2488	1.0016	0.9545	0.8920	1.0854	1.0476
2021	1.5732	0.7865	0.6875	0.6083	0.7912	1.0251	1.1632	0.9063	0.8038	0.8708
2022	0.8632	1.2745	1.0668	1.3768	0.9458	0.8892	1.5153	0.9671	1.1145	0.9737
2023	1.4086	1.1112	1.6986	1.6324	1.3368	1.1437	0.7218	1.9638	1.4691	0.9067
2024	0.7771	1.0903	0.9131	0.9267	1.1794	0.9445	1.056	1.0203	0.8499	1.1199

Source: Developed by the authors.

Overall, the values of the selected set of coefficients over the period 2006–2024 demonstrate volatility and sample heterogeneity. Considered individually, none of these coefficients enables a comprehensive conclusion regarding the dynamics of the economic development of the analysed object. Therefore, there arises a need to derive a composite indicator that provides an integrated characterisation of the economic development dynamics of the analysed entity—namely, the Economic Development Index (illustrated using the case of “Dominik Co” LLC).

To address this objective, it is proposed to apply a taxonomic indicator, calculated using the classical taxonomy algorithm, which includes the following stages: (i) constructing the observation matrix; (ii) standardising the values of the observation matrix elements; (iii) identifying the benchmark (reference) vector; (iv) determining the distance between individual observations and the benchmark vector; and (v) calculating the taxonomic development coefficient. The approach to constructing the integral indicator on the basis of the taxonomic economic development index (K_i) relies on the application of the taxonomic method, which is grounded in distance-based procedures.

The results of applying the taxonomic method in accordance with the algorithm for calculating the integral indicator based on the determination of the taxonomic economic development index (K_i) are presented in Table 4. The data in this table constitute the observation matrix, which was standardised (a_{ij}) in order to convert the indicators into a common dimensionless scale. For this purpose, the following were computed: the mean value, variance, and standard deviation for each indicator in the initial dataset. Subsequently, a benchmark vector was constructed, the elements of which correspond to the indicator values presented in Table 3: $P_0 = (3.9923; 2.1807; 2.5616; 2.0570; 1.7880; 3.0372; 2.7549; 3.5044; 2.1704; 2.3678)$. In the subsequent stage of the research, the distances between individual observations and the benchmark (reference) vector (C_{i0}) were determined using the following formula:

$$C_{i0} = \sum (a_{ij} - a_{ideal})^2 \quad (76)$$

where C_{i0} – the distance between the i -th observation (object) and the ideal (benchmark) vector (reference point) in the taxonomic analysis (often interpreted as the Euclidean-type distance measure); a_{ij} – the standardised value of the j -th indicator for the i -th observation (object) in the observation matrix; a_{ideal} – the ideal (benchmark) value of the j -th indicator (i.e., the corresponding component of the ideal/reference vector).

The taxonomic index of economic development (K_i) was calculated according to the following procedure:

1. The average distance was determined as:

$$\overline{C}_0 = \frac{1}{m} \sum_{i=1}^m C_{i0} \quad (77)$$

2. The standard deviation was calculated as:

$$S_0 = \sqrt{\frac{1}{m} \sum_{i=1}^m (C_{i0} - \overline{C}_0)^2} \quad (78)$$

3. The critical (threshold) distance between the indicators and the benchmark (ideal) vector was defined as:

$$C_0 = \overline{C_0} + 2S_0 \quad (79)$$

4. The relative distance between the i -th observation and the benchmark vector was computed as:

$$d_i = \frac{C_{i0}}{C_0} \quad (80)$$

5. Finally, the taxonomic development index was obtained as:

$$K_i = 1 - d_i \quad (81)$$

where K_i – the taxonomic index of economic development for the i -th observation (object / year); m – the number of observations (objects, periods, years) included in the analysis; C_{i0} – the distance between the i -th observation and the benchmark (ideal) vector (reference point) in the multidimensional indicator space; $\overline{C_0}$ – the average (mean) distance across all observations; S_0 – the standard deviation of the distances C_{i0} , reflecting their dispersion; C_0 – the critical/threshold distance, calculated as the mean distance plus twice the standard deviation: $C_0 = \overline{C_0} + 2S_0$; d_i – the relative (normalised) distance of the i -th observation from the benchmark: $\frac{C_{i0}}{C_0}$.

