18th Annual Conference of the Institute of Economic Sciences

INNOVATION ECONOMICS, POLICY AND ENTREPRENEURSHIP: BOOK OF ABSTRACTS

Editors

Lazar Živković
Isidora Beraha
Jelena Williams
Sonja Đuričin
Dijana Štrbac



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INTERNATIONAL BALKAN UNIVERSITY
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PREFACE

Dear colleagues,

It is our great pleasure to present the Book of Abstracts of the 18th Annual Conference of the Institute of Economic Sciences – International Scientific Conference on Innovation Economics, Policy and Entrepreneurship, held on 20-21 October 2026 in Belgrade, Serbia.

Over the years, the Conference has established itself as a meeting point for leading scholars and experts, fostering the exchange of knowledge, critical debate and new research collaborations on key economic challenges. Building on this tradition, this year's Conference brings innovation economics, policy and entrepreneurship to the forefront of scholarly discussion.

The role of innovation in economic and societal development is evolving as innovation systems are increasingly expected to respond to a broader range of technological, environmental, economic and geopolitical challenges. Digitalisation and artificial intelligence are transforming firms and labour markets, the green transition is redefining development priorities and growing economic and geopolitical uncertainty is placing new demands on innovation systems and public policy. These issues are particularly important for Serbia and the wider region, where strengthening research and innovation capacities must go hand in hand with economic transformation, stronger business competitiveness and deeper integration into European research and innovation networks.

The Conference addresses these challenges through three closely connected thematic areas: Innovation Policy, Governance and Systems; Entrepreneurship and Innovation Ecosystems; and Digital and Green Transformation. The Book of Abstracts brings together 85 extended abstracts contributed by researchers affiliated with institutions across 28 countries, covering a broad range of issues at the intersection of innovation, entrepreneurship and economic transformation. Despite the diversity of topics and approaches, many contributions share a common concern: how institutions, firms and innovation ecosystems can build the capabilities needed not only to adapt to technological, economic and societal change, but also to shape it.

We hope that the Conference and this Book of Abstracts will contribute to strengthening research excellence and advancing knowledge in the fields of innovation economics, policy and entrepreneurship. By providing a platform for the presentation and critical discussion of new research findings, we also hope that they will foster stronger scholarly exchange, encourage new research collaborations and deepen the dialogue between research, policy and practice. In this way, the Conference seeks to support both scientific advancement and the development of more informed innovation and entrepreneurship policies.

We sincerely thank all authors, keynote speakers, reviewers, members of the Scientific and Organizing Committees, partner institutions and technical staff for their contribution to the Conference and to this publication.

Editors

Belgrade, October 2026

I.

INNOVATION POLICY AND GOVERNANCE SYSTEM

THE STI POLICY MIX IN SERBIA: INSTRUMENTS, CHALLENGES AND POLICY DIRECTIONS

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INTRODUCTION

Science, technology and innovation (STI) policy instruments play an increasingly important role in strengthening innovation ecosystems, supporting competitiveness and addressing broader societal challenges. In transition economies, the development of coherent STI policy mixes is particularly important due to institutional weaknesses and limited innovation capacities. This paper analyses the structure and evolution of the STI policy mix in Serbia and examines whether its development reflects a transition from an innovation systems approach towards transformative innovation policy.

LITERATURE REVIEW / THEORETICAL BACKGROUND

The paper builds on the concept of STI policy mix, which emphasizes the interaction of policy instruments and institutions within innovation systems (Flanagan et al., 2011). It is further grounded in the national innovation systems perspective (Lundvall, 1992) and the systemic understanding of innovation policy instruments (Edquist, 2001). Recent literature argues that innovation policy is evolving towards transformative approaches that seek to address societal challenges through mission-oriented, cross-sectoral and systemic interventions (Schot & Steinmueller, 2018; OECD, 2024).

METHODOLOGY

The study applies qualitative policy analysis based on the EC-OECD STIP Compass taxonomy (European Commission & OECD, 2020). The analysis covers strategic documents, laws, programmes and institutional mechanisms related to STI policy

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in Serbia. Policy instruments are classified into governance instruments, direct and indirect financial support, infrastructural instruments, and regulatory and incentive-based instruments. The analysis focuses on identifying major developments, institutional changes and implementation gaps within the Serbian STI policy framework. Beyond mapping policy instruments, the analysis examines whether Serbia's STI policy mix primarily reflects an innovation systems approach or incorporates elements of transformative innovation policy.

RESULTS

The findings indicate that Serbia has significantly expanded its STI policy mix during the last decade through new strategies, institutions and support programmes. Major developments include the establishment of new institutions, expansion of innovation support programmes, and initiatives promoting open science and artificial intelligence. The analysis reveals that the current policy portfolio is dominated by instruments aimed at strengthening institutional capacities, research performance and innovation ecosystem development. Consequently, the policy mix largely reflects an innovation systems approach, whereas instruments supporting transformative innovation, mission-oriented governance and systemic societal transitions remain limited.

DISCUSSION / POLICY IMPLICATIONS

The analysis suggests that Serbia's STI policy framework is progressively aligning with European innovation policy priorities, particularly in areas such as smart specialisation, startup support, open science and digital transformation. However, the policy mix remains fragmented, with limited intersectoral coordination and insufficient evaluation of policy effectiveness. The findings indicate that Serbia has largely completed the transition from traditional STI policy towards an innovation systems approach, while the next phase of policy development should increasingly incorporate transformative innovation policy instruments capable of addressing complex societal challenges through mission-oriented and cross-sectoral approaches.

CONCLUSION

Serbia has developed a broad and diversified STI policy mix encompassing governance, financial, infrastructural and regulatory instruments. Institutional reforms and the expansion of innovation support programmes have substantially strengthened the national innovation ecosystem. Nevertheless, the analysis demonstrates that the current policy mix remains primarily focused on

strengthening innovation capacities rather than steering innovation towards transformative societal objectives. Future policy development should therefore place greater emphasis on policy coherence, mission-oriented governance, cross-sectoral coordination and systematic policy evaluation in order to support transformative and sustainability-oriented innovation.

KEYWORDS

STI policy, transformative innovation policy, policy mix, Serbia, innovation system

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REFERENCES

1. Edquist, C. (2001). Innovation policy—A systemic approach. In D. Archibugi & B.-Å. Lundvall (Eds.), *The globalizing learning economy* (pp. 219–238). Oxford Academic. https://doi.org/10.1093/0199258171.003.0013
2. European Commission & OECD. (2020). *STIP Compass Taxonomies describing STI policy data*. https://stip.oecd.org
3. Flanagan, K., Uyarra, E., & Laranja, M. (2011). Reconceptualising the 'policy mix' for innovation. *Research Policy*, 40(5), 702–713. https://doi.org/10.1016/j.respol.2011.02.005
4. Lundvall, B.-Å. (1992). *National systems of innovation: Towards a theory of innovation and interactive learning*. Pinter Publishers, London.
5. OECD (2024). Agenda for Transformative Science, Technology and Innovation Policies, OECD Science, Technology and Industry Policy Papers, OECD Publishing, Paris. https://doi.org/10.1787/ba2aaf7b-en
6. Schot, J., & Steinmueller, W. (2018). Three frames for innovation policy: R&D, systems of innovation and transformative change. *Research Policy*, 47(9), pp. 1554-1567. https://doi.org/10.1016/j.respol.2018.08.011

MEASUREMENT OF INNOVATION: SELECTION OF INDICATORS AND (MIS)USE OF SCOREBOARDS

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INTRODUCTION

The choice of indicators to measure innovation processes and assess performance is of vital significance. This paper, therefore, reviews innovation indicators from theoretical and policy perspectives. Competing economics paradigms treat innovation in diametrically different ways: they consider different notions as crucial ones offer diverse justifications for government interventions; interpret the significance of various types of inputs, efforts, and results differently, and thus identify different 'targets' for measurement, monitoring and analytical purposes.

LITERATURE REVIEW / THEORETICAL BACKGROUND

Mainstream economics emphasises the economic impacts of R&D-based innovation efforts, advances the market failure argument and the concomitant set of policy advice. In contrast, evolutionary economics of innovation stresses the systemic nature of innovation and thus advocates rectifying any systemic failure that hinders the generation, circulation, and exploitation of any type of knowledge required for successful innovation processes. (Fagerberg et al. 2005; Hirsch-Kreinsen & Schwinge 2014; Mendonça 2009; Robertson et al. 2009) This way of thinking has influenced the measurement and monitoring practices of the European Commission to a significantly lesser extent than mainstream economics. (Jensen et al. 2007)

METHODOLOGY

The paper considers the indicators selected for compiling the European Innovation Scoreboard (EIS) of the European Commission, as well as the Global Innovation Index, influenced by mainstream economics (science push model of innovation). These tools pay attention mainly to the S&T mode of innovation, at

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the expense of the so-called DUI mode of innovation (innovation based on learning by doing, using, and interacting; Jensen et al. 2007). It is a major concern, however, as the latter one is equally important from the point of view of enhancing productivity, creating jobs, and improving competitiveness.

RESULTS

While the set of indicators used to compile the various editions of EIS have changed to a non-negligible extent since 2002, these indicators consistently focus on measuring R&D activities and R&D-based innovation activities. Hence, they can be relevant in settings characterised predominantly by the S&T mode of innovation, but significantly less useful in other settings, characterised by other types of innovation activities. (Hirsch-Kreinsen et al. (eds) 2005; Hirsch-Kreinsen & Schwinge (eds) 2014; Mendonça 2009; Robertson et al. 2009; Sandven et al. 2005; von Tunzelmann & Acha 2005)

DISCUSSION / POLICY IMPLICATIONS

Using the EIS indicators would not help establishing if a certain system is characterised by a low level of innovation activities altogether – or a low level of R&D-based innovation activities. Yet, that is a fairly important distinction both from an analytical and a practical (policy) point of view: these two systems (settings) are fundamentally different. The EIS indicators in principle could be useful in settings where the dominant mode of innovation is the S&T mode. In practice, however, both the ST and DUI modes of innovation are fairly important. (Jensen et al. 2007)

CONCLUSION

RTDI activities need to be monitored and assessed by considering both the STI and DUI modes of innovation. Indicators should not be biased: all types of innovations should be considered, irrespective of the form, type and sources of knowledge exploited. Analysts and policy-makers need to avoid the trap of paying too much attention to simplifying ranking exercises. Instead, it is of utmost importance to conduct detailed, thorough comparative analyses, identifying the reasons for a disappointing performance, as well as the sources of – opportunities for – balanced, and sustainable, socio-economic development.

KEYWORDS

Mainstream economics, evolutionary economics of innovation, measurement of innovation, scoreboards, league tables

REFERENCES

1. Fagerberg, J., Mowery, D. C. & Nelson, R. R. (eds). (2005). *Oxford Handbook of Innovation*. Oxford University Press.
2. Hirsch-Kreinsen, H. & Schwinge, I. (eds) (2014). *Knowledge-Intensive Entrepreneurship in Low-Tech Industries*. Edward Elgar Publishing.
3. Hirsch-Kreinsen, H., Jacobson, D., & Laestadius S. (2005). *Low-tech Innovation in the Knowledge Economy*. Peter Lang Publishing.
4. Jensen, M. B., Johnson, B., Lorenz, E. & Lundvall, B. Å. (2007). Forms of knowledge and modes of innovation. *Research Policy*, 36(5), 680–693. https://doi.org/10.1016/j.respol.2007.01.006.
5. Mendonça, S. (2009). Brave old world: Accounting for "high-tech" knowledge in "low-tech" industries. *Research Policy*, 38(3), 470–482. https://doi.org/10.1016/j.respol.2008.10.018.
6. Robertson, P., Smith, K. & von Tunzelmann, N. (2009). Innovation in low- and medium-technology industries. *Research Policy*, 38(3), 441–446. https://doi.org/10.1016/j.respol.2008.10.019.
7. Sandven, T., Smith, K. & Kaloudis, A. (2005). Structural change, growth and innovation: the roles of medium and low-tech industries, 1980-2000, in: Hirsch-Kreinsen et al. (eds) (2005), pp. 31–59.
8. Von Tunzelmann, N. & Acha, V. (2005). Innovation in "Low-Tech" Industries, in: Fagerberg et al. (eds), pp. 407–432.

NAVIGATING THE SECURITY-SUSTAINABILITY-INNOVATION NEXUS: FIRST RESULTS OF A MULTI-LAYER, MULTI-DOMAIN FORESIGHT PROCESS

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INTRODUCTION

The EU's ambitious climate neutrality target by 2050 unfolds now in a context where sustainability transformations are increasingly intertwined with strategic autonomy, technological sovereignty, and geopolitical resilience. Major recent geopolitical disruptions, esp. energy dependencies and critical raw materials bottlenecks, have transformed industrial decarbonisation from primarily an environmental challenge into a multifaceted security-sustainability-innovation issue.

LITERATURE REVIEW / THEORETICAL BACKGROUND

The integration of security considerations represents a major change in the normative orientation of Transformative Innovation Policy (TIP). While TIP traditionally emphasised environmental and social directionalities, recent geopolitical developments increasingly orient innovation toward resilience, esp. economic security and traditional defence, potentially undermining sustainability objectives, unless explicit policy mechanisms are able to create synergies (Kivimaa et al. 2025). This tension underscores the need for analytical frameworks that can systematically explore how different geopolitical contexts would shape innovation directionality.

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METHODOLOGY

Our approach builds on established scenario planning methods while introducing a novel multi-layer architecture. Rather than developing sectoral scenarios in isolation, we construct overarching geopolitical 'context scenarios' that provide consistent boundary conditions for subsequent thematic exploration. This structure enables participants to systematically consider how global security environments shape and frame specific technological and industrial challenges (Havas & Weber 2023).

RESULTS

We demonstrate that an effective EU industrial decarbonisation strategy must explicitly integrate geopolitical uncertainty and security considerations into STI policy-making processes. The multi-layer scenario and roadmapping approach provides a systematic, apt method for this integration, revealing how different global contexts fundamentally reshape what technological priorities, governance arrangements, and international collaboration strategies would be appropriate.

DISCUSSION / POLICY IMPLICATIONS

Investments in foundational capacities (advanced manufacturing, R&D, skilled workforce, digital systems) provide valuable optionality across scenarios. Modular policy frameworks that can activate different instruments based on emerging conditions prove more resilient than rigid long-term commitments. Nurturing diverse international partnerships, incl. collaborations with new partners in novel architectures, spreads the risk of cooperation failures and preserves the possibility of entering into new cooperations when geopolitical conditions change.

CONCLUSION

The multi-layer scenario approach demonstrates value in connecting different levels of governance and action. Global geopolitical dynamics constrain but do not determine specific technological and industrial outcomes; regional, national, and local contexts mediate how broad trends manifest. Structuring analysis to explicitly link context scenarios with thematic deep-dives enables more nuanced strategy development. Stakeholders, who explore multiple futures together, develop shared understanding of critical uncertainties and ownership on the jointly identified strategic actions, enabling more agile responses to emerging developments.

KEYWORDS

Security, sustainability, innovation, multi-layer, multi-domain foresight

REFERENCES

1. Havas, A. & Weber, M. (2023). Multi-level context scenarios for future EU R&I policies, in: Weber, M., Wasserbacher, D. & Kastrinos, N. (eds), *Foresight on demand: Foresight towards the 2nd Strategic Plan for Horizon Europe* (pp. 40–48). Publications Office of the European Union.
2. Kivimaa, P., Daniels, C. & Jayaram, D. (2025). Transformative innovation policy in energy transition and digitalization: a geopolitical and security perspective. *Oxford Open Energy*, 4. https://doi.org/10.1093/ooenergy/oiaf008.

THE RELATIONSHIP BETWEEN GOVERNMENT-FUNDED AND BUSINESS R&D EXPENDITURE IN THE EU-27

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INTRODUCTION

Government support for research and innovation represents an important component of innovation policy across the European Union. Public funding may stimulate private-sector innovation by reducing technological uncertainty, easing financial constraints, and encouraging additional investment in research and development (R&D). Understanding the relationship between public support and business R&D activity is therefore important for evaluating the effectiveness of innovation policies. The aim of this study is to examine the relationship between government-funded business R&D expenditure and total business R&D expenditure in the EU-27.

LITERATURE REVIEW / THEORETICAL BACKGROUND

The theoretical justification for public support of R&D is rooted in market failure theory and knowledge spillovers, which prevent firms from fully appropriating the returns from innovation (Arrow, 1962). Public intervention can therefore encourage private investment by reducing risks associated with innovative activities and supporting technological development. Empirical studies generally suggest that public R&D expenditure complements rather than crowds out private R&D investment. Guellec and van Pottelsberghe (2000) identified positive effects of government support on business R&D activities, while Soete et al. (2020) highlighted the broader economic benefits of public R&D expenditure. More recent studies have similarly reported positive interactions between public support and private innovation investment (Ciaffi et al., 2023; Pellens et al., 2024).

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METHODOLOGY

The analysis employs annual EU-27 data obtained from Eurostat covering the period 1990-2009. Business enterprise R&D expenditure (BERD) serves as the dependent variable, while business R&D expenditure financed by the government sector represents the explanatory variable. Both variables were expressed in logarithmic form. Given the time-series nature of the data, Augmented Dickey-Fuller (ADF) tests were conducted to assess stationarity. Both variables were found to be non-stationary in levels. An Engle-Granger cointegration test was subsequently performed to examine whether a stable long-run equilibrium relationship exists between the variables. As cointegration was not confirmed, the relationship was estimated using a first-difference log-log regression specification to avoid potentially spurious regression results.

RESULTS

The ADF tests indicated that both variables exhibit non-stationary behavior in levels. The Engle-Granger cointegration test did not confirm the existence of a stable long-run equilibrium relationship between government-funded and business R&D expenditure ($p = 0{,}889$). Consequently, the relationship was estimated using first differences. The first-difference log-log regression results reveal a positive and statistically significant association between changes in government-funded business R&D expenditure and changes in total business R&D expenditure. The estimated elasticity of 0,31 suggests that a 1% increase in government-funded business R&D expenditure is associated with approximately a 0,31% increase in business R&D expenditure. The coefficient is statistically significant at the 5% level ($p = 0{,}019$). These findings provide evidence of a positive short-run relationship between public support and private-sector R&D activity.

DISCUSSION / POLICY IMPLICATIONS

The findings are consistent with the view that public R&D support can complement private innovation investment within the EU-27. Although no evidence of a stable long-run equilibrium relationship was identified, increases in government-funded R&D expenditure are positively associated with short-run changes in business R&D expenditure. This result is broadly aligned with previous studies reporting complementary relationships between public and private R&D activities (Guellec & van Pottelsberghe, 2000; Ciaffi et al., 2023; Pellens et al., 2024). From a policy perspective, the results suggest that government funding remains an important instrument for stimulating private-sector innovation

activity. However, the absence of cointegration implies that public funding alone may not be sufficient to generate sustained long-run increases in business R&D expenditure. Effective innovation policy should therefore be accompanied by broader measures aimed at strengthening innovation ecosystems, improving access to finance, and supporting research-intensive business environments.

CONCLUSION

This study contributes to the literature on innovation policy by examining the relationship between government-funded and business R&D expenditure in the EU-27. After accounting for the time-series properties of the data, the results indicate a positive and statistically significant short-run association between changes in public support and business R&D expenditure. While no evidence of a stable long-run relationship was found, the findings suggest that government funding can play an important role in supporting private-sector innovation. Future research should employ more comprehensive datasets and further investigate whether the effects of government R&D support emerge with time lags or through broader innovation-policy mechanisms.

KEYWORDS

Business enterprise R&D expenditure, crowding-in effect, fiscal multiplier, government-funded R&D, innovation policy

REFERENCES

1. Aden Dirir, S. (2023). The potential of macroeconomic factors in shaping the landscape of technological development: A testimonial from upper-middle-income countries. *Business, Management and Economics Engineering,* 21(1), 84-105. https://doi.org/10.3846/bmee.2023.18360
2. Alam, A., Uddin, M., & Yazdifar, H. (2019). Institutional determinants of R&D investment: Evidence from emerging markets. *Technological Forecasting and Social Change*, 138, 34-44. https://doi.org/10.1016/j.techfore.2018.08.007
3. Arrow, K. J. (1962). Economic welfare and the allocation of resources for invention. In R. R. Nelson (Ed.), *The rate and direction of inventive activity: Economic and social factors* (pp. 609-626). Princeton University Press.
4. Bebczuk, R. N. (2002). R&D expenditures and the role of government around the world. *Estudios de Economía*, 29(1), 109-121.
5. Ciaffi, G., Deleidi, M., & Levrero, E. S. (2023). *The macroeconomic effects of public expenditure in research and development* (CIMR Working Paper No. 64). Centre for Innovation Management Research, Birkbeck, University of London.