Table 3. Standardised Data Matrix with the Calculation of the Economic Development Index (K_i) for the Analysed Entity over 2006–2024 (case study of “Dominik Co” LLC).

As at 1 January	K ₁	K ₂	K ₃	K ₄	K ₅	K ₆	K ₇	K ₈	K ₉	K ₁₀	C _{io}	d _i	K _s
2006	-0.3935	0.5095	0.2141	0.3244	0.2068	-0.4235	-0.1757	-0.1529	0.1830	1.0631	8.5230	0.3160	0.684
2007	-0.4785	-0.5785	-0.9820	-1.2016	0.0550	-0.0119	-0.9815	-1.1825	-1.4246	-1.0624	11.1220	0.4120	0.5880
2008	-0.2909	-0.2743	-1.2492	-0.6699	-1.0524	-0.2634	0.8929	-0.0630	-1.2567	-0.1198	9.9710	0.3690	0.6310
2009	-0.3589	0.6081	0.5830	1.7897	0.3058	0.2181	0.1565	-0.2054	0.5997	1.0500	7.7620	0.2870	0.7130
2010	-0.4082	-1.2797	0.1408	-1.2846	-0.4261	0.2100	-1.0769	-0.7723	0.6148	-0.6375	10.2800	0.3810	0.6190
2011	0.5308	-0.4546	-1.2452	-0.9871	-0.3395	-0.7232	0.1283	-0.5808	-1.6282	-0.3531	10.3330	0.3830	0.6170
2012	0.4377	0.2400	-0.1321	-0.1163	0.3647	0.2264	0.3746	-0.5578	-0.3706	0.6653	8.3560	0.3090	0.6910
2013	0.2826	-0.5698	0.2561	0.2373	-0.4272	0.0695	-0.1488	-0.2816	0.6339	-0.5104	8.7800	0.3250	0.6750
2014	3.9923	-0.7116	0.3857	-0.4186	-0.2493	-0.2603	-0.2892	-0.3214	0.8208	-1.7867	8.7880	0.3250	0.6750
2015	-0.9447	0.7839	-0.1548	-0.0915	0.5986	1.2058	0.4763	1.4037	-0.4917	0.6456	7.9210	0.2930	0.7070
2016	-0.1600	1.8726	0.9283	1.3787	1.7643	0.3501	0.4639	0.8823	0.5772	1.2757	6.5990	0.2440	0.7560
2017	-0.1681	-0.0677	0.0144	0.1169	-0.5656	-0.2904	-0.6134	-0.6173	0.2848	-1.1202	9.6580	0.3580	0.6420
2018	-0.0442	-0.2755	-0.7481	-0.0205	-2.1895	-0.0907	0.7743	0.3486	0.2471	2.3678	8.9880	0.3330	0.6670
2019	-0.3408	-1.1815	1.6136	0.4672	0.3549	-0.3834	-1.8186	-0.1252	1.3324	-1.2482	9.7530	0.3610	0.6390
2020	-0.3164	-1.0514	0.3941	-0.5899	1.2419	0.0502	-0.3364	-0.5243	0.0889	0.2213	9.2010	0.3410	0.6590
2021	-0.1131	-1.4949	-1.7126	-1.6375	-1.6007	0.5432	0.8142	-0.4705	-1.4391	-0.5181	10.9960	0.4070	0.5930
2022	-0.4899	2.1808	-0.1090	1.1351	-0.6401	-2.3129	2.7549	-0.2421	0.2468	-0.0880	9.2930	0.3440	0.6560
2023	-0.2005	0.9508	2.5617	2.0570	1.7880	3.0372	-1.6190	3.5044	2.1704	-0.3679	6.7610	0.2500	0.7500
2024	-0.5357	0.7938	-0.7589	-0.4888	0.8103	-1.1508	0.2234	-0.0421	-1.1889	0.5235	9.5970	0.3550	0.6450
Ideal	3.9923	2.1808	2.5617	2.0570	1.7880	3.0372	2.7549	3.5044	2.1704	2.3678	x	x	x

Source: Developed by the authors.

As a result of successive transformations of the initial data matrix, a new aggregated indicator—the economic development index (K_i)—was obtained. This index enables a comprehensive assessment of the business activity cycle of the analysed entity by capturing periods of stability, volatility, decline, and growth over 2006–2024 (Fig. 1).

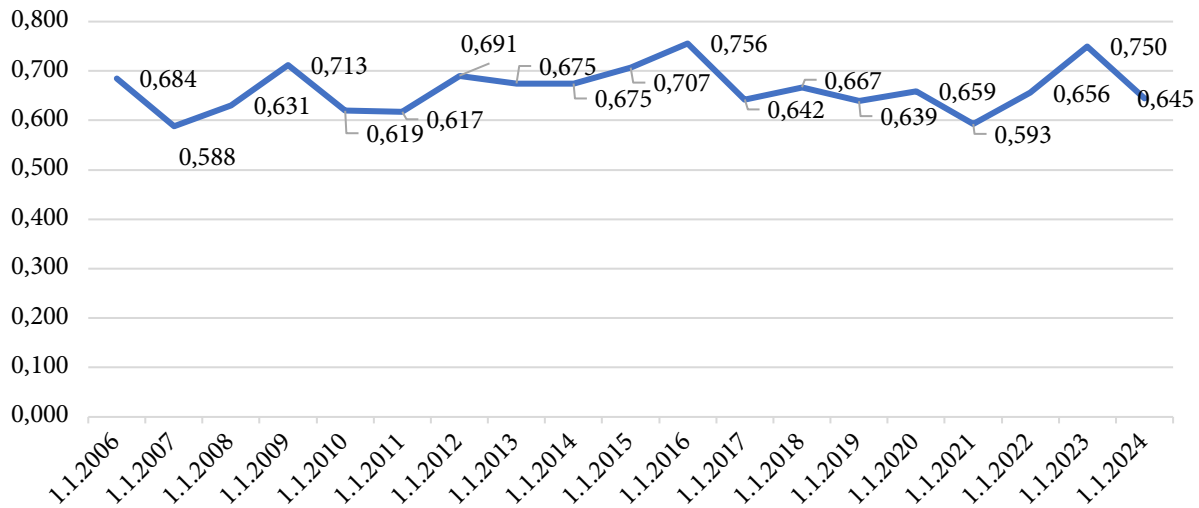


Figure 1. Title Dynamics of the economic development index of the analysed entity over 2006–2024 (case study of “Dominik Co” LLC).

Source: Developed by the authors.

For forecasting the dynamics of economic development, an economic–mathematical model was developed within the study using correlation and regression analysis. Its application and interpretation enable the estimation of the Economic Development Index and the assessment of factor impacts on the index for the analysed entity. In determining the relevance of heuristic methods, system analysis techniques, and expert judgement, the experts considered a set of critically important determinants required for constructing a multifactor model. This provided the basis for identifying the impact of four factors on the Economic Development Index (Y) of the analysed entity (using “Dominik Co” LLC as an example), which reflects the cyclical nature of business activity.

The selected factors represent indicators describing dynamics in liquidity, solvency, profitability, and financial sustainability, specifically the growth rates of: the autonomy ratio (X1), calculated as the ratio of equity to total capital and reflecting the firm’s level of financial independence; the current solvency ratio (X2), computed as the ratio of current assets to current liabilities and characterising the enterprise’s capacity to settle creditors’ obligations in a timely manner; operating expenses (X3), i.e., the total costs directly associated with the core business activity–confectionery production; and the absolute liquidity ratio (X4), calculated as the ratio of cash and cash equivalents to total current liabilities and indicating the share of obligations that can be settled immediately.

In addition, an economic interpretation of the matrix of pairwise correlation coefficients was performed, which made it possible to identify factors that should not be simultaneously included in the model (Table 4).

Table 4. Matrix of Pairwise Correlation Coefficients.

Factors	X1i	X2i	X3i	X4i	Y
X1i	1.00000	0.71260	-0.21093	0.22630	0.56307
X2i	—	1.00000	-0.07597	0.52631	0.69065
X3i	—	—	1.00000	0.13864	0.37401
X4i	—	—	—	1.00000	0.69974
Y	—	—	—	—	1.00000

Source: Developed by the authors.

The obtained results indicate that the strongest relationship (0.71260) is observed between the levels of financial independence and solvency, which can be explained by the fact that both indicators are determined through the enterprise’s liabilities (X2_i). The second and third positions in the ranking of importance are occupied by the two pairwise correlation coefficients between X4 and X2 and the

economic development index (Y). This finding is substantiated by the core of financial and economic performance, which is fundamentally shaped by the firm's liquidity and solvency (Table 5).