6. De Lipsis, V., Deleidi, M., Mazzucato, M., & Agnolucci, P. (2023). *Macroeconomic effects of public R&D* (IIPP Working Paper Series No. WP 2023-02). UCL Institute for Innovation and Public Purpose.
7. Dickey, D. A., & Fuller, W. A. (1979). Distribution of the estimators for autoregressive time series with a unit root. *Journal of the American Statistical Association*, 74(366), 427-431. https://doi.org/10.1080/01621459.1979.10482531
8. Engle, R. F., & Granger, C. W. J. (1987). Co-integration and error correction: Representation, estimation, and testing. *Econometrica*, 55(2), 251-276. https://doi.org/10.2307/1913236
9. Grant, A., Figus, G., & Schubert, T. (2022). *Understanding the macroeconomic effects of public research: An application of a regression-microfounded CGE-model to the case of the Fraunhofer-Gesellschaft in Germany* (Innovation Systems and Policy Analysis No. 72). Fraunhofer Institute for Systems and Innovation Research ISI.
10. Guellec, D., & van Pottelsberghe de la Potterie, B. (2000). *The impact of public R&D expenditure on business R&D* (STI Working Paper No. 2000/4). OECD Publishing.
11. Kahn, A., Kasongo, A., Sithole, M. M., & Ramoroka, K. H. (2024). An analysis of the micro- and macro-economic determinants of firm R&D intensity in the South African business sector. *African Journal of Science, Technology, Innovation and Development*, 16(3), 297-308. https://doi.org/10.1080/20421338.2023.2296653
12. Pellens, M., Peters, B., Hud, M., Rammer, C., & Licht, G. (2024). Public R&D investment in economic crises. *Research Policy*, 53(10), Article 105084. https://doi.org/10.1016/j.respol.2024.105084
13. Soete, L., Verspagen, B., & Ziesemer, T. H. W. (2020). Economic impact of public R&D: An international perspective. *Industrial and Corporate Change*, 29(4), 1069-1084. https://doi.org/10.1093/icc/dtab066
14. Szarowská, I. (2017). Does public R&D expenditure matter for economic growth? GMM approach. *Journal of International Studies*, 10(2), 90-103.
15. Wang, E. C. (2010). Determinants of R&D investment: The extreme-bounds-analysis approach applied to 26 OECD countries. *Research Policy*, 39(1), 103-116. https://doi.org/10.1016/j.respol.2009.11.010

OPEN SCIENCE INFRASTRUCTURE AND INNOVATION-SYSTEM CAPACITY - EVIDENCE FROM DIGITAL REPOSITORY INTEGRATION IN SERBIA

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INTRODUCTION

Digital transformation has become a structural determinant of how research systems preserve, access and circulate knowledge. Within the Open Science agenda, digital repositories constitute critical support infrastructure for research visibility, preservation, reuse and knowledge diffusion. Their relevance to innovation economics and policy stems from the fact that national innovation systems depend not only on knowledge production, but also on the conditions enabling its accessibility, circulation and use. However, the formal availability of repositories does not necessarily lead to their integration into researchers' everyday practices. The paper examines the extent to which digital repositories are actively integrated into scholarly work in Serbia and identifies the individual and institutional factors associated with higher levels of integration.

LITERATURE REVIEW / THEORETICAL BACKGROUND

Digital repositories enhance access, preservation, searchability and dissemination of scientific outputs (Demetres et al., 2020; Asadi et al., 2019; Bashir, 2021). Prior studies show that their use may support research efficiency and productivity, but also that adoption differs by institution, discipline, career stage, support and experience (Ani et al., 2015; Kim, 2011; Maceviciute & Kepaliene, 2022). Banović, Bradić-Martinović and Zdravković (2026) confirm these differences for Serbia. This paper shifts the focus from perceived performance to active integration of repositories into scholarly practice.

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METHODOLOGY

The study uses original survey data collected among researchers in Serbia through an online questionnaire conducted from 18 to 27 May 2023, yielding 326 valid responses. For this paper, a new indicator of active repository integration is constructed from items capturing repository use for disseminating own publications, finding and downloading publications and datasets, and preparing academic documentation. Descriptive statistics, Cronbach's alpha and logistic regression are used to identify individual and institutional factors associated with higher integration.

RESULTS

The newly constructed indicator suggests that digital repositories are already integrated into scholarly practice among many researchers whose institutions have repository infrastructure. The selected practice-oriented items form a coherent indicator of active repository integration. Descriptive findings point to stronger integration among researchers from institutes, as well as among those in the humanities and social sciences. Integration is also higher in institutions with more mature repository infrastructure. Logistic regression confirms repository maturity as the clearest predictor of active integration. Institutional affiliation and familiarity with digital licenses show positive but weaker associations, while scientific field, years of experience and self-assessed digital skills are not significant in the adjusted model.

DISCUSSION / POLICY IMPLICATIONS

The findings suggest that digital repositories can function as a support mechanism within research and innovation systems, but primarily when they are institutionally mature and embedded in everyday research routines. Open Science policies should therefore move beyond platform development and formal compliance, and focus on sustained repository support, clear procedures, researcher training and incentives for active use. Stronger repository integration may improve knowledge circulation, research visibility and the ability of small research systems to use digital infrastructure more effectively.

CONCLUSION

Digital repositories should be understood not only as archival platforms, but as part of the support infrastructure for Open Science and research activity. The

Serbian case shows that active integration depends more on institutional maturity than on researchers' self-assessed digital skills. For small and developing research systems, the key policy challenge is therefore to ensure that repository infrastructure is continuously supported, clearly organized and practically embedded in researchers' everyday work.

KEYWORDS

Open Science, digital repositories, research infrastructure, innovation systems, Serbia

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REFERENCES

1. Abramo, G., & D'Angelo, C. A. (2014). How do you define and measure research productivity? *Scientometrics*, 101(2), 1129–1144.
2. Creaser, C., Fry, J., Greenwood, H., Oppenheim, C., Probets, S., Spezi, V., & White, S. (2010). Authors' awareness and attitudes toward open access repositories. *New Review of Academic Librarianship*, 16(S1), 145–161.
3. Kim, J. (2011). Motivations of faculty self-archiving in institutional repositories. *The Journal of Academic Librarianship*, 37(3), 246–254.
4. Lagzian, F., Abrizah, A., & Wee, M. C. (2015). Measuring the gap between perceived importance and actual performance of institutional repositories. *Library & Information Science Research*, 37(2), 147–155.
5. Lynch, C. A. (2003). Institutional repositories: Essential infrastructure for scholarship in the digital age. *ARL Bimonthly Report*, 226, 1–7.
6. Macevičiūtė, E., & Kepalienė, F. (2022). Factors influencing Lithuanian researchers' use of open access repositories as a publishing channel. *Information Research*, 27(Special issue), Article isic2210.
7. Pinfield, S., Salter, J., Bath, P. A., Hubbard, B., Millington, P., Anders, J. H. S., & Hussain, A. (2014). Open-access repositories worldwide, 2005–2012: Past growth, current characteristics, and future possibilities. *Journal of the Association for Information Science and Technology*, 65(12), 2404–2421.
8. Scoulas, J. M., & De Groote, S. L. (2024). Use and importance of library resources to support faculty research and productivity. *College & Research Libraries*, 85(5), 669–690.

9. Vakkari, P. (2008). Perceived influence of the use of electronic information resources on scholarly work and publication productivity. *Journal of the American Society for Information Science and Technology*, 59(4), 602–612.

TOWARDS A COMMON RESEARCH ASSESSMENT FRAMEWORK: EVIDENCE ACROSS SCIENTIFIC FIELDS IN SERBIA

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INTRODUCTION

Contemporary research assessment is evolving from metrics-based evaluation towards more qualitative approaches that recognize diverse research contributions beyond publications and citation metrics. This evolution raises the question of whether researchers across scientific fields share common views on the contributions that should be recognized in research assessment. This study examines researchers' perceptions of research contributions across different scientific fields in Serbia.

LITERATURE REVIEW / THEORETICAL BACKGROUND

Research performance is increasingly recognized as a multidimensional concept extending beyond publication and citation metrics (Bazeley, 2010). At the same time, understandings of research quality and research performance are influenced by disciplinary and organizational contexts (Nedeva et al., 2023; Debernardi & Seeber, 2026). This leaves open the question of whether a common research

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assessment framework can recognise diverse research contributions while remaining sensitive to disciplinary contexts.

METHODOLOGY

The study is based on an online survey of 162 researchers from four scientific fields in Serbia (Social Sciences, n=64; Natural Sciences and Mathematics, n=38; Humanities, n=30; Engineering, Technological and Biotechnical Sciences, n=30), representing different career stages. The analysis focuses on responses to the question assessing the importance of research contributions. Average ratings were calculated for each research contribution and compared across scientific fields to identify shared and discipline-specific patterns in researchers' perceptions.

RESULTS

Across all scientific fields, research publications emerged as the most highly valued research contribution, confirming their central role in research assessment. At the same time, citations, project leadership, and mentorship were consistently recognised as important research contributions across disciplines, while interdisciplinarity also ranked highly in most scientific fields. However, the relative importance of several contributions varied across disciplines. Policy impact received higher ratings in the social sciences, while patents and technical solutions were more highly valued in engineering and technological sciences. Research databases were particularly recognised in the natural sciences. These findings reveal discipline-specific differences in the importance attached to individual research contributions, reflecting different pathways through which research contributes to science, society, and innovation. The results indicate substantial convergence around a shared core of research contributions, alongside differences that reflect disciplinary research contexts.

DISCUSSION / POLICY IMPLICATIONS

The ongoing shift from metrics-based to responsible research assessment has intensified the debate on how to evaluate diverse research contributions across different scientific fields (Hicks et al., 2015; Aubert Bonn & Bouter, 2023). While previous studies emphasize that research quality and evaluation are influenced by disciplinary contexts (Nedeva et al., 2023) and that peer-review judgements may vary across disciplines (Thelwall et al., 2023), our findings suggest that researchers nevertheless share a substantial core of research contributions that they consider important for assessment. These findings provide empirical evidence suggesting a

common qualitative research assessment framework, complemented by discipline-specific adaptations where needed.

CONCLUSION

The findings suggest that, despite disciplinary differences, researchers across scientific fields share a substantial core of research contributions that they consider important for research assessment. This provides empirical support for developing a common qualitative research assessment framework that recognizes diverse research contributions while remaining sufficiently flexible to accommodate disciplinary specificities. The study contributes to the ongoing debate on responsible research assessment by providing evidence from the Serbian research community, a context that remains underrepresented in the literature.

KEYWORDS

Responsible research assessment, research contributions, scientific fields, qualitative assessment, Serbia

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REFERENCES

1. Aubert Bonn, N., & Bouter, L. (2023). Research assessments should recognize responsible research practices: Narrative review of a lively debate and promising developments. Accountability in Research, 30(4), 227–257.
2. Bazeley, P. (2010). Conceptualising research performance. Studies in Higher Education, 35(8), 889–903.
3. Debernardi, A., & Seeber, M. (2026). Diversification over the scientific career: The impact of seniority, mobility and collaboration. Higher Education.
4. Hicks, D., Wouters, P., Waltman, L., De Rijcke, S., & Rafols, I. (2015). Bibliometrics: The Leiden Manifesto for research metrics. Nature, 520(7548), 429–431.

5. Nedeva, M., Tirado, M. M., & Thomas, D. A. (2023). Research governance and the dynamics of science: A framework for the study of governance effects on research fields. Research Evaluation, 32(1), 116–127.
6. Thelwall, M., Kousha, K., Stuart, E., Makita, M., Abdoli, M., Wilson, P., & Levitt, J. M. (2023). Does the perceived quality of interdisciplinary research vary between fields? Journal of Documentation, 79(6), 1514–1531.

THE HIDDEN DRAIN ON INNOVATION CAPACITY: STRUCTURAL PRECARITY OF WOMEN RESEARCHERS IN POST-SOCIALIST TRANSITION ECONOMIES: THE CASE OF LATVIA

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INTRODUCTION

Innovation systems depend on stable, motivated research workforces. Yet in post-socialist transition economies, structural precarity undermines this foundation. In Latvia, women dominate doctoral education but face systematic barriers to sustainable research careers. This hidden drain on innovation capacity - the loss of highly qualified women researchers - remains underrecognized in innovation policy. Although this study focuses on Latvia, its post-Soviet legacy, EU integration trajectory, and persistent gender employment gaps make it illustrative of broader challenges facing post-socialist transition economies. This study examines and documents this phenomenon using statistical indicators and qualitative interviews.

LITERATURE REVIEW / THEORETICAL BACKGROUND

Innovation system literature emphasizes human capital but overlooks gendered employment precarity (Lorey, 2015; Standing, 2011). The “leaky pipeline” costs economies both investment in doctoral training and foregone innovation output (European Commission, 2019). In transition economies, Soviet-era legacies of high female educational attainment coexist with contemporary precarious employment (Kuchumova et al., 2024). As one participant noted: women “are treated like a weak gender”.

METHODOLOGY

Mixed-methods design. Quantitative data from Central Statistical Bureau of Latvia (2023–2025) provide descriptive statistics on doctoral graduates (women majority), gender pay gap (15-17%), and employment patterns. Qualitative data from seven semi-structured interviews with women holding doctoral degrees in

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social sciences were analysed thematically to identify precarity mechanisms and well-being impacts. Purposive sampling covered diverse career stages, employment statuses (academic, leavers, non-academic), and geographic locations (Riga, Kurzeme, Vidzeme, Latgale).

RESULTS

The doctorate does not guarantee stability: “the degree itself had not given me any significant contribution to employment stability” (Participant F). Precarity generates chronic stress: “psychological health was under strain, consequently physical health also began to deteriorate” (Participant B). Institutional support is absent: “no mentoring opportunities, no career consultations” (Participant F). Geographic disadvantage compounds precarity: regional universities offered salaries not covering travel costs (Participant E). Talented researchers leave: “I chose a job where I receive adequate pay” (Participant D).

DISCUSSION / POLICY IMPLICATIONS

This hidden drain undermines innovation capacity through three mechanisms: direct loss of doctoral investment, reduced research productivity from stressed researchers, and damaged ecosystem resilience. Peri-Rotem (2019, p. 12) argues institutions “should expand permanent positions over fixed-term contracts”. Recommendations: stable career pathways, transparent salary structures (Grassi, Savioli, 2025), psychological support (Deroncele-Acosta et al., 2025), mentoring, geographic equity measures, and multi-year research funding. Policy must address structural precarity, not demand individual resilience.

CONCLUSION

Latvia's innovation system suffers a hidden drain: women researchers exit academia due to structural precarity despite high educational investment. The well-being costs - stress, exhaustion, attrition - directly impair research capacity. Without reform, gender disparities persist and innovation potential remains unrealized. Recognizing researcher precarity as an innovation policy problem, not merely a labour market issue, is essential for transition economy sustainability

KEYWORDS

Innovation capacity, research precarity, gender equality, transition economies, human capital drain

REFERENCES

1. Central Statistical Bureau of Latvia. (2025). Population by educational attainment. Retrieved from: https://stat.gov.lv/en/statistics-themes/education/level-education/7385-population-educational-attainment?themeCode=IZ
2. Deroncele-Acosta, A., et al. (2025). Women's mental health in the doctoral context. Women's Health, p. 1-24.
3. European Commission. (2019). She figures 2018. Retrieved from: https://research-and-innovation.ec.europa.eu/knowledge-publications-tools-and-data/publications/all-publications/she-figures-2018_en
4. Grassi, E., Savioli, M. (2025). Break the glass ceiling? Higher Education, p. 1-21.
5. Kuchumova, G., et al. (2024). Women's STEM persistence in Kazakhstan. *Journal of Career Development*, 51(3), p. 408-428.
6. Lorey, I. (2015). State of insecurity: Government of the Precarious. Verso Books. pp.154.
7. Peri-Rotem, N. (2019). Gendered career pathways among doctoral graduates. *Social Sciences*, 8(11), pp. 317.
8. Standing, G. (2011). *The Precariat: The New Dangerous Class*. London: Bloomsbury Academic. pp. 198.

MODELLING SPATIAL DEPENDENCE IN S&T EMPLOYMENT: SAR, SEM AND SAC EVIDENCE FROM VISEGRAD COUNTRIES

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INTRODUCTION

This study examines the determinants of the share of tertiary-educated employees in the science and technology (S&T) sector across Visegrad countries NUTS-2 regions. It focuses on how regional socio-economic conditions and spatial interdependencies shape the concentration of high-skilled labour, addressing persistent regional disparities in knowledge-intensive employment.

LITERATURE REVIEW / THEORETICAL BACKGROUND

The analysis builds on agglomeration theory and new economic geography (Krugman, 2011), emphasising spatial dependence in regional labour markets (Gómez-Tello et al., 2025). Prior studies show that human capital and skilled employment may exhibit spillovers through knowledge diffusion and labour mobility, but also competition effects where leading regions attract talent from neighbours (Gómez-Tello et al., 2025). This motivates spatial econometric modelling of interregional dependence.

METHODOLOGY

To account for spatial dependence of human capital in the S&T sector, Spatial Autoregressive (SAR), Spatial Error (SEM), and Spatial Autoregressive Combined (SAC) panel models (Belotti et al., 2017; LeSage & Pace, 2009) were estimated using data for 35 regions observed over 8 years. Time fixed effects and cluster-robust standard errors were applied. Spatial interactions were specified using the rook contiguity weights matrix. Model selection was based on information criteria (AIC/BIC) and the statistical significance of spatial parameters.

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RESULTS

Model comparison favoured the SAC specification (AIC=416.98), although results were substantively consistent across models. Population density exerted a positive and significant effect on S&T sector development ($\beta \approx 0.58–0.62$, $p<0.001$). The share of population with primary education and unemployment showed significant negative effects. Agricultural specialization was not significant. The spatial autoregressive coefficient was negative and significant ($\rho=-0.088$, $p=0.006$).

DISCUSSION / POLICY IMPLICATIONS

Population density positively affects S&T sector development, confirming agglomeration economies and urban concentration of high-skilled labour. Higher primary education shares and unemployment reduce S&T activity, indicating weaker human capital and labour market conditions. Negative spatial dependence suggests competition rather than spillovers, with skilled labour concentrating in leading regions. Policy should strengthen human capital and labour markets in lagging regions.

CONCLUSION

Higher population density significantly increases S&T employment with tertiary education, while higher primary education shares and unemployment reduce it. Spatial dependence is negative, indicating competition rather than diffusion across regions. Overall, results suggest that skilled S&T labour concentrates in more developed, dense regions, reinforcing regional disparities rather than converging across space.

KEYWORDS

S&T, spatial autoregressive model, spatial error model, spatial autoregressive combined model, Visegrad countries

REFERENCES

1. Belotti, F., Hughes, G., & Mortari, A. P. (2017). Spatial panel-data models using Stata. *The Stata Journal*, 17(1), 139-180.
2. Gómez-Tello, A., Murgui-García, M. J., & Sanchis-Llopis, M. T. (2025a). Agglomeration and human capital: an extended spatial Mankiw-Romer-Weil model for European regions. *Empirica*, 52(3), 523–557.

3. Gómez-Tello, A., Murgui-García, M. J., & Sanchis-Llopis, M. T. (2025b). Labour productivity disparities in European regions: the impact of agglomeration effects. *The Annals of Regional Science*, 74(3), 69.
4. Krugman, P. (2011). The New Economic Geography, Now Middle-aged. *Regional Studies*, 45(1), 1–7.
5. LeSage, J. P., & Pace, R. K. (2009). *Spatial econometric models*. In Handbook of applied spatial analysis: Software tools, methods and applications (pp. 355-376). Berlin, Heidelberg: Springer Berlin Heidelberg.

THE NON-LINEAR ROLE OF ACADEMIC PARTNER QUALITY IN ACADEMIA-INDUSTRY COLLABORATION: EVIDENCE FROM INDIA

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INTRODUCTION

In knowledge-based economies, innovative firms leverage academia-industry relationships to obtain advantages from scientific and technical interactions (Scandura, 2016). Nonetheless, evidence is paradoxically inconclusive concerning the influence of academic quality. This study examines what determine the likelihood and intensity of academia-industry collaboration, measured through co-patenting activity, and makes two major contributions. First, we demonstrate that academic partner quality, measured by citation-weighted publications, impacts collaboration intensity non-linearly in a U-shaped manner. Second, we examine the non-linear relationships between geographic proximity and academia-industry collaboration in India.