Table 5. Strength and Direction of Relationships between Variables.

Pairwise correlation coefficient between variables	Interval of the absolute value of the pairwise correlation coefficient	Strength of relationship	Direction of relationship
$r(X1, X2) = 0.71260$	$0.3 < r_{ij} < 0.8$	Moderate relationship	Positive relationship
$r(X1, X3) = -0.21093$	$0.1 < r_{ij} < 0.3$	Weak relationship	Negative relationship
$r(X1, X4) = 0.22630$	$0.1 < r_{ij} < 0.3$	Weak relationship	Positive relationship
$r(X1, Y) = 0.56307$	$0.3 < r_{ij} < 0.8$	Moderate relationship	Positive relationship
$r(X2, X3) = -0.07597$	$0.1 > r_{ij} $	Very weak relationship	Negative relationship
$r(X2, X4) = 0.52631$	$0.3 < r_{ij} < 0.8$	Moderate relationship	Positive relationship
$r(X2, Y) = 0.69065$	$0.3 < r_{ij} < 0.8$	Moderate relationship	Positive relationship
$r(X3, X4) = 0.13864$	$0.1 < r_{ij} < 0.3$	Weak relationship	Positive relationship
$r(X3, Y) = 0.37401$	$0.3 < r_{ij} < 0.8$	Weak relationship	Positive relationship
$r(X4, Y) = 0.69974$	$0.3 < r_{ij} < 0.8$	Moderate relationship	Positive relationship

Source: Developed by the authors.

Thus, the assessment of the strength of interrelationships among the explanatory variables allows us to conclude that the selected factors can be jointly included in a single model. As a result of the calculations, the multiple regression equation was estimated (Table 6).

Table 6. Parameters of the Correlation–Regression Model of Economic Development.

Model coefficients	Estimated coefficient values	Standard errors of coefficient estimates	t-statistic for model coefficients	Elasticity coefficients (Ki)
a0	-0.056405	0.195718	-0.2882	x
a1	0.519003	0.207761	2.4981	0.039
a2	0.037318	0.035312	1.0568	0.196
a3	0.120643	0.033395	3.6126	0.061
a4	0.016585	0.004996	3.3196	0.789

Source: Developed by the authors.

Accordingly, the correlation–regression model of economic development of the analysed economic entity is proposed in the following form:

$$Y = -0.056405 + 0.519003 \cdot X1 + 0.037318 \cdot X2 + 0.120643 \cdot X3 + 0.016585 \cdot X4 \quad (82)$$

In order to identify the factors exerting the greatest impact on the economic development index, the parameters of Equation (82) were interpreted as follows: *ceteris paribus*, an increase in the growth rate of the share of equity capital in total financial resources (X1) by one unit leads to an average increase in the economic development index (Y) by 0.519003; *ceteris paribus*, an increase in the growth rate of the current solvency ratio (X2) by one unit results in an average increase in the economic development index (Y) by 0.037318; *ceteris paribus*, an increase in the growth rate of operating expenditures—particularly their investment and innovation component (X3) by one unit contributes to an average increase in the economic development index (Y) by 0.120643; *ceteris paribus*, an increase in the growth rate of the share of highly liquid assets within the firm's current assets (X4) by one unit causes an average increase in the economic development index (Y) by 0.016585.

Since the explanatory variables included in Model (83) are expressed in different measurement units, a comparative assessment of their influence on the economic development index of the analysed entity requires normalisation of the regression coefficients. This is achieved through calculating the standardised beta coefficients (β_i), which reflect the relative contribution of each factor to the dependent variable:

$$b_i = \frac{a_i}{\bar{Y}} \bar{X}_i, \quad (83)$$

where a_i – the weight (regression) coefficient of the i -th explanatory variable X_i ; $\bar{X}_i$ – the mean value of the i -th explanatory variable X_i ; $\bar{Y}$ – the mean value of the dependent (result) variable.