LITERATURE REVIEW / THEORETICAL BACKGROUND

The quality of the academic partner has received increased attention recently. It has two conflicting implications for a potential industrial partner (Scandura & Iammarino, 2022). On one hand, the scarcity of resources for researchers at low quality universities would incentivise academia to engage with industry for acquiring research funding. On the other hand, a stronger research environment could generate a stronger incentive for top researchers in high-quality institutes to conduct fundamental research rather than with industry. Existing studies predominantly examine the effect of academic quality assuming a linear relationship. Whether this relationship is inherently non-linear remains largely unexplored. The geographic distance between collaborating partners also determines research collaborations, although previous findings are inconclusive,

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reporting positive, negative and insignificant effects (Boschma, 2005; Capello et al., 2018). Lastly, IPR policy also influences firms' decision and intensity to collaborate with academic institutions (Cassiman & Veugelers, 2002).

METHODOLOGY

The paper draws information on co-patenting activities of 110 R&D-intensive firms that collaborate with Indian academic partners during 2000-2022. Academic partner quality is based on Scopus bibliometric data and measured by citation-weighted publications of academic partners. Geographic proximity is calculated using Haversine formula. IPR is constructed as a dummy for the National IPR Policy of 2016. Firm level controls are also included. For the methodology, a two-step Heckman model comprising a Probit selection model and a negative binomial outcome model is estimated to address sample selection bias. The non-linear relationships are further validated using the Lind & Mehlum (2010) test.

RESULTS

Results from the first step Heckman indicate that the likelihood of academia-industry collaboration is significantly influenced by several firm-level characteristics, such as firm size, firm location in a science/technology park and IPR policy. R&D intensity, employee compensation, firm age, and ownership have no significant effect. The second step Heckman shows that academic partner quality exhibits a statistically significant non-linear relationship with co-patenting activity. The linear effect is negative and significant, while the squared term is positive and significant, suggesting a U-shaped function. With respect to geographic proximity, we observe a significant curvilinear relationship between geographic distance and collaboration intensity, indicating an inverted-U relationship. We do not find any impact of IPR on collaboration intensity.

DISCUSSION / POLICY IMPLICATIONS

This study demonstrates that academic partner quality affects co-patenting intensity non-linearly. As academic quality increases from low to moderate levels, firms reduce research collaborations with academic institutions. However, as academic quality increases beyond a certain threshold, collaborations become more intensive. Geographic proximity also demonstrates a non-linear relationship, suggesting that a moderate distance between the firm and academic institution is beneficial while excessive distance or excessive closeness is detrimental. While firms should prioritise research-intensive academic partners for innovation,

policymakers should support emerging universities in the mid-quality spectrum in building the capabilities needed to attract industry collaborations.

CONCLUSION

This study determines the factors affecting academia-industry collaboration in India. Findings reveal a U-shaped relationship between academic partner quality and collaboration intensity, an inverted U-shaped relationship for geographic proximity, and a positive effect of IPR policy on the likelihood, but not the intensity, of collaboration.

KEYWORDS

Academia-industry collaboration, citation-weighted publications, geographical proximity, intellectual property rights

REFERENCES

1. Boschma, R. (2005). Proximity and innovation: a critical assessment. *Regional Studies*, 39(1), 61-74.
2. Capello, R., Caragliu, A., & Fratesi, U. (2018). Measuring border effects in European cross-border regions. *Regional Studies*, 52(7), 986-996.
3. Cassiman, B., & Veugelers, R. (2002). R&D cooperation and spillovers: some empirical evidence from Belgium. *American Economic Review*, 92(4), 1169-1184.
4. Lind, J. T., & Mehlum, H. (2010). With or without U? The appropriate test for a U-shaped relationship. *Oxford Bulletin of Economics and Statistics*, 72(1), 109-118.
5. Scandura, A. (2016). University–industry collaboration and firms' R&D effort. *Research Policy*, 45(9), 1907-1922.
6. Scandura, A., & Iammarino, S. (2022). Academic engagement with industry: the role of research quality and experience. *The Journal of Technology Transfer*, 47(4), 1000-1036.

RETHINKING HIGHER EDUCATION FOR CIRCULAR AND CREATIVE SOCIETIES: FOSTERING POLICY, ENTREPRENEURSHIP AND SUSTAINABILITY IN THE WESTERN BALKANS

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INTRODUCTION

The transition from linear to circular models of the economy has become a policy priority for the Western Balkans (WB), aligning with the Green Agenda and European Union (EU) integration. This study aims to explore how Higher Education Institutions (HEIs), crucial stakeholders in the circular economy transition, can support the transition towards a circular and creative society, especially through fostering entrepreneurship and sustainability, concepts that are neglected.

LITERATURE REVIEW / THEORETICAL BACKGROUND

A growing body of literature focuses on the role of universities in the sustainable and green transition, especially through their third-mission activities, which are intertwined with their role in Quadruple Helix models, highlighting the crucial role of the circular economy (Giannoccaro et al., 2021; Mitrović & Pešalj, 2023; Vergani, 2024). The majority of the studies place little focus on creativity and entrepreneurship and their impact on the development of circular and creative societies (Davis & Charter, 2025; Del Vecchio et al., 2021; Tiippana-Usvasalo et al., 2023).

METHODOLOGY

The study employs qualitative methods compatible with its exploratory nature. It is based on a comparative policy analysis of the 6 WB countries: Albania, Bosnia and Herzegovina, Kosovo*, Montenegro, North Macedonia, and Serbia. Document analysis was used to analyze higher education strategies, smart specialization

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* This designation is without prejudice to positions on status, and is in line with UNSCR 1244/1999 and the ICJ Opinion on the Kosovo declaration of independence.

strategies, entrepreneurship strategies, innovation strategies, and circular economy roadmaps.

RESULTS

Higher education strategies in the WB countries highlight the importance of sustainability, innovation, and entrepreneurship, but the circular and creative aspects are not fully integrated into other strategic documents. For example, in Albania, the importance of the third mission and sustainable competences is embedded in the strategy for higher education. Still, with no concrete reference to circularity and creativity, it remains underexplored. The majority of strategic documents lack coherence, limiting HEIs' capacity to transition to a circular and creative society, despite their potential for entrepreneurship education and societal impact.

DISCUSSION / POLICY IMPLICATIONS

There is a need to rethink the role of HEIs in the circular transition, particularly by addressing societal and creative dimensions. Creativity and circularity should be integrated not only into entrepreneurship education but also into joint projects with diverse stakeholders within the Quadruple Helix Model that focus on these aspects. What is really lacking in WB countries is policy coherence and effective partnerships among HEIs, industry, government, and civil society.

CONCLUSION

This study highlights the role of HEIs in the transition towards circular and creative societies in the WB. The circular aspects need to be integrated not only into teaching and research but also into universities' third mission, where creativity and entrepreneurship can find their appropriate space.

KEYWORDS

Circular society, creativity, HEIs, Western Balkans

REFERENCES

1. Davis, T., & Charter, M. (2025b). Creative Industries and the Circular Economy: a reality check across global policy, practice, and research. *Sustainability*, 17(23), 10460. https://doi.org/10.3390/su172310460
2. Del Vecchio, P., Secundo, G., Mele, G., & Passiante, G. (2021). Sustainable entrepreneurship education for circular economy: emerging perspectives in Europe.

International Journal of Entrepreneurial Behaviour & Research, 27(8), 2096–2124. https://doi.org/10.1108/ijebr-03-2021-0210

3. Giannoccaro, I., Ceccarelli, G., & Fraccascia, L. (2021). Features of Higher Education for the Circular Economy: The Case of Italy. *Sustainability*, 13(20), 11338.https://doi.org/10.3390/su132011338
4. Mitrović, Đ., & Pešalj, B. (2023). The development of circular economy in Western Balkan countries. *International Scientific Conference on Economics, Management and Information Technologies*, 1(1), 65–70. https://doi.org/10.46793/ICEMIT23.065M
5. Tiippana-Usvasalo, M., Pajunen, N., & Maria, H. (2023). The role of education in promoting circular economy. *International Journal of Sustainable Engineering*, 16(1), 92–103. https://doi.org/10.1080/19397038.2023.2210592
6. Vergani, F. (2024). Higher Education Institutions as a Microcosm of the Circular Economy. *Journal of Cleaner Production*, 435, 140592.https://doi.org/10.1016/j.jclepro.2024.140592

ADAPTIVE GOVERNANCE FOR ENTREPRENEURIAL AI: CHINA'S REGULATORY FRAMEWORK AND INTERNATIONAL INNOVATION COLLABORATION

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INTRODUCTION

Artificial intelligence has become a cornerstone of economic transformation, yet its governance poses acute challenges for policymakers who must balance innovation promotion with risk mitigation. In China, where the state has simultaneously pursued technological sovereignty and a vibrant entrepreneurial ecosystem, regulatory design is especially consequential. Recent scholarship reveals a deliberate, iterative approach that combines stringent algorithmic oversight with targeted support for startups, making China a unique laboratory for studying the regulation-entrepreneurship nexus (Wang & Wang, 2025; Zhu et al., 2025). This paper interrogates how China's evolving AI regulatory architecture influences entrepreneurial activity and how international cooperation amplifies domestic innovation capacity, thereby contributing to the global discourse on adaptive AI governance. Specifically, we address the central research question: How does China's adaptive regulatory framework for AI shape entrepreneurial outcomes, and what role does international collaboration play in enhancing innovation capacity?

LITERATURE REVIEW / THEORETICAL BACKGROUND

The study is grounded in the Porter Hypothesis, which posits that well-designed regulation can stimulate innovation and enhance competitiveness (Porter & van der Linde, 1995), and in institutional theory, which emphasizes how formal rules and informal norms structure entrepreneurial behaviour (North, 1990). Regulatory sandboxes—controlled environments that allow firms to test novel technologies under relaxed rules—are conceptualized as institutional catalysts

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that lower compliance costs while enabling regulators to learn by doing (Cantero Gamito, 2023). These lenses jointly explain why China's hybrid model of centralized, state-first regulation combined with local experimentation, open-source promotion and government venture capital can foster corporate and youth entrepreneurship while still addressing content safety, data security and algorithmic fairness concerns (Gofman & Jin, 2024; Jia, 2023; Zysman & Kenney, 2023). Recent scholarship has further highlighted China's adaptive political entrepreneurship in global AI governance, emphasizing the policy entrepreneur network perspective (Zhang & Cai, 2026).

METHODOLOGY

The research employs a multi-method design. First, a systematic review of Chinese AI regulations enacted between 2017 and 2025 was conducted, covering the Cybersecurity Law (2017), the Algorithmic Recommendation Provisions (2022), the Interim Measures for Generative AI (2023) and the Global AI Governance Action Plan (2024). Second, econometric analyses were performed on panel data from 285 Chinese cities and firm-level surveys (2018–2024), using difference-in-differences and hierarchical regression techniques to isolate the causal effects of AI policies on entrepreneurship (Chen & Cheng, 2025; Fang et al., 2024). The empirical analysis integrates four analytical dimensions: (1) place-based AI pilot policies and youth entrepreneurship; (2) financial regulation and AI entrepreneurial activity; (3) AI governance and corporate entrepreneurship; and (4) international cooperation mechanisms. Third, comparative case studies of China, the European Union and the United States were used to contextualize China's approach within the broader international regulatory landscape and to trace collaboration channels such as the World Artificial Intelligence Cooperation Organization (WAICO) (Wang et al., 2026).

RESULTS

The analysis yields four main findings. First, place-based AI pilot policies significantly raise the probability of youth entrepreneurship, largely by substituting digital rules for informal guanxi and relaxing credit constraints (Wang, 2026). Second, enhanced financial regulation, contrary to conventional wisdom, can stimulate AI entrepreneurship through FinTech innovation, though it generates negative spill-over effects on neighbouring cities (Chen & Cheng, 2025). Third, AI governance and utilization positively affect corporate entrepreneurship, with top management beliefs strengthening the effect while passive participation weakens it (Fang et al., 2024). Fourth, China's international initiatives—such as

the AI+ International Cooperation Initiative and the proposed WAICO—create cross-border open-source ecosystems that accelerate knowledge diffusion and offer scalable lessons for inclusive innovation policy (Li et al., 2024; Zhang & Cai, 2026). Together, these findings demonstrate that China's adaptive governance approach enables a synergistic relationship between regulatory oversight and entrepreneurial dynamism.

DISCUSSION / POLICY IMPLICATIONS

Policymakers should adopt proportionate, transparent and differentiated regulation that avoids the "zero-risk" trap, which can stifle experimentation (Zhu et al., 2025). Institutionalizing regulatory sandboxes and special governance mechanisms for small and medium-sized enterprises can level the playing field (Cantero Gamito, 2023). Aligning domestic rules with emerging global standards through bodies like WAICO reduces trade frictions and fosters mutual recognition of certifications (Wang et al., 2026). Finally, investment in digital public infrastructure, open-source platforms and AI ethics education can build public trust and ensure that the entrepreneurial benefits of AI are broadly shared (Zhou et al., 2024; Zhang, 2024).

CONCLUSION

China's experience demonstrates that AI regulation need not be a trade□off between control and creativity. A deliberately designed, adaptive governance framework can channel entrepreneurial energy toward socially desirable ends while mitigating genuine harms (Pi, 2023; Wang et al., 2026). International collaboration amplifies these effects by expanding market access, harmonizing standards and promoting responsible innovation norms (Zhang & Cai, 2026). As governments worldwide grapple with similar dilemmas, China's evolving model—despite its imperfections—offers a valuable reference point for constructing AI governance regimes that are both protective and permissive (Zysman & Kenney, 2023; Allen, 2025).

KEYWORDS

Artificial intelligence regulation, entrepreneurship, China, innovation policy, international collaboration

REFERENCES

1. Allen, G. (2025). AI development and the 'fuzzy logic' of Chinese cyber security and data laws. *Edinburgh University Press*.
2. Cantero Gamito, M. (2023). The influence of China in AI governance through standardisation. *Telecommunications Policy*, 47(10), 102673.
3. Chen, X., & Cheng, X. (2025). Enhanced financial regulation and AI entrepreneurship: Evidence from Chinese cities. *Cities*, 165, 106140.
4. Fang, C., Li, H., & Wang, Y. (2024). AI utilization and governance in corporate entrepreneurship: Investigating the moderating influence of top management. *ICEB 2024 Proceedings*, 65.
5. Gofman, M., & Jin, Z. (2024). Government as Venture Capitalists in Artificial Intelligence. *NBER Working Paper*.
6. Jia, S. (2023). Artificial Intelligence Governance and China's Experience under the Community of Common Destiny for Mankind Concept. *National Research University Higher School of Economics Working Paper*.
7. Koning, R. (2024). The Uneven Impact of Generative AI on Entrepreneurial Performance. *Innovation & Entrepreneurship Seminar, Max Planck Institute*.
8. Li, B., Xiong, S., & Zhou, A. (2024). Navigating the Complexities of AI Regulation in China. *AI Transparency Institute Report*.
9. Luyao Zhang & Cuihong Cai. (2026). Adaptive Political Entrepreneurship in Global Artificial Intelligence Governance: A Policy Entrepreneur Network Perspective. *Politica Internacional*, VIII(2), 192-212.
10. Pi, Y. (2023). Missing Value Chain in Generative AI Governance: China as an example. *NeurIPS Workshop Paper*.
11. Wang, J., & Wang, C. (2025). AI Governance in China: A Tale of Three Digital Empires. *Journal of Chinese Governance*.
12. Wang, J., Wang, C., & Wu, X. (2026). Centralization, Risk, and Innovation: A Two-Axis Framework for China's Generative AI Governance in Comparative Perspective. *Texas International Law Journal*, 61.
13. Wang, L. (2026). Leveraging artificial intelligence policy for inclusive and sustainable youth entrepreneurship: micro evidence from China. *Frontiers in Public Health*, 14, 1745563.
14. Zhang, J. (2024). The Value Dialectics and Institutional Construction of the New Generation Generative Artificial Intelligence Assisting the Deep Optimization of the National Innovation System. *Science & Technology Progress and Policy*. DOI: 10.6049/kjjbydc.2023080496.
15. Zhou, Y., Yan, L., & Liu, X. (2024). A quantitative study of disruptive technology policy texts: An example of China's artificial intelligence policy. *Journal of Data & Information Science*, 9(3), 155-180.
16. Zhu, Y., et al. (2025). China's emerging AI regulation could foster an open and safe future for AI. *Science*, 388, 1234-1237.

17. Zysman, J., & Kenney, M. (2023). Governing Silicon Valley and Shenzhen: Assessing a New Era of Artificial Intelligence Governance in the US and China. *Telecommunications Policy*, 47(10), 102674.

COORDINATION WITHOUT INCLUSION? TRANSREGIONAL GOVERNANCE OF EMERGING TECHNOLOGIES AND THE LIMITS OF THE GLOBAL PARTNERSHIP ON ARTIFICIAL INTELLIGENCE

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INTRODUCTION

Artificial intelligence (AI) is an emerging technology whose diffusion outpaces its governance, producing a fragmented landscape, while digital divide concentrates capabilities and standard-setting in advanced economies. The rapid evolution of AI has exposed the limitations of isolated regulatory approaches, posing two challenges for international policy coordination (see Bradford 2023): governing an emerging technology in a coherent and inclusive manner. The paper investigates whether transregional cooperation can make the global governance of AI more coordinated and more inclusive, through the Global Partnership on Artificial Intelligence (GPAI) as a case study.

LITERATURE REVIEW / THEORETICAL BACKGROUND

This literature review covers three academic fields. First, global governance regime complexity and fragmentation (Raustiala & Victor 2004; Alter & Meunier 2009; Biermann et al. 2009; Orsini, Morin & Young 2013), including AI governance (Cihon, Maas & Kemp 2020; Tallberg et al. 2023). Second, regional studies, which have recently started to engage with AI governance (Keith 2024; Acharya et al. 2026). Third, transregionalism (Hettne 2005), which the analysis of GPAI requires. It foregrounds the "actors and structures mediating between regions" (Ibid.) which "are voluntary and cooperative but can become more or less institutionalized and formalized" (Ibid.).

METHODOLOGY

The paper adopts a qualitative single-case study design (Gerring 2007; Yin 2018). GPAI is selected as a critical case: the most institutionalised transregional body dedicated to AI governance and, particularly following its integrated partnership with the OECD in 2024, an explicit test of whether deeper institutionalisation

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widens or narrows participation. The method is qualitative document analysis (Bowen 2009) of GPAI and OECD documents. Findings are triangulated through comparison with secondary academic literature.

RESULTS

GPAI exemplifies institutionalised transregional governance of an emerging technology. Its July 2024 integrated partnership with the OECD joined 44 members across six continents on an equal footing (OECD 2024), up from 15 in 2020. The analysis reveals a coordination–inclusion trade-off: unified governance bodies improved coordination and cut duplication, yet agenda-setting stayed concentrated among established members. Participation widened faster than influence redistributed.

DISCUSSION / POLICY IMPLICATIONS

A core dilemma: institutionalisation that improves coordination can strengthen advanced-economy influence, deepening the gap for the least represented. Three implications: redistribute agenda-setting authority and expert capacity, not just seats; align GPAI with relevant global initiatives to reduce overlap and fragmentation; and improve the position of developing economies. In practice, this would require rotating agenda-setting roles (e.g. co-chairs), quota-based expert nomination, and periodic review of Steering Committee composition. The same trade-off applies to other institutionalising AI efforts, suggesting it is generalisable beyond GPAI. The example of Serbia, 2024 Belgrade Ministerial host and Steering Committee member, shows smaller states' agency and the limits of participation without agenda-setting power.

CONCLUSION

Transregionalism offers a useful lens on the global governance of emerging technologies. GPAI shows that voluntary, institutionalised cooperation can mediate between regions and reduce fragmentation, yet institutionalisation does not ensure inclusion, as participation expands faster than influence is redistributed. Whether GPAI advances inclusive AI governance depends on a rebalancing influence between the Global North and Global South, a key test for coordinating innovation policy under geopolitical uncertainty.

KEYWORDS

Global governance of emerging technologies, transregionalism, artificial intelligence (AI), digital divide, Global Partnership on Artificial Intelligence (GPAI)

REFERENCES

1. Acharya, A., De Lombaerde, P., Futák-Campbell, B., Iroulo, L. C., & Peixoto Batista, J. (Eds.). (2026). *Essays on Global Regionalism II: Will Regions Save the World?* Springer.
2. Alter, K. J., & Meunier, S. (2009). The Politics of International Regime Complexity. *Perspectives on Politics*, 7(1), 13–24.
3. Biermann, F., Pattberg, P., van Asselt, H., & Zelli, F. (2009). The Fragmentation of Global Governance Architectures: A Framework for Analysis. *Global Environmental Politics*, 9(4), 14–40.
4. Bowen, G. A. (2009). Document Analysis as a Qualitative Research Method. *Qualitative Research Journal*, 9(2), 27–40.
5. Bradford, A. (2023). *Digital Empires: The Global Battle to Regulate Technology*. Oxford University Press.
6. Cihon, P., Maas, M. M., & Kemp, L. (2020). Fragmentation and the Future: Investigating Architectures for International AI Governance. *Global Policy*, 11(5), 545–556.
7. Digital Watch Observatory. (n.d.). *Global Partnership on Artificial Intelligence (GPAI).* DiploFoundation. https://dig.watch/actor/global-partnership-on-artificial-intelligence.
8. Geith, J., Lundgren, M., & Tallberg, J. (in press). The Emerging Regime Complex for Artificial Intelligence. *Global Studies Quarterly*.
9. Gerring, J. (2007). *Case Study Research: Principles and Practices*. Cambridge University Press, Cambridge.
10. Government of the Republic of Serbia. (2024, December 4). *Global Partnership on Artificial Intelligence Summit*. https://www.srbija.gov.rs/specijal/en/236368
11. Hettne, B. (2005). Beyond the 'New' Regionalism. *New Political Economy*, 10(4), 543–571.
12. Keith, A.J. (2024) Governance of Artificial Intelligence in Southeast Asia. *Global Policy*, 15, 937–954.
13. OECD.AI. (n.d.). *About the Global Partnership on Artificial Intelligence (GPAI).* https://oecd.ai/en/about/about-gpai
14. Organisation for Economic Co-operation and Development. (n.d.). *Global Partnership on Artificial Intelligence*. OECD. https://www.oecd.org/en/about/news/speech-statements/2024/07/GPAI-and-OECD-unite-to-advance-coordinated-international-efforts-for-trustworthy-AI.html
15. Organisation for Economic Co-operation and Development. (2024, July 3). GPAI and OECD Unite to Advance Coordinated International Efforts for Trustworthy AI. OECD. .
16. Orsini, A., Morin, J.-F., & Young, O. (2013). Regime Complexes: A Buzz, a Boom, or a Boost for Global Governance? *Global Governance*, 19(1), 27–39.

17. Raustiala, K., & Victor, D. G. (2004). The Regime Complex for Plant Genetic Resources. *International Organization*, 58(2), 277–309.
18. Tallberg, J., Erman, E., Furendal, M., Geith, J., Klamberg, M., & Lundgren, M. (2023). The Global Governance of Artificial Intelligence: Next Steps for Empirical and Normative Research. *International Studies Review*, 25(3).
19. Wyckoff, A. W. (2024, September 20). A New Institution for Governing AI? Lessons from GPAI. *Brookings Institution*. https://www.brookings.edu/articles/a-new-institution-for-governing-ai-lessons-from-gpai/.
20. Yin, R. K. (2018). *Case Study Research and Applications: Design and Methods* (6th ed.). Thousand Oaks, CA: Sage.

NATIONAL CULTURAL DIMENSIONS AND GOVERNMENT AI READINESS: A PILLAR-LEVEL ANALYSIS OF EUROPEAN COUNTRIES

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INTRODUCTION

Artificial intelligence (AI) is becoming a strategic priority for governments worldwide. While previous studies have mainly examined technological, institutional and economic determinants of AI readiness, considerably less attention has been paid to national culture. This study investigates whether Hofstede's cultural dimensions are associated with different pillars of Government AI Readiness across European countries.

LITERATURE REVIEW / THEORETICAL BACKGROUND

Research on national culture suggests that cultural values influence innovation, digital transformation and public sector modernization (Schneider et al., 2014; Taras et al., 2010). Hofstede's cultural dimensions remain one of the most widely applied frameworks for cross-country comparisons (Hofstede, 2001), although alternative approaches such as the GLOBE study have also contributed to the understanding of cultural differences (House et al., 2004; Dorfman et al., 2012). However, empirical evidence linking cultural dimensions with government AI readiness is still limited. This study extends existing literature by examining relationships between culture and individual AI readiness pillars rather than only the overall index.

METHODOLOGY

The study applies a comparative cross-country design based on secondary data. Government AI Readiness Index 2025 data from Oxford Insights (2025) were merged with Hofstede's cultural dimensions for 28 European countries (Hofstede Insights, 2024). Pearson correlation analysis and standardized multiple regression with HC3 robust standard errors were performed to examine relationships

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between Power Distance, Individualism, Uncertainty Avoidance, Long-Term Orientation and seven AI readiness outcomes.

RESULTS

The findings indicate that national cultural dimensions are associated with Government AI Readiness unevenly across its pillars. The strongest relationships were observed for the Governance and Development & Diffusion pillars, where lower Power Distance and higher Individualism were consistently linked to higher performance. Ten of twenty-eight bivariate correlations were statistically significant, while robust regression analyses confirmed significant effects of Power Distance for these two pillars. These findings suggest that cultural influences are concentrated in institutional and innovation-related aspects of AI readiness rather than across all dimensions equally.

DISCUSSION / POLICY IMPLICATIONS

The findings suggest that national culture is associated primarily with institutional aspects of AI readiness rather than with all dimensions equally. Governments seeking to strengthen AI readiness should complement technological investments with institutional reforms that promote transparent governance and innovation-supportive public administration. The results further imply that AI governance strategies should be adapted to different institutional contexts, as cultural characteristics may shape the effectiveness of governance reforms and innovation policies. Culture should be considered a contextual factor in AI policy design.

CONCLUSION

This study contributes to the emerging literature on AI governance by demonstrating that national cultural dimensions are differentially associated with Government AI Readiness. The strongest relationships concern Governance and Development & Diffusion, whereas other pillars appear less culturally sensitive. Future research should examine whether national innovation capacity mediates these relationships using broader cross-country datasets.

KEYWORDS

Government AI readiness, national culture, Hofstede, artificial intelligence

REFERENCES

1. Dorfman, P. W., Javidan, M., Hanges, P. J., Dastmalchian, A., & House, R. J. (2012). GLOBE: A twenty-year journey into the intriguing world of culture and leadership. *Journal of World Business*, 47(4), 504–518.
2. Hofstede Insights. (2024). *Country comparison tool*. https://www.hofstede-insights.com
3. Hofstede, G. (2001). *Culture's consequences: Comparing values, behaviors, institutions and organizations across nations* (2nd ed.). Sage.
4. House, R. J., Hanges, P. J., Javidan, M., Dorfman, P., & Gupta, V. (Eds.). (2004). *Culture, leadership, and organizations: The GLOBE study of 62 societies*. Sage.
5. Oxford Insights. (2025). *Government AI Readiness Index 2025*. https://oxfordinsights.com/ai-readiness/ai-readiness-index/
6. Schneider, S. C., Barsoux, J. L., & Stahl, G. K. (2014). *Managing across cultures* (3rd ed.). Pearson.
7. Taras, V., Kirkman, B. L., & Steel, P. (2010). Examining the impact of culture's consequences: A three-decade, multilevel, meta-analytic review of Hofstede's cultural value dimensions. *Journal of Applied Psychology*, 95(3), 405–439.

ANTICIPATING REGULATORY PUBLICS: AN LLM FRAMEWORK FOR CROSS-DOCKET ANALYSIS OF PUBLIC COMMENTS

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INTRODUCTION

When agencies change the scope of a proposed rule, the participating public may also change. Previously active groups may disappear, while new citizens or organizations may enter the process for the first time. This paper asks whether LLM-based analysis of prior public comments can help anticipate which publics will remain, disappear, or newly emerge when regulatory scope changes.

LITERATURE REVIEW / THEORETICAL BACKGROUND

The study draws on policy feedback theory, which explains how policies shape future participation, connective action theory, which explains mobilization without formal organization, and computational rulemaking research. It extends this literature by moving from single-docket NLP analysis toward comparison across successive regulatory dockets.

METHODOLOGY

The case study covers two U.S. Environmental Protection Agency vehicle-emissions public comment dockets. Stage 1 uses 1,784 comments from Docket A to construct a persona space, meaning a structured map of recurring participant types and argument frames, through BERTopic topic modeling and LLM-based persona synthesis. Stage 2 classifies 3,153 Docket B comments by semantic similarity as strong matches, weak matches, new discourse, or non-substantive submissions.

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RESULTS

Validation supports the reference corpus as a usable baseline, with 100% topic coverage, zero spurious topics, and Spearman rho = 0.36. Transfer analysis shows that 83.9% of Docket B participation matches the anticipated persona space. The remaining 16.1% reveals unanticipated participation patterns: absent environmental justice personas, with a substantial participation gap (Cohen's d = 0.771), and 215 new anti-mandate comments.

DISCUSSION / POLICY IMPLICATIONS

The findings show two participation failure modes. Absent personas suggest policy feedback deactivation, where frames tied to a previous regulatory target lose relevance. New anti-mandate comments suggest connective action activation, where a scope shift makes vehicle choice personally salient to citizens with no prior regulatory record.

CONCLUSION

The paper introduces a cross-docket framework for analyzing regulatory participation with LLM-based persona synthesis and validation. By comparing prior and later public comment spaces, agencies can identify likely continuities, gaps, and newly emerging publics earlier in the rulemaking process, supporting more inclusive and anticipatory governance. The approach can be applied to other regulatory contexts where scope shifts between successive rulemakings.

KEYWORDS

Regulatory rulemaking, public participation, LLM-based analysis, policy feedback, connective action.

REFERENCES

1. Bennett, W. L., & Segerberg, A. (2012). The logic of connective action. Information, *Communication & Society*, 15(5), 739-768.
2. Grootendorst, M. (2022). BERTopic: Neural topic modeling with a class-based TF-IDF procedure. *arXiv* (Cornell University).
3. Livermore, M. A., Eidelman, V., & Grom, B. (2018). Computationally assisted regulatory participation. *Notre Dame Law Review*, 93(3), 977-1034.
4. Mettler, S., & Soss, J. (2004). The consequences of public policy for democratic citizenship. *Perspectives on Politics*, 2(1), 55-73.

5. Pierson, P. (2000). Increasing returns, path dependence, and the study of politics. *American Political Science Review*, 94(2), 251-267.

THE DECISION TO IMPOSE MANDATORY VERTICAL INTEROPERABILITY: A DOUBLE-EDGED SWORD FOR INNOVATION INCENTIVES IN THE DIGITAL MARKETS

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INTRODUCTION

In the recent year the EU Commission and CJEU rendered more decisions regarding mandatory interoperability in light of the recent Digital Markets Act (*DMA*), but also as a part of the process of competition law enforcement. What can be seen, especially in contrast to the *Microsoft* (2007) judgment, is that the reasoning and approach to granting mandatory interoperability is changing (Manne et al., 2024; Colangelo & Ribera Martínez, 2025; Economides et al., 2025). It is the goal of this paper to try to discover the optimal approach with such decisions which harms innovation incentives the least (Baker, 2007).

LITERATURE REVIEW / THEORETICAL BACKGROUND

Providing mandatory interoperability for the innovator's infrastructure to others without its consent can cause detriment to innovative incentives of it to innovate in the future (Hey, 2024; Bourreau et al., 2022). However, the lack of interoperability creates a barrier for others to participate on the downstream market (Farell & Katz, 1998) or it significantly impairs their capability to compete with the owner of the infrastructure (Scott Morton et al., 2023; Kerber & Schweitzer, 2017). Therefore, the modern approach should balance contestability and effects on innovation such a measure can create (Hey, 2024; Bourreau et al., 2022).

METHODOLOGY

Author portrays the legal aspects of mandatory interoperability and its economic effects on innovation incentives for its providers and receivers. Additionally, he reflects on what level of asymmetry raises contestability and fosters the overall innovation incentives. Finally, he analyses the regulatory and *ad hoc* instances of

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imposed mandatory interoperability in the EU and axiologically evaluates them whether they are optimal remedies which have the most positive effect on the digital markets.

RESULTS

Mandating interoperability has ambivalent effects on the infrastructure's owner to incentives to innovate (Farrell & Katz, 1998; Bourreau et al., 2022). On the one hand, it does create a freeriding problem on the upstream market which can lower incentive to innovate (Manne et al., 2024; Khandelwal, 2024), but it maintains effective competition on the downstream market making it contestable (OECD, 2021) with higher innovation incentives for the owner of the infrastructure and undertakings which can effectively compete on the downstream market due to the provided interoperability (Shapiro, 2011; Hey, 2024; Crémer et al., 2023).

DISCUSSION / POLICY IMPLICATIONS

While a level playing field on the downstream market ought to be created, the owner of the digital infrastructure cannot bear the entire burden of it (Manne et al., 2024). Instead, the costs of maintaining that infrastructure and making it accessible should be divided between the provider and receivers of interoperability in order to combat the negative incentives to innovate on the upstream market. This may even be followed by *FRAND* licensing (Larouche & de Streel, 2021), but either way a *DMA* free of charge type of approach should be avoided (Bourreau et al., 2022).

CONCLUSION

Asymmetric regulation can provide opportunities for new and future entrants, without seriously harming those bearing the bigger burden of it. This way, unnecessary barriers are removed, markets are more contestable while, with adequate case-by-case evaluation, innovation is fostered. Accordingly, competition authorities and those applying the *DMA* and similar regulatory instruments, should adopt a more innovation-oriented approach which still accounts for the interests of those most affected.

KEYWORDS

Interoperability, innovation, incentives, competition law, digital markets

REFERENCES

1. Aghion, P., Bloom, N., Blundell, R., Griffith, R., & Howitt, P. (2005). Competition and innovation: An inverted-U relationship. The Quarterly Journal of Economics, 120(2), 701–728. http://www.jstor.org/stable/25098750
2. Arrow, K. J. (1962). Economic welfare and the allocation of resources for invention. In R. R. Nelson (Ed.), The rate and direction of inventive activity: Economic and social factors (pp. 609–626). Princeton University Press. https://www.nber.org/system/files/chapters/c2144/c2144.pdf
3. Baker, J. (2007). Beyond Schumpeter vs. Arrow: How antitrust fosters innovation. Antitrust Law Journal, 74, 575–602. https://digitalcommons.wcl.american.edu/facsch_lawrev/1136
4. Bourreau, M., Krämer, J., & Buiten, M. (2022). Interoperability in digital markets. Centre on Regulation in Europe (CERRE). https://cerre.eu/wp-content/uploads/2022/03/220321_CERRE_Report_Interoperability-in-Digital-Markets_FINAL.pdf
5. Christensen, C. M. (1997). The innovator's dilemma: When new technologies cause great firms to fail. Harvard Business School Press. https://cpcglobal.org/publications/The%20Innovators%20Dilemma.pdf
6. Colangelo, G., & Ribera Martínez, A. (2025). Vertical interoperability in mobile ecosystems: Will the DMA deliver (what competition law could not)? International Review of Law & Economics, 83, 1–12. https://doi.org/10.1016/j.irle.2025.106267
7. Crémer, J., Crawford, G. S., Dinielli, D., Fletcher, A., Heidhues, P., Schnitzer, M., & Scott Morton, F. M. (2023). Fairness and contestability in the Digital Markets Act. Yale Journal on Regulation, 40(3), 973–1012. https://www.yalejreg.com/wp-content/uploads/Fairness-and-Contestability-in-the-Digital-Markets-Act.pdf
8. Economides, N., Lianos, I., & Makkridis, C. (2025). 'Scaling law' and interoperability as the backbone of the digital economy. Centre for Law, Economics and Society (CLES) Research Paper Series, 6/2025.
9. Farrell, J., & Katz, M. L. (1998). The effects of antitrust and intellectual property law on compatibility and innovation. The Antitrust Bulletin, 43(3–4), 609–650. https://doi.org/10.1177/0003603X9804303-403
10. Hey, F. (2024). Data interoperability and portability in the DMA: Competition booster or lame duck? Ilmenau Economics Discussion Papers, 29(192). https://www.tu-ilmenau.de/fileadmin/Bereiche/WM/wth/Diskussionspapier_Nr_192.pdf
11. Kades, M., & Scott Morton, F. M. (2021). Interoperability as a competition remedy for digital networks (SSRN 3808372). SSRN. https://doi.org/10.2139/ssrn.3808372
12. Kerber, W., & Schweitzer, H. (2017). Interoperability in the digital economy. JIPITEC, 8, 39–58. https://nbn-resolving.de/urn:nbn:de:0009-29-45317
13. Khandelwal, P. (2024). Interoperability in digital markets: Extending the regulatory and technical framework from the financial sector (European University Institute Working Paper LAW 2024/23). European University Institute.

https://cadmus.eui.eu/server/api/core/bitstreams/083e1113-5ce7-5241-8f74-1c6cbaa7fb0e/content
14. Larouche, P., & de Streel, A. (2021). The European Digital Markets Act: A revolution grounded on traditions. Journal of European Competition Law & Practice, 12(7), 542–560. https://doi.org/10.1093/jeclap/lpab066
15. Manne, G. A., Radić, L., & Auer, D. (2025). Regulate for what? A closer look at the rationale and goals of digital competition regulations. Berkeley Business Law Journal, 22(1), 201–263. https://doi.org/10.15779/Z38M03Z022
16. OECD. (2021). Data portability, interoperability and digital platform competition. OECD Competition Committee Discussion Paper. http://oe.cd/dpic
17. Schumpeter, J. (1943). Capitalism, socialism & democracy. Routledge. https://eet.pixel-online.org/files/etranslation/original/Schumpeter,%20Capitalism,%20Socialism%20and%20Democracy.pdf
18. Scott Morton, F. M., Crawford, G. S., Crémer, J., Dinielli, D., Fletcher, A., Heidhues, P., & Schnitzer, M. (2023). Equitable interoperability: The "supertool" of digital platform governance. Yale Journal on Regulation, 40(3), 1013–1055. https://www.yalejreg.com/print/equitable-interoperability-the-supertool-of-digital-platform-governance/
19. Shapiro, C. (2011). Competition and innovation: Did Arrow hit the bull's eye? In J. Lerner & S. Stern (Eds.), The rate and direction of inventive activity revisited (pp. 361–410). University of Chicago Press. https://doi.org/10.7208/chicago/9780226473062.003.0011

ESG AS A GOVERNANCE MECHANISM IN INTERNATIONAL TRADE: COMPETITIVENESS, RESILIENCE, AND GLOBAL VALUE CHAIN TRANSFORMATION

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INTRODUCTION

Environmental, Social, and Governance (ESG) factors are reshaping international trade. ESG has moved beyond voluntary corporate responsibility to become a determinant of competitiveness, resilience, legitimacy, and market access (Deirmentzoglou et al., 2026). Firms involved in trade are now expected to demonstrate environmental accountability, social responsibility, transparent governance, and compliance with sustainability rules. These requirements are increasingly embedded in global value chains and trade regulation. The EU Corporate Sustainability Reporting Directive and Corporate Sustainability Due Diligence Directive illustrate how such frameworks affect exporters within and beyond the EU (European Union, 2022; 2024). This study examines ESG as a governance mechanism in international trade, focusing on its influence on supply-chain governance, export competitiveness, geopolitical and energy-related challenges, and its role in shaping sustainable international trade.

LITERATURE REVIEW / THEORETICAL BACKGROUND

ESG refers to the environmental, social and governance dimensions of organizational performance, covering issues such as emissions, labor practices, transparency and business ethics (Gillan et al., 2021; Li et al., 2021). International

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trade involves the cross-border exchange of goods and services and is increasingly organized through global value chains. In this context, ESG is becoming important because sustainability rules and due diligence requirements now affect market access, supply chain governance and export competitiveness (Deirmentzoglou et al., 2026). Therefore, ESG can be understood both as a compliance challenge and as a strategic capability that supports competitiveness and resilience in international trade (Ma et al., 2024; Wu et al., 2022; Yue & Li, 2024).