After converting the regression coefficients into a comparable form, the regression equation was obtained in a standardised (normalised) form, which makes it possible to compare the strength of the factors' influence on the dependent (result) variable:

$$Y = 0.039 \cdot X_1 + 0.196 \cdot X_2 + 0.061 \cdot X_3 + 0.789 \cdot X_4 \quad (84)$$

The results of analysing Equation (84) provide grounds for determining the degree of influence of the selected factors on the economic development index of the analysed object. As a result, it was found that the share of highly liquid assets in working assets has the greatest influence on the economic development index of the analysed object, since the impact of this factor is seven times more significant than the influence of the other determinants. This conclusion is supported by the results of assessing the strength of the relationships between the factors included in the model (Table 6).

In order to assess the suitability of the model for forecasting the dynamics of the economic development index, a statistical evaluation of Model (8) was conducted using the data presented in Table 7.

Table 7. Parameters for Describing the Correlation–Regression Model.

Indicator	Value	Indicator	Value
Coefficient of determination	0.8322	Tabular value of the Fisher criterion	0.0702
Fisher criterion	17.36	Degrees of freedom	14.00

Source: Developed by the authors.

The value of the multiple coefficient of determination ($R^2 = 0.8322$) indicates that the dynamics of the economic development index are explained by the factors included in the model by 83.22%, while 16.77% is explained by other unaccounted determinants. According to the Fisher criterion, it can be stated that, with a probability of 0.99, the model is statistically reliable, since $F = 17.36$ exceeds the critical value $F_{tab} = 0.0702$. Therefore, it can be concluded that the proposed model is suitable for forecasting the dynamics of the economic development index of the analysed object by substituting probable values of the explanatory variables.

4. Discussion

This study proposes and validates an integrated heuristic–analytical framework for modelling, diagnosing, and forecasting the dynamics of economic development of a socio-economic system under crisis conditions. The approach combines heuristic structuring of diagnostic indicators (liquidity, solvency, profitability, and financial stability), taxonomic aggregation of multidimensional evidence into an integrated Economic Development Index, and an econometric correlation–regression model enabling quantitative identification of dominant endogenous drivers and forecasting of index trajectories.

A key methodological advantage of the proposed framework is its explicit recognition of uncertainty, incomplete observability, and imprecision of baseline information in turbulent environments. Under such conditions, heuristic methods within systemic analysis make it possible to incorporate expert knowledge, professional experience, and informed intuition, thereby compensating for missing or distorted information through economically meaningful heuristic hypotheses. This stance is consistent with broader methodological arguments emphasising the appropriateness of heuristics in complex systems where exact optimisation and fully formalised

modelling are constrained by informational gaps and combinatorial complexity (Ordonez et al., 2025; Wiener, 2022). The present study extends this logic to crisis-driven socio-economic processes by formalising heuristics through indicator logic and subsequent quantitative modelling.

The constructed system of coefficients (K1–K10) operationalises the endogenous logic between liquidity, solvency, profitability, and financial stability and allows cyclical shifts between crisis and development stages to be captured as a structured trajectory. In contrast to conventional ratio analysis, which often interprets indicators in isolation, the proposed approach emphasises lead–lag relations and growth-rate comparisons, enabling the identification of internal dominants of development. The integrated index functions as a monocriterial instrument for complex analysis of system state dynamics along the time axis, aligning with classical ideas of synthesising multidimensional observations into interpretable composite measures (Aivazian et al., 1974; Wu, 2020).

Empirical results for “Dominik Co” LLC (2006–2024) confirm the diagnostic capacity of the index to reflect non-linear development trajectories, including crisis-related declines and recovery phases. The regression component indicates that liquidity-driven determinants—particularly the share of highly liquid assets in working assets—represent the strongest internal driver of the Economic Development Index. This finding supports the managerial interpretation that crisis resilience and development capacity depend critically on the internal liquidity architecture and the structure of working assets. In this respect, the study complements research demonstrating that constrained development outcomes depend on the efficiency of resource allocation; however, it shifts attention from macro- and project-level allocation to enterprise-level internal resource structure under crisis conditions (Bu et al., 2021).

In forecasting terms, the results contribute to ongoing debates between econometric and machine-learning approaches. While deep learning and neural network models have demonstrated strong predictive performance in certain contexts, interpretability and robustness under structural breaks remain key challenges for crisis forecasting (Berger, 2026; Hill et al., 1994; Zhang et al., 1998). Recent econometric forecasting research similarly stresses the importance of modelling strategies that remain reliable after large forecast errors and regime shifts. (Castle et al., 2025). The proposed approach prioritises interpretability and actionability, which is crucial when modelling outcomes should directly inform anti-crisis resource allocation decisions rather than purely maximise forecast accuracy.