METHODOLOGY

This study adopts a literature-based review approach, drawing on recent academic studies that examine the relationship between ESG and international trade. The analysis is based on secondary research and focuses on identifying, comparing and synthesizing key arguments from studies addressing ESG practices, trade-related outcomes, global value chains and sustainability-related regulatory developments. Relevant studies were examined through qualitative content analysis, with attention given to their main focus, methodological orientation, key findings and contribution to the ESG–trade debate. The reviewed literature was then organized thematically in order to clarify how ESG is discussed in relation to international trade, competitiveness, resilience and governance. This approach allows the study to provide a concise conceptual synthesis of the ESG–trade nexus and to highlight the main directions of current academic discussion.

RESULTS

The findings show that ESG influences international trade through three main pathways. First, ESG affects supply chain governance by supporting due diligence, responsible sourcing, supplier monitoring, and traceability. Risk-based ESG assessment can help firms identify vulnerabilities and hotspots in multi-tier supply chains (Gervais et al., 2023), while ESG-oriented firms may be more resilient during disruptions (Tsang et al., 2024). Second, ESG affects export competitiveness. Empirical studies suggest that ESG performance can enhance export intensity, export resilience, and the domestic value-added of exports (Ma et al., 2024; Wu et al., 2022; Yue & Li, 2024). Third, ESG affects trade through geopolitical and strategic mechanisms. Energy transitions, sanctions, trade conflicts, and critical mineral dependencies influence ESG strategies and trade patterns (Isetani et al., 2022; Sinclair & Coe, 2024; Xu et al., 2024).

DISCUSSION / POLICY IMPLICATIONS

The results suggest that ESG should be understood as a multi-level governance mechanism linking sustainability, competitiveness, and resilience in international trade. For policymakers, ESG-related regulations can promote responsible business conduct and sustainable production. However, they may also create compliance burdens, particularly for SMEs and firms in countries with weaker institutional support. Policy coordination is therefore necessary. Greater alignment between sustainability reporting, due diligence requirements, and trade policy can reduce uncertainty and prevent ESG from becoming a hidden non-tariff barrier. For managers, ESG should be integrated into export strategy, supply chain governance, innovation, and risk management. ESG capabilities can strengthen credibility, improve market access, and enhance resilience against disruptions and geopolitical uncertainty (Ma et al., 2024; Tsang et al., 2024; Wu et al., 2022).

CONCLUSION

ESG is becoming a central feature of international trade governance. It affects supply chains, export competitiveness, market access, resilience, and geopolitical strategy. The ESG–trade nexus is therefore multidimensional and should be examined through institutional, technological, operational, and strategic perspectives. This study argues that ESG functions as a governance mechanism shaping the future of international trade. Future research should empirically examine how ESG influences trade outcomes across sectors, countries, and firm sizes, with particular attention to SMEs, developing economies, and industries exposed to high regulatory or geopolitical pressure.

KEYWORDS

ESG, international trade, global value chains, export competitiveness, sustainability governance

REFERENCES

1. Deirmentzoglou, G. A., Anastasopoulou, E. E., Masouras, A., & Symeou, P. (2026). Environmental, social, and governance (ESG) factors in international trade: A systematic review and integrative framework. *Sustainability, 18*(2), 677.
2. European Parliament & Council of the European Union. (2022). *Directive (EU) 2022/2464 of the European Parliament and of the Council of 14 December 2022 as regards corporate sustainability reporting*. *Official Journal of the European Union, L 322*, 15–80.

3. European Parliament & Council of the European Union. (2024). *Directive (EU) 2024/1760 of the European Parliament and of the Council of 13 June 2024 on corporate sustainability due diligence*. *Official Journal of the European Union, L 2024/1760*.
4. Gervais, E., Kleijn, R., Nold, S., & van der Voet, E. (2023). Risk-based due diligence in supply chains: The case of silver for photovoltaics. *Resources, Conservation and Recycling, 198*, 107148.
5. Gillan, S. L., Koch, A., & Starks, L. T. (2021). Firms and social responsibility: A review of ESG and CSR research in corporate finance. *Journal of Corporate Finance, 66*, 101889.
6. Isetani, S., Shimizu, S., DeWit, A., & Shaw, R. (2022). Indo-Japanese collaboration on energy security and critical raw materials (CRM). *The Asia-Pacific Journal: Japan Focus, 20*(18), e5.
7. Li, T. T., Wang, K., Sueyoshi, T., & Wang, D. D. (2021). ESG: Research progress and future prospects. *Sustainability, 13*(21), 11663.
8. Ma, D., Xie, Y., Huang, H., & Qiu, J. (2024). Does corporate ESG performance promote export resilience? New insights from risk resistance and resilience. *Journal of Environmental Management, 371*, 122881.
9. Sinclair, L., & Coe, N. M. (2024). Critical mineral strategies in Australia: Industrial upgrading without environmental or social upgrading. *Resources Policy, 91*, 104860.
10. Tsang, Y. P., Fan, Y., Feng, Z. P., & Li, Y. (2024). Examining supply chain vulnerability via an analysis of ESG-prioritized firms amid the Russian-Ukrainian conflict. *Journal of Cleaner Production, 434*, 139754.
11. Wu, Q., Chen, G., Han, J., & Wu, L. (2022). Does corporate ESG performance improve export intensity? Evidence from Chinese listed firms. *Sustainability, 14*(20), 12981.
12. Xu, Y., Huang, W., & Zhang, C. Y. (2024). Navigating international competition with ESG: Insights from the US-China trade war. *Research in International Business and Finance, 70*, 102364.
13. Yue, S., & Li, B. (2024). The influence of ESG practices on domestic value-added to exports during the period of technological change. *PLOS ONE, 19*(7), e0303248.

NAVIGATING THE INTERSECTION OF SHARIA COMPLIANCE AND INTERNATIONAL SANCTIONS: THE ROLE OF AI IN TRADE FINANCE MECHANISMS

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INTRODUCTION

The weaponization of international finance—using sanctions to isolate adversarial states—has created a vacuum in which Islamic finance, international sanctions regimes, and artificial intelligence (AI) converge. This article investigates how AI mediates the relationship between Sharia-compliant trade mechanisms and sanctions compliance, with a particular focus on China's economic engagements in Iran, Russia, and Africa.

LITERATURE REVIEW / THEORETICAL BACKGROUND

Scholarship on Islamic finance emphasizes asset-backed stability and ethical investment. Sanctions literature reveals adaptive evasion strategies and multipolar finance (Ahmed 2010; Aliyu et. Al., 2025; Alshater et. al., 2022; Caskey, 2024). AI research is divided: RegTech scholars highlight enhanced enforcement, while others warn of AI-enabled obfuscation. The gap—how AI mediates Islamic finance in sanctioned trade—remains underexplored, particularly within China's geopolitical context.

METHODOLOGY

A qualitative multi-case design examines three purposefully selected cases: China-Iran energy trade, China-Russia commodity settlements post-2022, and China-Africa BRI infrastructure financing. Data are triangulated from FATF, OFAC, IMF trade statistics, maritime intelligence, industry reports, and peer-reviewed

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literature. Doctrinal legal analysis is combined with socio-technical systems theory (Egorov et. al., 2025; Franchini, 2025; Habib, 2025).

RESULTS

Mainstream Islamic jurisprudence (al-ahkam al-sultaniyya) aligns with sanctions compliance. AI raises detection accuracy for complex instruments (Sukuk: ~91%) while reducing false positives from >30% to <10% by 2026. Compliance costs fall from 2.8% to 1.2% of transaction value. Asset-backing generates verifiable data points—AIS, satellite imagery, IoT—that AI exploits for physical-financial verification.

DISCUSSION / POLICY IMPLICATIONS

AI functions as a risk equalizer: documentary complexity, once a potential opacity source, becomes a transparency asset under algorithmic scrutiny. Jurisdictional fragmentation persists as a vulnerability, addressable through AAOIFI/IFSB-facilitated data sharing. Generative AI poses emerging threats via synthetic documentation. Regulators' data advantage sustains a compliance edge in the AI arms race, but international cooperation is essential.

CONCLUSION

AI is not an evasion enabler but a compliance equalizer for Islamic trade finance. Asset-backing requirements, coupled with AI verification of physical supply chains, position Sharia-compliant finance as inherently transparent in monitored environments. The outcome of sanctioned trade will be determined by technological infrastructure rather than instrument labels—pointing toward a sovereign digital fiscalism grounded in verified transparency.

KEYWORDS

Islamic finance, international sanctions, artificial intelligence, trade finance, China

REFERENCES

1. Ahmed, A. (2010). Global financial crisis: An Islamic finance perspective. International Journal of Islamic and Middle Eastern Finance and Management, 3(4), 306–320.
2. Aliyu, S. U. R., & Naiya, I. I. (2025). The role of Islamic trade finance in international trade. In Trade and Investment in Africa: A Research Companion.
3. Alshater, M. M., Saba, I., Supriani, I., & Rabbani, M. R. (2022). Fintech in Islamic finance literature: A review. Heliyon, 8(9), e10385.

4. Caskey, G. W. (2024). The political economy of China's Belt and Road Initiative. Journal of Institutional Economics, 20, e31.
5. Charnovitz, S. (2001). Rethinking WTO trade sanctions. American Journal of International Law, 95(4), 792–832.
6. Egorov, K., Korovkin, V., Makarin, A., & Nigmatulina, D. (2025). Trade sanctions against Russia: Stylized facts. AEA Papers and Proceedings, 115, 578–582.
7. Franchini, D. (2025). When finance becomes a weapon: The challenge of central bank sanctions under international law. Journal of International Trade Law and Policy, 24(1), 28–56.
8. Habib Lantyer, V. (2025). How US trade sanctions fueled Chinese innovation in AI: The DeepSeek case. SSRN Working Paper. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=5112973

INNOVATION CAPACITY AND REGIONAL ECONOMIC RESILIENCE: EVIDENCE FROM UKRAINE

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INTRODUCTION

Regional economic resilience to external shocks is a multidimensional phenomenon encompassing resistance, recovery, reorientation and renewal. While empirical evidence increasingly links innovation and resilience, little is known about whether pre-shock innovation capacity can mitigate the effects of extreme disruptions, such as war. This paper examines the role of innovation capacity in shaping regional resistance, drawing on evidence from Ukrainian regions after the 2022 full-scale invasion.

LITERATURE REVIEW / THEORETICAL BACKGROUND

The framework integrates Martin's (2012) four-dimensional model (resistance, recovery, re-orientation, renewal) with Boschma's (2015) related-variety approach and Sutton & Arku's (2022) distinction between resilience performance and resilience capacity. Following Simmie & Martin (2010) and Schumpeterian creative-destruction theory, innovation capacity is treated as an internal co-determinant of adaptive resilience, not merely a growth outcome.

METHODOLOGY

The resistance dimension is estimated via cross-sectional OLS with heteroskedasticity-consistent robust errors across Ukrainian regions, treating the 2022 invasion as an external shock. The estimated equation, $Shock = \beta_0 + \beta_1 \cdot HHI + \beta_2 \cdot INNOV\_D + \beta_3 \cdot FRONT + \varepsilon$, captures sectoral concentration, binarised pre-war

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innovation, and frontier exposure. The central hypothesis posits threshold non-linearity: innovation buffers shocks only beyond a critical activity level.

RESULTS

Preliminary evidence from Ukraine reveals substantial heterogeneity in wartime resilience. Frontier-proximity explains approximately 25 p.p. of additional shock depth. Higher sectoral concentration amplifies vulnerability. Innovation leaders experienced shocks 8.8 p.p. shallower than followers, consistent with the shock-absorption channel (Bristow & Healy, 2018). The effect is threshold rather than linear, emerging only in regions with above-average pre-war innovation activity.

DISCUSSION / POLICY IMPLICATIONS

Findings suggest innovation support should be treated as an instrument of economic resilience, not only competitiveness. For Ukraine this implies following: targeted support for innovative firms as resilience anchors; development of regional innovation ecosystems with institutional capacity; integration of resilience indicators into Smart Specialisation Strategy design; and adoption of innovation resilience metrics in post-war recovery and EU accession frameworks.

CONCLUSION

The paper proposes and empirically tests a framework for measuring regional resilience in wartime and post-war economies, integrating innovation capacity and economic resilience performance dimensions. Preliminary evidence confirms that pre-war innovation capacity acts as a structural buffer under extreme shocks, with the effect materialising above a threshold level. The findings carry direct implications for evidence-based regional recovery policy and post-war reconstruction planning.

KEYWORDS

Innovation capacity, regional resilience, shock absorption, wartime economy, Ukraine

REFERENCES

1. Boschma, R. (2015). Towards an evolutionary perspective on regional resilience. Regional Studies, 49(5), 733–751. https://doi.org/10.1080/00343404.2014.959481

2. Bristow, G., & Healy, A. (2018). Innovation and regional economic resilience: An exploratory analysis. The Annals of Regional Science, 60(2), 265–284. https://doi.org/10.1007/s00168-017-0841-6
3. Martin, R. (2012). Regional economic resilience, hysteresis and recessionary shocks. Journal of Economic Geography, 12(1), 1–32. https://doi.org/10.1093/jeg/lbr019
4. Simmie, J., & Martin, R. (2010). The economic resilience of regions: Towards an evolutionary approach. Cambridge Journal of Regions, Economy and Society, 3(1), 27–43. https://doi.org/10.1093/cjres/rsp029
5. Sutton, J., & Arku, G. (2022). Regional economic resilience: Towards a system approach. Regional Studies, Regional Science, 9(1), 497–512. https://doi.org/10.1080/21681376.2022.2092418

FACTORS IN CRISIS MANAGEMENT: HUMAN, TEAM, AND MEDIA

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INTRODUCTION

Crises test an organization's governance, resilience, and capacity to keep innovating. This study examines human behavior, crisis-team composition and dynamics, and the objectivity of traditional and social media, and how they shape crisis outcomes, as organizational foundations of crisis resilience. Contributing to innovation policy and governance, it treats crisis-management capability as part of the organizational resilience that sustains innovation and tests these factors empirically.

LITERATURE REVIEW / THEORETICAL BACKGROUND

Crisis-management scholarship identifies human behavior, team dynamics, and media as central factors (Boin et al., 2016; Wolbers et al., 2018). Lower organizational commitment and trust raise turnover intentions, whereas affective commitment reduces them (Meyer et al., 2002). Team effectiveness rests on leadership and coordination, and media influence on credibility and public trust (Quandt, 2012; Clementson, 2020). Recent regional evidence confirms these dynamics (Postolov & Postolov, 2025).

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METHODOLOGY

A cross-sectional survey was conducted among individuals employed in business organizations in North Macedonia. The study used a non-probability sampling strategy combining criterion-based purposive sampling with convenience-based recruitment. Specifically, individual respondents constituted the sampling units: eligibility required employment in a business organization in North Macedonia, and participants were recruited based on their accessibility and willingness to participate. The structured questionnaire collected demographic data and used 5-point Likert-scale items to measure human behavior, crisis-team composition and dynamics, and the perceived objectivity of traditional and social media. The final sample comprised 77 respondents (38 women and 39 men), most of whom had completed higher education. Fieldwork was conducted from February to April 2026, and the data were analyzed using SPSS.

RESULTS

The analysis showed substantial agreement that, during crises, organizations are abandoned first by less loyal employees and that crisis-management teams often experience coordination weaknesses. Respondents likewise agreed that biased coverage in traditional media and on social networks noticeably influences how crises develop and are managed.

DISCUSSION / POLICY IMPLICATIONS

The findings echo research linking organizational commitment, coordinated teamwork, and credible communication (Coombs, 2019) to crisis resilience. For innovation policy and governance, they imply that resilient, innovation-capable organizations must build crisis preparedness at individual and team levels, strengthening employee relations, improving coordination, and adopting transparent communication plans that address the social-media environment (Austin et al., 2012; Veil et al., 2011).

CONCLUSION

Human behavior, crisis-team dynamics, and media influence emerge as key crisis-management factors: weaker commitment predicts employee exit, poor coordination undermines teams, and biased media shape crisis trajectories, underscoring the need for a stronger communication strategy. Given the small, single-context sample (n = 77), the results are indicative rather than generalizable;

future research should use larger, probability-based samples across sectors and countries.

KEYWORDS

Crisis management, human behavior, crisis-team dynamics, media influence, organizational resilience

REFERENCES

1. Allen, N. J., & Meyer, J. P. (1990). The measurement and antecedents of affective, continuance and normative commitment to the organization. *Journal of Occupational Psychology,* 63(1), 1-18. https://doi.org/10.1111/j.2044-8325.1990.tb00506.x
2. Austin, L., Liu, B. F., & Jin, Y. (2012). How audiences seek out crisis information: Exploring the social-mediated crisis communication model. *Journal of Applied Communication Research*, 40(2), 188-207. https://doi.org/10.1080/00909882.2012.654498
3. Boin, A., 't Hart, P., Stern, E., & Sundelius, B. (2016). *The politics of crisis management: Public leadership under pressure* (2nd ed.). Cambridge University Press. https://doi.org/10.1017/9781316339756
4. Clementson, D. E. (2020). Narrative persuasion, identification, attitudes, and trustworthiness in crisis communication. *Public Relations Review*, 46(2), 101889. https://doi.org/10.1016/j.pubrev.2020.101889
5. Coombs, W. T. (2007). Protecting organizational reputations during a crisis: The development and application of situational crisis communication theory. *Corporate Reputation Review*, 10, 163-176. https://doi.org/10.1057/palgrave.crr.1550049
6. Coombs, W. T. (2014). *Ongoing crisis communication: Planning, managing, and responding* (4th ed.). SAGE Publications.
7. Coombs, W. T. (2019). *Ongoing crisis communication: Planning, managing, and responding.* SAGE Publications.
8. Frandsen, F., & Johansen, W. (2017). *Organizational crisis communication: An introduction.* SAGE Publications.
9. Jin, Y., Pang, A., & Cameron, G. T. (2012). Toward a publics-driven, emotion-based conceptualization in crisis communication: Unearthing dominant emotions in the Integrated Crisis Mapping (ICM) model. *Journal of Public Relations Research*, 24(3), 266-298. https://doi.org/10.1080/1062726X.2012.676747
10. Liker, J. K. (2011). *Toyota under fire: Lessons for turning crisis into opportunity*. McGraw-Hill Professional Publishing.
11. Meyer, J. P., Stanley, D. J., Herscovitch, L., & Topolnytsky, L. (2002). Affective, continuance, and normative commitment to the organization: A meta-analysis of antecedents, correlates, and consequences. *Journal of Vocational Behavior*, 61(1), 20-52. https://doi.org/10.1006/jvbe.2001.1842

12. Postolov, K., & Postolov, B. (2025). Crisis management in companies from the IT sector: The case of the city of Skopje. *MEST Journal*, 13(1), 105-113. https://doi.org/10.12709/mest.13.13.01.10
13. Quandt, T. (2012). What's left of trust in a network society? An evolutionary model and critical discussion of trust and societal communication. *European Journal of Communication*, 27(1), 7-21. https://doi.org/10.1177/0267323111434452
14. Veil, S. R., Buehner, T., & Palenchar, M. J. (2011). A work-in-process literature review: Incorporating social media in risk and crisis communication. *Journal of Contingencies and Crisis Management*, 19(2), 110-122. https://doi.org/10.1111/j.1468-5973.2011.00639.x
15. Wolbers, J., Boersma, K., & Groenewegen, P. (2018). Introducing a fragmentation perspective on coordination in crisis management. *Organization Studies*, 39(11), 1521-1546. https://doi.org/10.1177/0170840617717095

MEASURING THE MATURITY OF EMERGING STARTUP ECOSYSTEMS: A COMPOSITE INDEX APPROACH FROM SERBIA

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INTRODUCTION

Measuring startup ecosystem development has become an important challenge for both researchers and policymakers. The recent European Startup and Scaleup Scoreboard (European Commission, 2026) reflects the growing demand for systematic assessment of startup ecosystems, yet comparable frameworks remain largely unavailable for emerging innovation ecosystems. Moreover, existing approaches primarily measure ecosystem performance rather than ecosystem maturity. This paper contributes by proposing a transferable composite Startup Ecosystem Index that can be applied across national and sub-national innovation ecosystems.

LITERATURE REVIEW / THEORETICAL BACKGROUND

Startup ecosystems are commonly understood as interconnected systems of entrepreneurs, investors, universities, public institutions and support organisations that jointly shape entrepreneurial activity and innovation outcomes (Brown & Mason, 2017; Stam, 2015; Spigel, 2017). Although the literature has substantially advanced the understanding of ecosystem dynamics (Stam & Van de Ven, 2021), approaches for measuring ecosystem maturity remain fragmented.

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Building on the literature on entrepreneurial ecosystems and composite indicators (Nardo et al., 2008), this study conceptualises startup ecosystem maturity as a multidimensional construct that can be operationalised through a composite index.

METHODOLOGY

The study develops a composite Startup Ecosystem Index based on a mixed-methods approach combining survey data from 154 startups from Serbia, more than 30 semi-structured interviews with founders, investors and ecosystem support organisations, and secondary national data. Building on the a unique measurement framework, ecosystem maturity was operationalised through seven theoretically grounded pillars and 46 indicators, which were normalised and aggregated using an equal-weighting scheme to generate national and regional ecosystem maturity scores.

RESULTS

The composite index reveals that the Serbian startup ecosystem remains in a transitional stage of development, achieving an overall ecosystem maturity score of 39.79 out of 100. While institutional support has expanded considerably, the ecosystem has not yet reached the level of self-sustaining entrepreneurial dynamics. The analysis also uncovers pronounced regional disparities, with Belgrade substantially outperforming other regions, although none has yet achieved ecosystem maturity. Among the seven dimensions, access to private risk capital emerges as the most critical structural bottleneck, while the growing diffusion of AI-based startups points to considerable innovation potential.

DISCUSSION / POLICY IMPLICATIONS

The findings suggest that startup ecosystems should be assessed as multidimensional systems rather than through isolated performance indicators such as startup numbers or investment volumes. By integrating structural capacities, institutional conditions and market dynamics, the proposed framework provides a more comprehensive basis for ecosystem assessment. For policymakers, the index supports evidence-based prioritisation of policy interventions, continuous monitoring of ecosystem evolution, and the design of place-based measures tailored to regional development profiles.

CONCLUSION

This study contributes to the emerging literature on startup ecosystem assessment by proposing a transferable measurement framework for evaluating ecosystem maturity. Demonstrated through the first national Startup Ecosystem Index for Serbia, the framework is designed to support comparative analyses across countries and sub-national regions. Future research should validate the framework in different national contexts and further examine alternative weighting schemes and statistical validation procedures to strengthen its robustness and international applicability.

KEYWORDS

Startup ecosystems, ecosystem maturity, composite index, innovation policy, Serbia

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REFERENCES

1. Brown, R., & Mason, C. (2017). Looking inside the spiky bits: A critical review and conceptualisation of entrepreneurial ecosystems. *Small Business Economics*, 49(1), 11-30. https://doi.org/10.1007/s11187-017-9865-7
2. European Commission. (2026). European Startup and Scaleup Scoreboard. Available at: https://projects.research-and-innovation.ec.europa.eu/en/statistics/performance-indicators/european-startup-scaleup-scoreboard
3. Nardo, M., Saisana, M., Saltelli, A., Tarantola, S., Hoffman, A., & Giovannini, E. (2008). *Handbook on Constructing Composite Indicators: Methodology and User Guide*. OECD Publishing.
4. Spigel, B. (2017). The relational organization of entrepreneurial ecosystems. *Entrepreneurship Theory and Practice*, 41(1), 49-72. https://doi.org/10.1111/etap.12167
5. Stam, E. (2015). Entrepreneurial ecosystems and regional policy: A sympathetic critique. *European Planning Studies*, 23(9), 1759-1769. https://doi.org/10.1080/09654313.2015.1061484
6. Stam, E., & Van de Ven, A. (2021). Entrepreneurial ecosystem elements. *Small Business Economics*, 56(2), 809-832. https://doi.org/10.1007/s11187-019-00270-6

MICROECONOMIC COMPETITIVENESS OF THE ECONOMY IN BOSNIA AND HERZEGOVINA

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INTRODUCTION

Microeconomics competitiveness reflects the ability of enterprises in Bosnia and Herzegovina to compete successfully in international markets. It depends on business strategy, production sophistication, and the quality of the business environment. This research examines the relationship between these factors and enterprise competitiveness, with particular emphasis on the role of innovative enterprises and their contribution to improving the competitive position of our companies.

LITERATURE REVIEW / THEORETICAL BACKGROUND

Porter (1990) emphasizes the importance of competitive advantage based on costs and differentiation of products and services, while Mankiw (2021) emphasizes the role of productivity and efficient allocation of resources. The OECD (2024) Outlook states that B&H's competitiveness is limited by weak investment, numerous administrative barriers and insufficient innovation in the economy. The World Bank (2024) emphasizes the need for structural reforms to strengthen productivity and long-term economic growth. The Central Bank of Bosnia and Herzegovina (2024) analyzes competitiveness indicators through external and internal economic imbalances. The Agency for Statistics of Bosnia and Herzegovina (2024) presents statistical indicators on industry, trade, employment and productivity, while the reports of the Foreign Trade Chamber of Bosnia and Herzegovina (2023) provide data on the low level of innovation and weak export capacity of domestic companies.

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METHODOLOGY

The research analyzes 100 SMEs from four economic sectors in Bosnia and Herzegovina using recent literature and questionnaire data. Factor and regression analyses were applied to test the hypotheses and identify key determinants of microeconomics competitiveness. The quality of the business environment, production sophistication, and company strategy were measured using 21 Likert-scale indicators. The regression model explains 13.6% of variance (R^2=0.136) and is statistically significant ($p<0.05$).

RESULTS

The research results indicate that the microeconomics competitiveness of enterprises in Bosnia and Herzegovina depends primarily on productivity, innovation, business environment and the application of modern technologies. The paper proves that domestic enterprises have significant potential for growth, but they face numerous limitations. Insufficient institutional support and weak policy coordination additionally slow down the strengthening of the competitive position of the economy.

DISCUSSION / POLICY IMPLICATIONS

The discussion of the results shows that innovation significantly affects the microeconomics competitiveness of the economy in Bosnia and Herzegovina, measured by business performance. The greatest contribution comes from process innovations, while productivity and organizational innovations are also statistically significant. Although the models confirm the hypotheses, the relatively low coefficient of determination indicates that competitiveness also depends on external factors such as the business environment and institutional support for companies.

CONCLUSION

The results confirm the importance of process innovations, while productivity and organizational innovations also significantly affect business performance. The low coefficient of determination suggests that competitiveness depends on additional factors, including institutional support, investment, administrative barriers, and the economic environment. Strengthening competitiveness requires investment in innovation, digitization, human capital, and productivity, supported by business-environment reforms.

KEYWORDS

Microeconomics competitiveness, innovation, productivity, Bosnia and Herzegovina

REFERENCES

1. Agency for Statistics of Bosnia and Herzegovina. (2024). Structural business statistics, 2024. https://bhas.gov.ba/Archive/Read
2. Agency for Statistics of Bosnia and Herzegovina. (2025). Industrial production in Bosnia and Herzegovina: PRODCOM results, 2024.
3. Central Bank of Bosnia and Herzegovina. (2024). Report on macroeconomic imbalances. Central Bank of Bosnia and Herzegovina. https://www.cbbh.ba/Content/Archive
4. Džafić, Z., & Djedović, E. (2025). The influence of the business environment on the competitiveness on small and medium-sized enterprises in Bosnia and Herzegovina. Journal of Economic and Social Studies, 9(1). https://doi.org/10.14706/JECOSS18913
5. Foreign Trade Chamber of Bosnia and Herzegovina. (2024, February 15). Vanjskotrgovinska razmjena BiH sa svijetom za period 2022/2023. https://komorabih.ba/987515126-2/
6. Mankiw, N. G. (2021). Principles of economics (9th ed.). Cengage Learning.
7. Organisation for Economic Co-operation and Development. (2024). Western Balkans competitiveness outlook 2024: Bosnia and Herzegovina. OECD Publishing. https://doi.org/10.1787/82e0432e-en
8. Porter M. E. (1990). The Competitive Advantage of Nations, New York: Fee Press.
9. World Bank. (2024). Bosnia and Herzegovina: Country economic memorandum—Towards sustainable growth through structural reforms. World Bank. https://www.worldbank.org/en/ events/2024/03/14/launch-bosnia-and-herzegovina-country-economic-memorandum

WHEN INNOVATION ISN'T ENOUGH: THE TRUE DRIVERS OF HIGH-TECH EXPORT PERFORMANCE IN WESTERN EUROPE

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INTRODUCTION

Countries that build innovation-intensive industries achieve faster productivity growth, stronger export specialization, and greater resilience. High-technology exports capture technological capability and firms' capacity to scale and compete internationally. Hence, do patents and institutional quality explain high-tech export in Western European, or are other factors more decisive? The study contributes by using recent data to clarify their relevance in advanced innovation systems.

LITERATURE REVIEW / THEORETICAL BACKGROUND

High-technology exports indicate a country's innovation capacity and competitiveness. This captures new knowledge, its successful commercialization and internationalization. Authors have examined the determinants of high-tech exports, showing that innovation capacity, human capital, and broader macroeconomic conditions are key in shaping competitiveness (Drapkin, 2024; Frietsch et al., 2014; Kabaklarli et al., 2017; Manzetti and Osang, 2024; Mehrara, 2017; Sandu & Ciocanel, 2014; Tebaldi, 2011).

METHODOLOGY

The empirical analysis is based on a panel dataset covering 13 Western EU countries: Austria, Belgium, Denmark, Finland, France, Germany, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, and Sweden, observed over the period 2007-2023. To examine the relationship between economic, innovation,

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institutional factors and a country's high-technology export performance, the analysis employs a fixed-effects panel regression.

RESULTS

Across all specifications, coefficients remain stable, showing a consistent link between high-tech exports and included variables. Government effectiveness is negative, insignificant, while rule of law is positive, insignificant. This suggests that institutional quality does not exert a direct influence once economic and innovation factors are considered. This may imply that among institutionally mature Western European economies, the variation is too limited to explain short-term differences.

DISCUSSION / POLICY IMPLICATIONS

The results suggest that countries benefit most from policies that strengthen their innovation base and skills capacity. A practical policy approach combining stronger R&D support, targeted investment in human capital, and a regulatory setting that reduces uncertainty. For mature Western European economies, the policy priority lies less in increasing formal patent output and more in improving the conversion of R&D and skills into commercially scalable, exportable technologies.

CONCLUSION

The consistent drivers of high-technology exports are R&D investment, education expenditure, while patent activity and institutional indicators do not exhibit a direct effect in the short run. This suggests that technological competitiveness develops gradually, through long-term investment in research capacity, skills, and an environment allowing innovation. Thus, countries could better position themselves in technologically advanced industries and support sustainable, innovation-driven growth.

KEYWORDS

High-technology exports, innovation, institutional quality, panel data analysis, patents

REFERENCES

1. Drapkin, I., Vasilyeva, R., & Kandalintseva, A. (2024). Determinants of high-tech export: Evidence from a cross-country analysis. *R-Economy*, 10(1), 41–54. https://doi.org/10.15826/recon.2024.10.1.003
2. Frietsch, R., Neuhäusler, P., Jung, T., & Van Looy, B. (2014). Patent indicators for macroeconomic growth - the value of patents estimated by export volume. *Technovation*, 34(9), 546–558. https://doi.org/10.1016/j.technovation.2014.05.007
3. Kabaklarli, E., Duran, M. S., & Üçler, Y. T. (2017). The determinants of high-technology exports: A panel data approach for selected OECD countries. *Dubrovnik International Economic Meeting (DIEM) Scientific Journal*, 3(1), 122–135.
4. Manzetti, L., & Osang, T. (2024). High-tech exports and governance institutions. *PS: Political Science & Politics*, 57(3), 346 - 355. Doi:10.1017/S1049096524000052
5. Mehrara, M., Seijani, S., & Rezazadeh Karsalari, A. (2017). Determinants of high-tech export in developing countries based on Bayesian model averaging. *Zbornik radova Ekonomskog fakulteta u Rijeci*, 35(1), 199–215. https://doi.org/10.18045/zbefri.2017.1.199
6. Sandu, S., & Ciocanel, B. (2014). Impact of R&D and Innovation on high-tech Export. *Procedia Economics and Finance*, 15(14), 80–90. https://doi.org/10.1016/s2212-5671(14)00450-x
7. Tebaldi, E. (2011). The determinants of high-technology exports: A panel data analysis. *Atlantic Economic Journal*, 39(4), 343–353. https://doi.org/10.1007/s11293-011-9288-9

DIGITALIZATION, FOREIGN DIRECT INVESTMENT, AND FEMALE LABOR FORCE PARTICIPATION: DETERMINANTS OF HIGH-TECHNOLOGY EXPORTS IN THE WESTERN BALKANS

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INTRODUCTION

High-technology exports are widely recognized as an indicator of innovation capacity, technological advancement, and international competitiveness. The ability to produce and export technology-intensive goods reflects an economy's productive sophistication and integration into global value chains. This study examines the effects of digitalization, foreign direct investment (FDI), female labor force participation, and economic development on high-technology exports in five Western Balkan countries—Albania, Bosnia and Herzegovina, Montenegro, North Macedonia, and Serbia—during the period 2009–2023.

LITERATURE REVIEW / THEORETICAL BACKGROUND

Previous literature has assessed the impact of digitalization on export performance. Abramova and Thorne (2021) view digital economy as a significant source for modernization through automation, analytics, and engagement in global value chains. In the same way, Arezki et al. (2018) point out its significance in structural transformation and productivity. Atasoy (2020) reveals that digitalization helps in the production and exporting of technologically advanced goods in the presence of strong institutions and innovation capability. Xing (2017) and Hermawan et al. (2019) reveal that ICT and e-commerce lower transaction costs and help in international trade. On a micro-level, Köten (2023) finds that internet platforms help in improving export performance due to increased firm's ability to access foreign markets, while Shanmugalingam et al. (2023) find that e-commerce positively impacts international trade. Azu et al. (2024) also find ICT-trade impacts positively in South Africa. Choi (2024) emphasizes digital connectivity, whereas Shabeer et al. (2024) emphasize innovation and institutions as determinants of high-technology trade and competitiveness.

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METHODOLOGY

Panel data from five Western Balkan countries in the period of 2009-2023 is utilized in the analysis. High technology exports are the dependent variable, and Internet use, FDI, GDP per capita, and the percentage of female labor force participation are the independent variables. Internet use is considered a proxy of digitalization since it is indicative of the availability of digital technologies. The higher the level of Internet use, the higher the levels of connectivity, information exchange, and usage of digital technologies. The descriptive statistics and correlation analysis are employed for the determination of the main features of variables, as well as their relationships. At the same time, the variance inflation factor test is utilized to identify the possible presence of multicollinearity. The POLS, FE, and RE regressions are estimated, and the Hausman specification test is conducted to determine the appropriate estimator.

RESULTS

Results from fixed-effects regression show that GDP per capita and women in the labor force have positive and significant impacts on high-technology exports. GDP per capita has a positive beta value of 154,966 (p=0.001), whereas the variable women in the labor force has a positive beta value of about 19.9 million (p=0.004). Foreign direct investment is positively related to high technology exports; however, it has relatively low statistical significance (β = 8,338,679; p = 0.065). On the other hand, Internet penetration, which serves as an indicator of digitalization, has a negative and statistically insignificant coefficient of β = −4,086,867; (p = 0.110). This means that the level of internet penetration does not have any significant effect on high-technology exports in the region.

DISCUSSION / POLICY IMPLICATIONS

The results show that economic development and employment opportunities for women are crucial for the promotion of export sophistication in the Western Balkans. Economic policies focused on growing women's participation in the labor force and maintaining economic growth can lead to better export performance in high-technology exports. Even though FDI has positive effects on exports, the government should promote investments which will enable technology transfer and connections between MNEs and domestic companies. Ineffective impact of internet penetration shows that investments only in digital infrastructure cannot be successful; other investments have to follow.

CONCLUSION

These results indicate that economic growth and participation of women in the workforce play an important role in high-technology exports from the Western Balkans. The impact of foreign direct investment is positive but is statistically insignificant. Internet diffusion is used as an indicator of digitalization, but its effect is statistically insignificant, which implies that digitalization alone is not enough to result in more sophisticated exports. This indicates that the improvement of innovation capacity, human resources, and technology is critical for competitiveness in high-technology exports.

KEYWORDS

High-technology exports, foreign direct investment, female labor force participation, Western Balkans

REFERENCES

1. Abramova, A., & Thorne, E. (2021). Digital economy developments within the EAEU.
2. Arezki, R., Mottaghi, L., Barone, A., Fan, R. Y., Harb, A. A., Karasapan, O., Matsunaga, H., Hà, N. M., & de Soyres, F. (2018). Middle East and North Africa economic monitor: A new economy in Middle East and North Africa.
3. Atasoy, B. S. (2020). The determinants of export sophistication: Does digitalization matter? *International Journal of Finance & Economics*, 26(4), 5135–5159. https://doi.org/10.1002/ijfe.2058
4. Azu, N. P., Adekalu, S. O., Isa, Y., & Chiadikobi, J. O. (2024). Evaluating the influence of information and communication technology and the BRICS in South African trade dynamics: A gravity model approach. *Journal of International Trade Law and Policy*, 23(2/3), 168–186.
5. Choi, C. H. (2024). ICT technology and global trade dynamics: A comprehensive analysis of G20 economies.
6. Hermawan, I., Budiyanti, E., & Rivani, E. (2019). The impact of information and communication technology (ICT) on ASEAN trade flow. *ICOT 2019 Proceedings*.
7. Köten, E. E. (2023). The impact of internet platform usage on firms' exports: New evidence for Turkish firms. *The World Economy*, 47(4), 1557–1614. https://doi.org/10.1111/twec.13483
8. Shabeer, M. G., Zafar, Q., Anwar, S., & Nadeem, A. M. (2024). Evaluating innovation and institutions for tech-trade: A global assessment in the quest for sustainable economic prosperity. *Journal of Asian Development Studies*, 13(1), 163–175.
9. Shanmugalingam, P., Shanmuganeshan, A., Manorajan, A., Kugathasan, M., & Pathirana, G. (2023). Does e-commerce really matter on international trade of Asian countries: Evidence from panel data. *PLOS ONE*, 18(4), e0284503.

10. Xing, Z. (2017). The impacts of information and communications technology (ICT) and e-commerce on bilateral trade flows. *International Economics and Economic Policy*, 15(3), 565–586.

BEYOND HDI: DEVELOPING SUSTAINABILITY AND INNOVATION-ADJUSTED HUMAN DEVELOPMENT INDEX (SI-ADJUSTED HDI)

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INTRODUCTION

Since its introduction, the Human Development Index (HDI) has broadened development assessment by integrating health, education, and income dimensions. However, HDI and its extensions inadequately capture sustainability, innovation and subjective well-being (Sagar & Najam, 1998; Dasic et al., 2020). This limitation highlights the need for a more comprehensive framework that captures both current development achievements and future development capacity (Costantini & Monni, 2005).

LITERATURE REVIEW / THEORETICAL BACKGROUND

The study builds on Anand and Sen's human development and capability approach, integrating insights from welfare, happiness, sustainability, and innovation economics. Although PQLI, HDI, and IHDI extend development assessment beyond income, they inadequately capture subjective well-being, environmental sustainability, and innovation (Hicks, 1997; Kovacevic, 2010; Burchi & De Muro, 2016). These gaps motivate the proposed SI-adjusted HDI framework.

METHODOLOGY

The proposed index retains the three core HDI dimensions and introduces environmental sustainability and innovation as adjustment dimensions, represented by carbon emissions, renewable energy, R&D expenditure, patents, and digital inclusion (Burchi & De Muro, 2016; Costantini & Monni, 2005). Indicators are normalized using the min-max method, assigned equal weights

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because no theoretical or empirical basis exists for differential weighting, and aggregated using the geometric mean to compute the index.

RESULTS

The proposed framework is expected to provide a more comprehensive assessment of development than existing indices. Countries with stronger environmental sustainability, digital inclusion, and innovation may receive different rankings than under the conventional HDI (Castells-Quintana et al., 2019). The findings are expected to show that existing measures may misrepresent development when qualitative and quantitative dimensions are not adequately considered (Volkovitckaia et al., 2020).

DISCUSSION / POLICY IMPLICATIONS

The proposed SI-adjusted HDI shifts the focus from measuring development outcomes to evaluating how effectively societies transform resources into sustainable human well-being. By integrating sustainability and innovation, it provides policymakers with a tool to identify development gaps and formulate strategies that promote the Sustainable Development Goals and long-term human welfare (Costantini & Monni, 2005; Castells-Quintana et al., 2019).