At the same time, the findings should be interpreted with due consideration of the study’s limitations. First, empirical validation relies on a single enterprise case, which restricts external generalisation of the quantitative results and factor dominance. Second, the heuristic construction of the indicator system is inherently dependent on expert judgement, which may introduce subjectivity and potential bias in indicator selection, weighting logic, and interpretation. Third, the taxonomic benchmark structure can be sensitive to extreme values and outliers, especially in wartime periods characterised by discontinuities. Fourth, the econometric model captures only a limited set of endogenous factors and does not explicitly incorporate exogenous shocks (e.g., regulatory interventions, supply chain disruptions, inflationary pressure), which may partly explain residual variation in the index trajectory. Finally, the framework is primarily deterministic and does not directly model probabilistic uncertainty or regime-switching behaviour, which may affect forecasting stability under abrupt structural changes. (Castle et al., 2025; Jia et al., 2020).

Overall, the study provides a coherent and practically oriented methodological toolkit that integrates heuristic systemic reasoning with taxonomic synthesis and econometric forecasting. Its primary contribution lies in enabling the identification of an enterprise development vector and the dominant internal determinants shaping crisis-development cyclicity, thereby strengthening the analytical basis for anti-crisis resource distribution and managerial decision-making.

Conclusions

The growing intensity of war-related shocks, together with pervasive globalisation and rapid digitalisation processes, has substantially transformed conventional approaches to forecasting and analysing the development of economic objects. The review of relevant information sources and methodological approaches to forecasting and dynamic analysis in the context of resource allocation and anti-crisis management confirms the multi-dimensional and multi-vector nature of the posed tasks. This complexity justifies the relevance of heuristic reasoning and systemic analysis as an appropriate methodological basis for the analytical substantiation of managerial decisions under uncertainty.

In this study, economic entities are conceptualised as dynamic economic systems, which determines the specificity of solving forecasting and analytical tasks related to economic development dynamics. On this basis, an integrated methodological approach is proposed, combining heuristic tools and systemic logic with formal quantitative procedures. The developed framework synthesises expert judgement in the formation of development parameters, taxonomic methods to construct an integrated Economic Development Index, and an economic-mathematical model based on correlation–regression analysis to quantify factor impacts on the index.

The empirical results demonstrate that the strongest interdependence in the financial and economic development of the analysed object is observed between financial independence and solvency indicators. This relationship is shaped primarily by the liquidity and payment capacity of the enterprise, which provides a justified foundation for determining the acceptable magnitude of obligations and for ranking the importance of determinants reflected through pairwise correlation coefficients with the Economic Development Index (Y). The analysis of the correlation–regression model parameters made it possible to identify the degree of influence exerted by the selected factors on the economic development index through the asset structure of the economic object under study.

Furthermore, the statistical evaluation of the model confirms its methodological applicability for forecasting the dynamics of the integrated economic development index. This substantiates the practical potential of the proposed framework as a decision-support tool for anti-crisis resource allocation, enabling more objective analytical justification of managerial interventions depending on the stage of the system's development trajectory and the internal configuration of liquidity, solvency, profitability, and financial stability.

Future research should focus on advancing the proposed methodological toolkit for forecasting and modelling economic development dynamics by explicitly addressing the challenges of analysis and synthesis under uncertainty of initial environmental conditions. In particular, improving forecast precision and decision robustness requires the integration of stochastic elements, stress-testing, and scenario-based analysis into the modelling architecture. Overall, existing evidence suggests that effective forecasting and analysis of economic development dynamics in the management of economic systems depends on a deeper understanding and incorporation of heuristic approaches in responding to emerging challenges, in substantiating resource allocation decisions, and in reorienting modelling methodology from stabilisation-centred frameworks toward approaches capturing self-organisation mechanisms in complex socio-economic systems.