CONCLUSION

What is measured shapes what is prioritized. The proposed SI-adjusted HDI extends the conventional HDI by integrating sustainability and innovation into human development assessment. It provides a more comprehensive measure of development effectiveness and captures not only current achievements but also societies' capacity to sustain and enhance human well-being in the future (Burchi & De Muro, 2016; Drastichová et al., 2023).

KEYWORDS

Sustainability and innovation-adjusted human development index, sustainability, innovation, development effectiveness, human development

REFERENCES

1. Anand, S., & Sen, A. (1994). *Human Development Index: Methodology and Measurement.* Human Development Report Office.

2. Burchi, F., & De Muro, P. (2016, July). Measuring human development in a high-income country: A conceptual framework for well-being indicators. In Forum for Social Economics (Vol. 45, No. 2-3, pp. 120-138). Routledge.
3. Castells-Quintana, D., Royuela, V., & Thiel, F. (2019). Inequality and sustainable development: Insights from an analysis of the human development index. *Sustainable Development*, 27(3), 448-460.
4. Costantini, V., & Monni, S. (2005). Sustainable human development for European countries. *Journal of Human Development*, 6(3), 329-351.
5. Costanza, R., Fisher, B., Ali, S., Beer, C., Bond, L., Boumans, R., ... & Snapp, R. (2007). Quality of life: An approach integrating opportunities, human needs, and subjective well-being. *Ecological Economics*, 61(2-3), 267-276. https://doi.org/10.1016/j.ecolecon.2006.02.023
6. Dasic, B., Devic, Z., Denic, N., Zlatkovic, D., Ilic, I. D., Cao, Y., ... & Le, H. V. (2020). Human development index in a context of human development: Review on the western Balkans countries. *Brain and Behavior*, 10(9), e01755.
7. Drastichová, M., Filzmoser, P., & Gajanin, R. (2023). Relationships between wellbeing and sustainable development in a group of selected developed countries. *Problemy Ekorozwoju*, 18(2), 49-77.
8. Grimm, M., Harttgen, K., Klasen, S., Misselhorn, M., Munzi, T., & Smeeding, T. (2010). Inequality in human development: An empirical assessment of 32 countries. *Social Indicators Research*, 97(2), 191-211.
9. Hicks, D. A. (1997). The inequality-adjusted human development index: a constructive proposal. *World Development*, 25(8), 1283-1298.
10. Howell, P., & Sotomayor, M. (2023). Measurement of Inequality-Adjusted Human Development at the Sub-National Level for the United States in 2015 And 2020. *Journal of Economic Development*, 48(3), 55-89.
11. Kovacevic, M. (2010). Measurement of inequality in Human Development–A review. *Measurement*, 35, 1-65.
12. Kwarcinski, T., & Ulman, P. (2020). Quality of life paradox. Well-being ranking of the selected European countries based on hybrid well-being approach. *Econ. Sociol*, 13, 160-180.
13. Matusiewicz, M. (2025). Endless Growth Does Not Bring Joy: Income Inequality, Human Development, and Happiness—A Cross-Country Analysis With a Focus on Europe. *American Journal of Economics and Sociology*, 84(5), 683-694.
14. Ogwang, T. (2000). Inter–country inequality in human development indicators. *Applied Economics Letters*, 7(7), 443-446.
15. Sagar, A. D., & Najam, A. (1998). The human development index: a critical review. *Ecological Economics*, 25(3), 249-264.
16. Suryanarayana, M. H., Agrawal, A., & Prabhu, K. S. (2016). Inequality-adjusted human development index: States in India. *Indian Journal of Human Development*, 10(2), 157-175.
17. Volkovitckaia, G. A., Konev, P., Popov, M. V., & Dobrovolskaya, O. P. (2020). Problematic points of methodologies for measuring quality of life: Human

Development Index, World Happiness Index, Well-being Index. *Revista Espacios*, 41(10).
18. Yin, R., Lepinteur, A., Clark, A. E., & D'ambrosio, C. (2023). Life satisfaction and the human development index across the world. *Journal of Cross-Cultural Psychology*, 54(2), 269-282.

MUNICIPAL GROWTH IN NORTH MACEDONIA: A PRINCIPAL COMPONENT ANALYSIS OF SOCIO-ECONOMIC AND FISCAL DETERMINANTS

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INTRODUCTION

Municipal growth is a multidimensional process shaped by fiscal capacity, demographic dynamics, economic activity, infrastructure, and institutional performance (World Bank, 2024; OECD, 2023). Although previous studies primarily examine the effect of fiscal decentralization on service delivery, limited attention has been given to identifying the latent factors that collectively determine municipal growth (Petkovski & Zafirova, 2026). This paper tries to address this gap by developing a Municipal Growth Index for North Macedonia. Moreover, innovation policy increasingly recognizes the importance of local institutional and socio-economic capacities in fostering regional competitiveness and sustainable development (Lee, 2023).

LITERATURE REVIEW / THEORETICAL BACKGROUND

Municipal growth is influenced by fiscal decentralization, local government capacity, investment, employment, population trends, and public service provision (Zafirova & Angelova, 2026). Existing studies typically estimate direct

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causal relationships using regression models. However, these variables are highly correlated, making multivariate dimension-reduction techniques particularly suitable for identifying the underlying components that jointly explain municipal development patterns (Hair et al., 2019).

METHODOLOGY

The empirical analysis is based on a dataset of 60 municipalities in North Macedonia, incorporating 27 socio-economic and fiscal indicators describing demographic structure, labour market conditions, fiscal capacity, infrastructure, and local public finance. Using municipal-level data collected from primary sources, Principal Component Analysis (PCA) is applied to construct a Municipal Growth Index (Abdi & Williams, 2010). Variables representing fiscal performance, municipal revenues and expenditures, capital investment, employment, demographic indicators, infrastructure, and service delivery are standardized prior to analysis. Kaiser-Meyer-Olkin and Bartlett's tests assess sampling adequacy, while components with eigenvalues greater than one are retained using Varimax rotation.

RESULTS

The PCA identifies several principal dimensions explaining most of the variation among municipalities. The first component captures fiscal and economic capacity, the second reflects demographic and labour-market characteristics, while the third represents infrastructure and municipal service provision. Together, these components explain a substantial proportion of total variance and allow municipalities to be classified according to their overall growth potential.

DISCUSSION / POLICY IMPLICATIONS

The findings demonstrate that municipal growth depends on the interaction of fiscal strength, demographic sustainability, and investment capacity rather than on individual indicators alone (Zafirova, 2025). The Municipal Growth Index provides policymakers with an evidence-based tool for benchmarking municipalities, identifying development disparities, and designing targeted regional and local innovation policies (Grillitsch & Asheim, 2018). From an innovation policy perspective, the Municipal Growth Index enables national and local authorities to identify municipalities with differing development capacities and innovation potential. The index can support the formulation of smart specialization strategies, regional innovation policies, and performance-based

public investment decisions by providing an integrated assessment of socio-economic and fiscal conditions.

CONCLUSION

Principal Component Analysis offers a robust alternative to conventional regression techniques by reducing numerous correlated municipal indicators into a smaller number of interpretable growth dimensions. The proposed Municipal Growth Index represents an evidence-based governance instrument that can strengthen innovation policy design, improve strategic planning, and support more effective allocation of development resources across municipalities. By integrating socio-economic and fiscal dimensions into a single analytical framework, the index contributes to data-driven public governance and territorial innovation systems.

KEYWORDS

Municipal growth, principal component analysis, local government, fiscal decentralization, North Macedonia

REFERENCES

1. Abdi, H., & Williams, L. J. (2010). Principal component analysis. Wiley Interdisciplinary Reviews: Computational Statistics, 2(4), 433–459.
2. Grillitsch, M., & Asheim, B. (2018). Place-based innovation policy for industrial diversification in regions. European Planning Studies, 26(8), 1638–1662.
3. Hair, J. F., Black, W. C., Babin, B. J., & Anderson, R. E. (2019). Multivariate data analysis (8th ed.). Cengage Learning.
4. Lee, N. (2023). Inclusive innovation in cities: From buzzword to policy. Regional Studies, 59(1).
5. OECD. (2023). Making decentralisation work: A handbook for policy-makers. OECD Publishing.
6. Petkovski, V., & Zafirova, A. (2026). Fiscal decentralization and municipal service delivery: Evidence from North Macedonian municipalities. Lex Localis, 24(2).
7. World Bank. (2024). North Macedonia public finance review. World Bank.
8. Zafirova, A. (2025). Assessment of the quality of public financial management in the municipality of Aerodrom using the PEFA methodology. Economic Development, (1–2), 152–166. https://doi.org/10.55302/ED251-2152z
9. Zafirova, A., & Angelova, B. (2026). Fiscal transparency and accountability in local self-government units: Evidence from North Macedonia. Economic Analysis. https://doi.org/10.28934/ea.2301

UNCOVERING THE LATENT DIMENSIONS OF YOUTH VULNERABILITY IN NORTH MACEDONIA: A PRINCIPAL COMPONENT ANALYSIS

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INTRODUCTION

Youth vulnerability is a multidimensional challenge affecting social inclusion, economic participation, and long-term development. In North Macedonia, youth face risks like unemployment, educational disparities, poverty, and limited opportunities. This affects the capacity of building innovative and resilient economies. Understanding youth vulnerability is essential not only for youth policy but also for innovation policies that strengthen human capital and enhance knowledge-based development.

LITERATURE REVIEW / THEORETICAL BACKGROUND

Literature shows that youth vulnerability is determined by interconnected educational, demographic and social factors (Bynner, 2019; OECD, 2024). Human capital theory links skills to growth (Becker, 1964), while social exclusion highlights resource gaps. Digital competencies are essential for employability, innovation, and entrepreneurship in knowledge economies (European

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Commission, 2024). Also, digital and green transitions require a workforce capable of adapting to technology (OECD, 2024).

METHODOLOGY

This study applies Principal Component Analysis (PCA) to identify latent dimensions of youth vulnerability in North Macedonia, providing an empirical basis for policy. This study analyzes 27 indicators across education, employment, and well-being from 2,266 survey respondents (ages 15 - 29). Sampling adequacy was confirmed (KMO = 0.808; Bartlett's test: $\chi^2 = 9746.951$, $p < 0.001$), and components with eigenvalues over one were retained using the Kaiser criterion to inform evidence-based policy.

RESULTS

The analysis extracted seven components explaining 48.37% of variance. First Component (15.71%) covers Human Capital, Digital Competencies, and Self-Efficacy (digital/STEM skills, reading, optimism, time management). Second Component (7.41%) reflects Life Stage and Educational Transition (age, education, experience). Remaining components capture well-being, living stability, social inclusion, and healthcare access, confirming youth vulnerability's multidimensionality.

DISCUSSION / POLICY IMPLICATIONS

Youth vulnerability extends beyond economic disadvantage. Human capital and digital skills emerge as the dominant dimension influencing resilience, while educational transitions, psychological well-being, social support networks, and access to health services are additional dimensions. Digital literacy, STEM, and transferable skills boost innovation and entrepreneurship. Trainings that reduce youth vulnerability should be an innovation policy priority rather than a mere social inclusion objective.

CONCLUSION

Youth vulnerability in North Macedonia is driven by structural socio-economic inequalities in employment, income, and education. PCA provide a robust framework to uncover latent dimensions and the foundation for constructing a comprehensive Youth Vulnerability. These findings help policymakers design targeted interventions that strengthen human capital, digital inclusion, and

psychosocial support. Thus, reducing vulnerability is vital for both social policy and sustainable economic growth.

KEYWORDS

Youth vulnerability, principal component analysis, digital competencies, innovation policy, North Macedonia

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REFERENCES

1. Bynner, J. (2019). Youth vulnerability and social exclusion. Journal of Youth Studies, 22(4), 451–468.
2. Djambaska, E., Lozanoska, A., Piperkova, I., & Josimovska, T. (2026). Demographic and geographic determinants of youth economic vulnerability in North Macedonia: A municipal-level cross-sectional analysis. Economic Development, 28(2), 71–86.
3. European Commission. (2024). Employment and social developments in Europe. European Commission.
4. Government of the Republic of North Macedonia. (2024). Human capital strategy of the Republic of North Macedonia 2024–2030.
5. Assa, J., & Meddeb, R. (2021). Towards a multidimensional vulnerability index: Discussion paper. United Nations Development Programme.
6. Lauri, T., Toots, A., Chevalier, T., Broka, A., & Hofäcker, D. (2025). Policy mixes and youth vulnerability in Europe: A qualitative comparative analysis of the NEET rate. Journal of European Social Policy, 35(2), 157–172. https://doi.org/10.1177/09589287241311159
7. Lozanoska, A., Djambaska, E., & Piperkova, I. (2022). Employment aspects related to quality of life in North Macedonia. Journal of Sustainable Development, 12(28), 38–55. https://doi.org/10.54442/JSD221228038l
8. OECD. (2024). Society at a glance: Social indicators. OECD Publishing.
9. O’Higgins, N., & Brockie, K. (2024). The Youth Guarantee, vulnerability, and social exclusion among NEETs in Southern Europe. Politics and Governance, 12, Article 7469. https://doi.org/10.17645/pag.7469

10. Petkovski, V., Djambaska, E., & Lozanoska, A. (2024). Socio-economic development and quality of life in terms of demographic changes in North Macedonia. Economic Development, 26(2–3).
11. Piperkova, I., Djambaska, E., & Lozanoska, A. (2022). Quality of education—the core of human capital. Economic Development, 24(1), 175–189. https://www.ek-inst.ukim.edu.mk/wp-content/uploads/2022/07/ED-year-24-no-1-2022-v.3-4-1.pdf
12. Regional Cooperation Council. (2021). Study on youth employment in the Republic of North Macedonia: Annex 5 (2nd ed.).
13. United Nations Development Programme. (2024). Youth development report. United Nations Development Programme.
14. World Bank. (2024). North Macedonia country economic memorandum. World Bank.

A COMPARATIVE ANALYSIS OF EDUCATIONAL ATTAINMENT AND LABOUR MARKET OUTCOMES IN ROMANIA AND THE EUROPEAN UNION

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INTRODUCTION

The relationship between educational attainment and labour market outcomes has attracted attention within the fields of labour economics, education economics, and human capital research. The present study investigates the relationship between educational attainment and labour market outcomes through a comparative analysis of Romania and the European Union. Beyond documenting existing educational and employment disparities, the study seeks to identify the specific structural differences that continue to limit Romania's convergence with EU labour market performance. By integrating educational attainment and labour market indicators within a comparative framework, the paper provides evidence on the mechanisms through which human capital disparities influence employment resilience and socioeconomic convergence, thereby offering policy-relevant insights for education and labour market reforms.

LITERATURE REVIEW / THEORETICAL BACKGROUND

Wolbers (2007) highlighted that school-to-work transitions differ substantially across European countries due to variations in educational structures, vocational training systems, and labour market institutions. Similarly, Marczuk (2024) argued that institutional settings play a decisive role in shaping employment outcomes,

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influencing both the speed and quality of labour market entry. Building upon these findings, Boboc et al. (2025) showed that effective labour market integration depends on the compatibility between educational provision and employers' demand for skills, emphasizing the importance of policies supporting the transition from education to employment. Krpan et al. (2023) demonstrated that longer educational pathways generally improve employment prospects across Europe, although considerable differences exist among countries. Rocca et al. (2022) further observed that reducing the proportion of young people not in employment, education, or training (NEET) requires integrated education, employment, and social inclusion policies rather than educational expansion alone. Manţa et al. (2015) emphasized the strategic role of universities in developing the competencies required by modern economies. In Romania, Herman (2012) identified a positive relationship between educational attainment and labour market performance but also highlighted persistent structural deficiencies affecting workforce integration. Tanase et al. (2025) confirmed that Romania continues to lag behind the European Union in educational attainment, workforce integration, and social inclusion, while Baciu (2022) demonstrated that higher education significantly improves graduate employability despite adverse economic conditions.

METHODOLOGY

The research adopts a quantitative descriptive approach based on secondary data obtained from European statistical sources. The analysis incorporates key indicators of educational attainment, employment, unemployment, labour market participation, and regional disparities, using descriptive statistics and comparative assessments to identify patterns, differences, and emerging trends. The study evaluates the extent to which educational attainment contributes to labour market integration while identifying structural disparities that influence employment performance.

RESULTS

The comparative analysis confirms that higher educational attainment is consistently associated with stronger labour market performance across both Romania and the European Union; however, the magnitude of this relationship differs considerably between the two contexts. While EU Member States generally demonstrate higher employment rates, greater participation in lifelong learning, and more effective transitions from education to employment, Romania continues to experience persistent structural disadvantages reflected in lower

educational attainment, wider regional inequalities, and more pronounced skills mismatches. These differences reduce workforce adaptability and limit the country's capacity to respond effectively to digitalisation, technological transformation, and the green transition. The comparative evidence suggests that Romania's challenge is not solely increasing educational participation but improving the quality, relevance, and labour market responsiveness of educational provision. Consequently, the study demonstrates that convergence with EU labour market outcomes depends on strengthening the institutional links between education systems, employers, and lifelong learning policies rather than on expanding educational attainment alone.

DISCUSSION / POLICY IMPLICATIONS

The comparative findings provide several policy insights that extend beyond the descriptive comparison between Romania and the European Union. First, the results indicate that educational attainment generates stronger labour market returns when supported by effective institutional coordination between education providers, employers, and public employment services. Second, Romania's comparatively weaker performance suggests that improving educational quality alone is insufficient without complementary policies promoting lifelong learning, regional cohesion, digital skills development, and smoother school-to-work transitions. Unlike many EU Member States where education policies are increasingly integrated with labour market strategies, Romania continues to face structural fragmentation that constrains workforce resilience. The study contributes by identifying the institutional dimensions that explain persistent convergence gaps and by highlighting priority areas for evidence-based policy interventions capable of strengthening human capital development and long-term socioeconomic competitiveness.

CONCLUSION

This study highlights that, while higher educational attainment is consistently associated with stronger employment outcomes across both Romania and the EU, significant structural disparities continue to constrain Romania's labour market performance. In particular, persistent regional inequalities, limited participation in lifelong learning, and enduring skills mismatches reduce the capacity of the education system to support workforce adaptability and sustainable economic development. The findings underscore that policy responses should extend beyond increasing educational attainment to strengthening the alignment

between education, skills development, and labour market demand through integrated and evidence-based policy frameworks.

KEYWORDS

Educational attainment, labour market outcomes, human capital, employment, regional disparities, Romania, European Union

REFERENCES

1. Baciu, E. L. (2022). Employment Outcomes of Higher Education Graduates from during and after the 2007–2008 Financial Crisis: Evidence from a Romanian University. *Sustainability*, 14(18), 11160.
2. Boboc, C. R., Ghiță, S. I., & Dogaru, O. I. (2025). Patterns of transition from the educational system to the labor market–analysis in a European context. *Revista Romana de Economie*, 60.
3. Herman, E. (2012). Education's impact on the Romanian labour market in the European context. *Procedia-Social and Behavioral Sciences*, 46, 5563-5567.
4. Krpan, M., Gardijan Kedžo, M., & Žmuk, B. (2023). Exploring the link between education length and employment outcomes among youth in Europe: A hierarchical clustering approach. Business Systems Research: *International journal of the Society for Advancing Innovation and Research in Economy*, 14(2), 190-213.
5. Manţa, Ş. G., Şarlea, M., & Vaidean, V. L. (2015). Comparative Analysis of University Education Systems from the Central and Eastern European Countries. *Procedia Economics and Finance*, 32, 1276-1288.
6. Marczuk, A. (2024). Literature review of comparative school-to-work research: how institutional settings shape individual labour market outcomes. *Journal for Labour Market Research*, 58(1), 19.
7. Rocca, A., Neagu, G., & Tosun, J. (2022). School-work-transition of NEETS: A comparative analysis of European countries. *Youth & Society*, 54(2_suppl), 130S-152S.
8. Tanase, A. M. P., Titan, E., & Caragea, I. (2025). Education, workforce integration, and social inclusion: how does Romania compare with the European Union?. *CACTUS-The Tourism Journal for Research, Education, Culture and Soul*, 32(1).
9. Wolbers, M. H. (2007). Patterns of labour market entry: A comparative perspective on school-to-work transitions in 11 European countries. *Acta sociologica*, 50(3), 189-210.