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Reference

1. Aivazian, S., Bazhaeva, O., & Staroverova, O. (1974). *Klassifikatsiia mnogomernykh nabludenii [Classification of multidimensional observations]*. Statistika.
2. Berger, T. (2026). Deep learning and econometric time series analysis: An assessment of daily return forecasts. *Journal of Forecasting*, 45(1), 377–390. <https://doi.org/10.1002/for.70045>.
3. Bu, X. N., Zhang, T. H., & Zhang, S. H. (2021). The road to prosperity: A study on the efficiency of resource allocation in China's expressway construction. *Journal of Management World*, 2021(3), 60–69.
4. Castle, J. L., Doornik, J. A., & Hendry, D. F. (2025). A novel approach to forecasting after large forecast errors. *Journal of Forecasting*. <https://doi.org/10.1002/for.70062>.
5. Dash, G., & Paul, J. (2021). CB-SEM vs PLS-SEM methods for research in social sciences and technology forecasting. *Technological Forecasting and Social Change*, 173, Article 121092. <https://doi.org/10.1016/j.techfore.2021.121092>.
6. Dzwigol, H. (2022). Comparing Idiographic and Nomothetic Approaches in Management Sciences Research. *Virtual Economics*, 5(4), 27–49. [https://doi.org/10.34021/ve.2022.05.04\(2\)](https://doi.org/10.34021/ve.2022.05.04(2)).
7. Filippi, E., Niero, M., Corsini, F., & Frey, M. (2025). Beyond the life cycle: Assessing business models for the circular economy through life-cycle-based methodologies. *Sustainable Production and Consumption*, 60, 18–35. <https://doi.org/10.1016/j.spc.2025.09.006>.
8. Gherbi, E. A. H., Khalifa, G. S. A., & Kwilinski, A. (2024). Forecasting Entrepreneurial and Employability Opportunities in the UAE: A Government Finance Analysis. *Virtual Economics*, 7(4), 92–121. [https://doi.org/10.34021/ve.2024.07.04\(5\)](https://doi.org/10.34021/ve.2024.07.04(5)).
9. Hassani, S. (2017). *Special relativity: A heuristic approach*. Elsevier.
10. Hill, T., Marquez, L., O'Connor, M., & Remus, W. (1994). Artificial neural network models for forecasting and decision making. *International Journal of Forecasting*, 10(1), 5–15. [https://doi.org/10.1016/0169-2070\(94\)90045-0](https://doi.org/10.1016/0169-2070(94)90045-0).
11. Holt, C. C. (2004). Forecasting seasonals and trends by exponentially weighted moving averages. *International Journal of Forecasting*, 20(1), 5–10. <https://doi.org/10.1016/j.ijforecast.2003.09.015>.
12. Kita, P., Čvirik, M., Maciejewski, G., Žambochová, M., & Kitová Mazalánová, V. (2023). Activities of retail units as an element of business model creation. *Polish Journal of Management Studies*, 27(1), 133–147. <https://doi.org/10.17512/pjms.2023.27.1.08>.
13. Jia, Q. M., Li, Y. P., & Liu, Y. R. (2020). Modeling urban eco-environmental sustainability under uncertainty: Interval double-sided chance-constrained programming with spatial analysis. *Ecological Indicators*, 115, Article 106438. <https://doi.org/10.1016/j.ecolind.2020.106438>.
14. Jin, S. H., Jeong, S. J., & Kim, K. S. (2017). A Linkage Model of Supply Chain Operation and Financial Performance for Economic Sustainability of Firm. *Sustainability*, 9(1), Article 139. <https://doi.org/10.3390/su9010139>.
15. Kamińska, B. (2018). Iterative Signal Processing in Anticipatory Management of Industrial Enterprise Development. *Virtual Economics*, 1(1), 53–65. [https://doi.org/10.34021/ve.2018.01.01\(4\)](https://doi.org/10.34021/ve.2018.01.01(4)).
16. Kharazishvili, Y., & Kwilinski, A. (2022). Methodology for Determining the Limit Values of National Security Indicators Using Artificial Intelligence Methods. *Virtual Economics*, 5(4), 7–26. [https://doi.org/10.34021/ve.2022.05.04\(1\)](https://doi.org/10.34021/ve.2022.05.04(1)).
17. Kharazishvili, Y., Kwilinski, A., Grishnova, O., & Miroshnychenko, O. (2025a). Quantifying the Impact of Innovation-Driven Supply Factors on Economic Growth and Innovation-

- Development Security. *Virtual Economics*, 8(2), 33–58. [https://doi.org/10.34021/ve.2025.08.02\(2\)](https://doi.org/10.34021/ve.2025.08.02(2)).
18. Kharazishvili, Y., Kwilinski, A., Ivaniuta, S., Sukhodolia, O., & Czart, P. (2025b). System of indicators for the environmental component of sustainable development in the security dimension. *Sustainable Development*, 33(S1), 146–160. <https://doi.org/10.1002/sd.70000>.
 19. Kwilinski, A. (2024). Understanding the nonlinear effect of digital technology development on CO2 reduction. *Sustainable Development*, 32(5), 5797–5811. <https://doi.org/10.1002/sd.2964>.
 20. Kwilinski, A. (2025). Artificial Intelligence and Energy Security: Plateaus. Bifurcations. Sinusoids. and Paradoxes of Development in the Context of Sustainability. *Energies*, 18(23), Article 6352. <https://doi.org/10.3390/en18236352>.
 21. Ordonez, C., Harper, M., Boylan, J. T., & Collins, E. G. (2025). *Trajectory planning using dynamics and power models: A heuristics-based approach*. Elsevier. <https://doi.org/10.1201/9781003623830>.
 22. Pankova, M., Kwilinski, A., Dalevska, N., & Khobta, V. (2023). Modelling the Level of the Enterprise' Resource Security Using Artificial Neural Networks. *Virtual Economics*, 6(1), 71–91. [https://doi.org/10.34021/ve.2023.06.01\(5\)](https://doi.org/10.34021/ve.2023.06.01(5)).
 23. Rohoza, M., Perebyynis, V., & Verhal, K. (2019). Cooperation and Integration Processes and Models in Context of Development of Branches of Economy and Territories. *Virtual Economics*, 2(1), 49–63. [https://doi.org/10.34021/ve.2019.02.01\(3\)](https://doi.org/10.34021/ve.2019.02.01(3)).
 24. Sakthi Balan, G., Santhosh Kumar, V., & Aravind Raj, S. (2025). Machine learning and artificial intelligence methods and applications for post-crisis supply chain resiliency and recovery. *Supply Chain Analytics*, 10, Article 100121. <https://doi.org/10.1016/j.sca.2025.100121>.
 25. Salamian, F., Paksaz, A., Khalil Loo, B., Mousapour Mamoudan, M., Aghsami, M., & Aghsami, A. (2024). Supply Chains Problem during Crises: A Data-Driven Approach. *Modelling*, 5(4), 2001–2039. <https://doi.org/10.3390/modelling5040104>.
 26. Soluk, J. (2022). Organisations' Resources and External Shocks: Exploring Digital Innovation in Family Firms. *Industry and Innovation*, 29(6), 792–824. <https://doi.org/10.1080/13662716.2022.2065971>.
 27. Vaničková, R., & Szczepańska-Woszczyna, K. (2020). Innovation of business and marketing plan of growth strategy and competitive advantage in exhibition industry. *Polish Journal of Management Studies*, 21(2), Article 30. <https://doi.org/10.17512/pjms.2020.21.2.30>.
 28. Wiener, R. (2022). *Generic data structures and algorithms in Go: An applied approach using concurrency. genericity and heuristics*. Elsevier. <https://doi.org/10.1007/978-1-4842-8191-8>.
 29. Wu, Y. (2020). Developing a Taxonomic Framework of Security Methods for Security Management and Information Resource Management. *Journal of Strategic Security*, 13(2), 64–77. <https://doi.org/10.5038/1944-0472.13.2.1787>.
 30. Xu, M., Chen, Y., Ali, F., Lyulyov, O., & Pimonenko, T. (2024). Efficiency of green total factor production: Exploring core determinants. *Romanian Journal of Economic Forecasting*, 27(3), 102–119.
 31. Zeng, X. T., Li, Y. P., Huang, W., Chen, X., & Bao, A. M. (2014). Two-stage credibility-constrained programming with Hurwicz criterion (TCP-CH) for planning water resources management. *Engineering Applications of Artificial Intelligence*, 35, 164–175. <https://doi.org/10.1016/j.engappai.2014.06.021>.
 32. Zhang, G., Patuwo, B. E., & Hu, M. Y. (1998). Forecasting with artificial neural networks: The state of the art. *International Journal of Forecasting*, 14(1), 35–62. [https://doi.org/10.1016/S0169-2070\(97\)00044-7](https://doi.org/10.1016/S0169-2070(97)00044-7).



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