FDI AND ECONOMIC PERFORMANCE IN THE WESTERN BALKANS: EMPIRICAL EVIDENCE FROM 2010–2024

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INTRODUCTION

This paper examines the relationship between FDI and GDP growth in six Western Balkan countries from 2010 to 2024, using World Bank annual data. By applying descriptive statistics and country-level correlation analysis, it assesses whether FDI inflows are associated with economic performance and highlights differences across the region.

LITERATURE REVIEW / THEORETICAL BACKGROUND

FDI-growth literature links FDI to capital accumulation, technology transfer and spillovers (Solow, 1956; Romer, 1986), but its effects depend on human capital, absorptive capacity and financial markets (Borensztein et al., 1998; De Mello, 1999; Alfaro et al., 2004). Evidence also shows endogeneity, bidirectional causality and country-specific thresholds (Carkovic & Levine, 2005; Chowdhury & Mavrotas, 2006; Hansen, 1999).

METHODOLOGY

Using annual World Bank data for 2010–2024, this study examines the relationship between FDI net inflows and GDP in the Western Balkans. GDP is specified as the dependent variable and FDI as the independent variable.

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Correlation, regression, determination coefficients and ANOVA are applied to assess model fit and significance.

RESULTS

Results indicate heterogeneous FDI–GDP dynamics across the Western Balkans. Serbia records the highest average FDI and strongest association with GDP, while Montenegro shows weak correlation and low model representativeness. ANOVA confirms significant linear relationships in all countries except Montenegro.

DISCUSSION / POLICY IMPLICATIONS

Findings suggest that FDI is associated with GDP growth across the Western Balkans, with no significant relationship in Montenegro. Policy should therefore shift from attracting higher FDI volumes toward targeting productive, technology-enhancing and export-oriented investment aligned with national development priorities.

CONCLUSION

The analysis demonstrates a heterogeneous relationship between FDI and GDP growth across the Western Balkans. While FDI is associated with GDP growth in North Macedonia, Serbia, Bosnia and Herzegovina, Albania, and Kosovo*, its assotciation is insignificant in Montenegro. These findings indicate the need for more selective, development-oriented FDI policies and deeper assessment of investment structures.

KEYWORDS

Macroeconomics, foreign direct investments, GDP

REFERENCES

1. Alfaro, L., Chanda, A., Kalemli-Ozcan, S., & Sayek, S. (2004). FDI and economic growth: The role of local financial markets. *Journal of International Economics*, 64(1), 89–112. https://doi.org/10.1016/S0022-1996(03)00081-3
2. Borensztein, E., De Gregorio, J., & Lee, J. W. (1998). How does foreign direct investment affect economic growth? *Journal of International Economics*, 45(1), 115–135. https://doi.org/10.1016/S0022-1996(97)00033-0

* This designation is without prejudice to positions on status, and is in line with UNSCR 1244/1999 and the ICJ Opinion on the Kosovo declaration of independence.

3. Carkovic, M., & Levine, R. (2005). Does foreign direct investment accelerate economic growth? https://doi.org/10.2139/ssrn.314924
4. Chowdhury, A., & Mavrotas, G. (2006). FDI and growth: What causes what? *The World Economy*, 29(1), 9–19. https://doi.org/10.1111/j.1467-9701.2006.00755.x
5. De Mello, L. R. (1999). Foreign direct investment-led growth: Evidence from time series and panel data. *Oxford Economic Papers*, 51(1), 133–151. https://doi.org/10.1093/oep/51.1.133
6. Estrin, S., & Uvalic, M. (2014). FDI into transition economies: Are the Balkans different? *Economics of Transition*, 22(2), 281–312. https://doi.org/10.1111/ecot.12040
7. Hansen, B. E. (1999). Threshold effects in non-dynamic panels. *Journal of Econometrics*, 93(2), 345–368. https://doi.org/10.1016/S0304-4076(99)00025-1
8. Iamsiraroj, S. (2016). The foreign direct investment–economic growth nexus. *International Review of Economics & Finance*, 42, 116–133. https://doi.org/10.1016/j.iref.2015.10.044
9. Malcheski, R., & Malcheski, S. (2024). *Statistics* (second revised and supplemented edition), MCSP St. Nikole, ISBN 978-608-65872-8-4
10. Nikolić, M., Petrović, J., & Kovačević, S. (2023). Foreign direct investment and economic growth in the Western Balkans: Institutional and structural perspectives. *Strategic Management Journal*, 28(2), 45–58.
11. OECD. (2024). *Western Balkans competitiveness outlook 2024: Serbia*. Organisation for Economic Co-operation and Development. https://www.oecd.org/en/publications/western-balkans-competitiveness-outlook-2024-serbia_3699c0d5-en/full-report/component-6.html.
12. Pegkas, P. (2015). The impact of FDI on economic growth in Eurozone countries. *Journal of Economic Asymmetries*, 12(2), 124–132. https://doi.org/10.1016/j.jeca.2015.05.001
13. Romer, P. M. (1986). Increasing returns and long-run growth. *Journal of Political Economy*, 94(5), 1002–1037. https://doi.org/10.1086/261420
14. Smolo, E. (2023). Foreign direct investment and economic growth in the Western Balkans: Challenges of absorptive capacity and institutional quality. *SSRN Electronic Journal*. https://papers.ssrn.com/sol3/papers.cfm?abstract_id=4016850
15. Solow, R. M. (1956). A contribution to the theory of economic growth. *Quarterly Journal of Economics*, 70(1), 65–94. https://doi.org/10.2307/1884513

LOCKED INTO SERVICES? RENT-ORIENTED GROWTH AND PRODUCTIVITY DIVERGENCE IN CROATIA

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INTRODUCTION

Over the past three decades, Croatia has undergone marked deindustrialisation alongside significant service-sector expansion (Stojčić & Aralica, 2018; Aralica, 2020), with substantial manufacturing job losses (Aralica, 2014). This trend persisted throughout our study period. We analyse the distribution of service and manufacturing sectors across Croatian NUTS 2 regions, examining which units—sectors, firm-size tiers, and their interactions—contributed most to the rise in the national average.

LITERATURE REVIEW / THEORETICAL BACKGROUND

Regional deindustrialization is the long-term decline in manufacturing's relative importance within a region, seen in falling employment, output, or value-added shares. Though driven by global/national forces, it is spatially uneven (Stojčić et al. 2019). Shift-share decomposition separates national, sectoral, and regional competitiveness effects (Knudsen, 1992; Haynes & Dinc, 1997; Artige & van Neuss, 2014), showing whether decline stems from national trends, initial composition, or reallocation.

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METHODOLOGY

We decompose the national change using a single shift-share identity, applied to the same change at progressively finer partitions — regions, sectors, region × sector cells, sector × tier cells, and region × sector × tier cells. The national average is an employment-weighted average of unit productivities, so when a unit changes, it moves the national average through three distinct channels. For a unit i with employment share $si=li/L$ and labour productivity lp$i$ (subscript 0 = 2015).

RESULTS

National labour productivity rose 17% over the decade, +€13,211/worker. Zagreb contributed most: €6,324 (47.9%), driven by a strong within-effect (~€7,489). North Croatia added 20.7%, Adriatic Croatia 18.5%, Pannonian Croatia 12.9%. Sectorally, growth stemmed mainly from within-sector efficiency gains, while reallocation effects were negative, as employment shifted toward lower-productivity services—both between and cross components contributed negatively, the cross effect notably so.

DISCUSSION / POLICY IMPLICATIONS

Croatia's productivity growth between 2015 and 2024 stemmed primarily from within-sector improvements rather than structural transformation toward higher-productivity activities. Though the service sector expanded and contributed substantially to aggregate productivity growth, reallocation effects were negative, as employment increasingly concentrated in relatively lower-productivity service activities. The City of Zagreb was the dominant source of growth, underscoring persistent spatial disparities in economic performance.

CONCLUSION

The results imply that future growth strategies should focus not only on raising productivity within existing sectors but also on fostering structural change toward more knowledge-intensive, tradable, and innovation-driven activities. Policies aimed at strengthening manufacturing capabilities, supporting digital transformation, promoting business innovation, and enhancing regional absorptive capacity may help generate stronger productivity spillovers across regions and sectors.

KEYWORDS

Productivity, shift-share decomposition, regional deindustrialisaton, Croatia

REFERENCES

1. Aralica, Z. (2014). Hrvatska prvak u deindustrijalizaciji, EU jača industrijsku proizvodnju. Banka, (lipanj), 38–41.
2. Aralica, Z. (2020). Analiza deindustrijalizacije i reindustrijalizacije na regionalnoj razini u Hrvatskoj. U J. Tica & K. Bačić (Ur.), Ekonomska politika u 2021. godini – Hrvatska poslije pandemije (Vol. 28, str. 59–79). Hrvatsko društvo ekonomista.
3. Artige, L., & van Neuss, L. (2014). A New Shift-Share Method. Growth and Change.
4. Haynes, K. E., & Dinc, M. (1997). Productivity Change in Manufacturing Regions: A Multifactor/Shift-Share Approach.
5. Knudsen, D. C. (1992). Manufacturing Employment Change in the American Midwest, 1977–86. Environment and Planning A.
6. Stojčić, N., & Aralica, Z. (2018). (De)industrialisation and lessons for industrial policy in Central and Eastern Europe. Post-Communist Economies, 30(6), 713–734. https://doi.org/10.1080/14631377.2018.1443251
7. Stojčić, N., Aralica, Z., & Anić, I.-D. (2019). Spatio-temporal determinants of the structural and productive transformation of regions in Central and East European countries. Economic Systems, 43(3). https://doi.org/10.1016/j.ecosys.2019.100717

PUBLIC DEBT, FISCAL SPACE, AND INNOVATION FINANCING IN CENTRAL AND EASTERN EUROPE: THE ROLE OF INFLATION REGIMES

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INTRODUCTION

Central and Eastern European (CEE) governments appear to draw increasingly on sovereign bond markets to finance R&D&I policies. Persistent instability and inflation regimes may raise borrowing costs, constraining innovation financing. This framework examines how inflation regimes may shape debt costs and R&D spending across seven CEE economies (Poland, Czechia, Hungary, Romania, Estonia, Latvia, Lithuania).

LITERATURE REVIEW / THEORETICAL BACKGROUND

Research links fiscal space to innovation policy capacity (Mazzucato, 2013) and sovereign risk to borrowing costs (Aizenman & Marion, 2011). Inflation regime-switching models reveal non-linear effects of inflation on macro-financial variables (Ang & Bekaert, 2002). Yet few studies connect inflation regimes, sovereign debt costs, and public R&D financing in CEE transition economies. This paper bridges macro-finance and innovation policy literatures.

METHODOLOGY

We employ a panel dataset (2000-2025) covering selected CEE economies listed above, combining sovereign bond yields, public R&D expenditure (% GDP), and macroeconomic controls (debt/GDP, deficit). Inflation regimes are identified via a Markov-switching model. Panel regressions with regime interaction terms test whether borrowing costs and R&D expenditure are linked across low- and high-

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inflation regimes. As estimation is ongoing, results below reflect the expected, not yet confirmed, direction of effects.

RESULTS

Higher sovereign bond yields are expected to be associated with lower public R&D expenditure, with this negative relationship intensifying during high-inflation regimes. Theoretical reasoning suggests fiscal space for innovation narrows disproportionately during inflationary shocks, reflecting tighter borrowing conditions and crowding-out of discretionary R&D spending.

DISCUSSION / POLICY IMPLICATIONS

If the expected relationships are confirmed, macroeconomic stabilization would appear as a precondition for sustained innovation financing in CEE economies. Policymakers may then need counter-cyclical funding mechanisms (e.g., dedicated innovation funds, EU co-financing) to shield R&D budgets from inflation-driven fiscal constraints. Innovation-linked sovereign bonds could also help stabilize financing conditions for innovation policy during volatile inflation regimes; these implications remain tentative pending completion of the empirical analysis.

CONCLUSION

This research links inflation regime dynamics, sovereign debt costs, and innovation financing in CEE transition economies, connecting macro-finance and innovation policy literatures that have so far developed largely in parallel. By tracing how macroeconomic instability may constrain R&D financing capacity, the framework aims to inform resilient innovation policy and public debt management in small, open, transition economies, pending completion of the empirical estimation.

KEYWORDS

Inflation regimes, sovereign debt, public R&D financing, innovation policy, Central and Eastern Europe

REFERENCES

1. Aizenman, J., & Marion, N. (2011). Using inflation to erode the U.S. public debt. *Journal of Macroeconomics*, 33(4), 524–541.
2. Ang, A., & Bekaert, G. (2002). Regime switches in interest rates. *Journal of Business & Economic Statistics*, 20(2), 163–182.

3. European Commission. (2023). *European Innovation Scoreboard 2023*. Publications Office of the European Union.
4. Eurostat. (2024). *R&D expenditure*. Eurostat Statistics Explained.
5. Mazzucato, M. (2013). *The entrepreneurial state: Debunking public vs. private sector myths*. Anthem Press.
6. Reinhart, C. M., & Rogoff, K. S. (2010). Growth in a time of debt. *American Economic Review*, 100(2), 573–578.

MACROECONOMIC FACTORS AND PUBLIC DEBT IN BOSNIA AND HERZEGOVINA (2011–2024): IMPLICATIONS FOR FISCAL SUSTAINABILITY IN THE CONTEXT OF ECONOMIC SHOCKS AND GROWING UNCERTAINTY

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INTRODUCTION

The past decade has been marked by economic shocks, including the COVID-19 pandemic, inflationary pressures, and geopolitical disruptions, which have increased the importance of fiscal sustainability. Under such circumstances, the analysis of public debt and its macroeconomic determinants is particularly important for small open economies. This paper examines the relationship between public debt, inflation, economic growth, and unemployment in Bosnia and Herzegovina during 2011–2024.

LITERATURE REVIEW / THEORETICAL BACKGROUND

Theoretical and empirical studies identify inflation, economic growth, and unemployment as key determinants of public debt and fiscal sustainability (Checherita-Westphal & Rother, 2012; Panizza & Presbitero, 2014; Afonso et al., 2025). Economic growth strengthens fiscal capacity, whereas unemployment increases fiscal pressures (Blanchard & Leigh, 2013). Evidence for Bosnia and Herzegovina remains limited, particularly in the context of economic shocks.

METHODOLOGY

The study covers the period 2011–2024 and is based on data obtained from the World Bank's World Development Indicators database. Multiple linear regression (OLS), together with descriptive and correlation analysis, was applied. Public debt (% of GDP) was used as the dependent variable, while inflation, the unemployment rate, and real GDP growth rate were included as independent variables.

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RESULTS

The unemployment rate is the strongest predictor of public debt in Bosnia and Herzegovina ($\beta = 0.415$; $p = 0.006$). Inflation is negatively associated with public debt, while economic growth has a positive but statistically insignificant effect. The regression model explains 80.2% of the variation in public debt ($R^2 = 0.802$) and is statistically significant ($F = 10.83$; $p = 0.003$).

DISCUSSION / POLICY IMPLICATIONS

The findings suggest that labour market developments have significant implications for fiscal sustainability in Bosnia and Herzegovina. In the context of economic shocks and increased uncertainty, high unemployment may place additional pressure on public finances and constrain the country's fiscal capacity. The results highlight the importance of policies aimed at increasing employment and strengthening fiscal stability in order to enhance resilience to future economic disturbances.

CONCLUSION

The study confirms the existence of a significant relationship between public debt and selected macroeconomic factors in Bosnia and Herzegovina. The results indicate that unemployment has the strongest impact on public debt dynamics, while the effects of inflation and economic growth are less pronounced. The findings contribute to a better understanding of fiscal sustainability and the challenges of economic policymaking in the context of economic shocks and uncertainty.

KEYWORDS

Public debt, fiscal sustainability, inflation, unemployment, economic shocks

REFERENCES

1. Afonso, A., Alves, J., & Coelho, J. C. (2025). Determinants of the degree of fiscal sustainability. *International Journal of Finance & Economics, 30*(2), 1190–1205. https://doi.org/10.1002/ijfe.2960
2. Ando, S., Mishra, P., Patel, N., Peralta-Alva, A., & Presbitero, A. F. (2025). Fiscal consolidation and public debt. *Journal of Economic Dynamics and Control, 170*, 104998. https://doi.org/10.1016/j.jedc.2024.104998
3. Arčabić, V. (2015). Public debt and economic growth in Croatia. Public Sector Economics, 39(4), 345–370. https://doi.org/10.3326/fintp.39.4.1

4. Bejaković, P., & Nestić, D. (2019). Labour market policies and fiscal sustainability in transition economies. *Economic Research-Ekonomska Istraživanja, 32*(1), 1765–1782. https://doi.org/10.1080/1331677X.2019.1638290
5. Blanchard, O. (2017). *Macroeconomics* (7th ed.). Pearson Education.
6. Blanchard, O., & Leigh, D. (2013). Growth forecast errors and fiscal multipliers. *American Economic Review, 103*(3), 117–120. https://doi.org/10.1257/aer.103.3.117
7. Catao, L. A. V., & Terrones, M. E. (2005). Fiscal deficits and inflation. *Journal of Monetary Economics, 52*(3), 529–554. https://doi.org/10.1016/j.jmoneco.2004.06.003
8. Checherita-Westphal, C., & Rother, P. (2012). The impact of high government debt on economic growth and its channels: An empirical investigation for the euro area. *European Economic Review, 56*(7), 1392–1405. https://doi.org/10.1016/j.euroecorev.2012.06.007
9. Domar, E. D. (1944). The "burden of the debt" and the national income. *American Economic Review, 34*(4), 798–827.
10. Gujarati, D. N., & Porter, D. C. (2009). *Basic econometrics* (5th ed.). McGraw-Hill.
11. International Monetary Fund. (2022). *Fiscal monitor: Managing public wealth*. International Monetary Fund. https://www.imf.org/en/Publications/FM
12. International Monetary Fund. (2024). *Fiscal monitor: Putting a lid on public debt.* International Monetary Fund. https://doi.org/10.5089/9798400281266.089
13. Mankiw, N. G. (2021). *Principles of macroeconomics* (9th ed.). Cengage Learning.
14. Panizza, U., & Presbitero, A. F. (2014). Public debt and economic growth: Is there a causal effect? *Journal of Macroeconomics, 41*, 21–41. https://doi.org/10.1016/j.jmacro.2014.03.009
15. Reinhart, C. M., & Rogoff, K. S. (2010). Growth in a time of debt. *American Economic Review, 100*(2), 573–578. https://doi.org/10.1257/aer.100.2.573
16. Wooldridge, J. M. (2019). *Introductory econometrics: A modern approach* (7th ed.). Cengage Learning.
17. World Bank. (2023). *Bosnia and Herzegovina economic update, Spring 2023*. World Bank Group. https://www.worldbank.org/en/country/bosniaandherzegovina
18. World Bank. (2023). *World development indicators*. World Bank. https://databank.worldbank.org

THE IMPACT OF MACRO-FINANCIAL SHOCKS ON CORPORATE INDEBTEDNESS: A COMPARATIVE ANALYSIS OF ROMANIA AND CENTRAL AND EASTERN EUROPE (2019-2025)

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INTRODUCTION

The period 2019-2025 was marked by a succession of major shocks – pandemic, energy crisis, geopolitical conflict and monetary adjustment – that reconfigured the global business environment. The study analyzes the impact of these shocks on the indebtedness of Romanian firms, compared to CEE countries (Poland, Hungary, and Czech Republic), through four transmission channels: demand, costs, interest and exchange rate.

LITERATURE REVIEW / THEORETICAL BACKGROUND

The literature (Bernanke, Gertler & Gilchrist, 1999; Brunnermeier & Koby, 2019; Lian & Ma, 2021) distinguishes four main channels of shock transmission to firms' indebtedness: the demand channel, the cost channel, the interest/credit channel, and the exchange rate channel. These are not mutually exclusive, but are activated simultaneously or successively, influencing companies' financing decisions.

METHODOLOGY

The study employs a descriptive-analytical approach, dividing the period 2019–2025 into four phases: Pre-shock, Pandemic, Energy/Geopolitical, and Monetary Adjustment. The comparative analysis between Romania and selected CEE countries uses quarterly data from central banks, Eurostat, and national statistical

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institutes. Key indicators include interbank rates, policy rates, average corporate loan rates, lending growth, inflation, and GDP growth.

RESULTS

The pandemic phase increased working capital credit, with debt stock expanding in 2021. The energy crisis compressed margins via cost channel, amid severe inflation, more pronounced in Hungary and Poland. Monetary adjustment raised debt costs, slowing lending. Hungary faced the most severe adjustment. Romania followed a moderate-high trajectory, but slower adjustment prolonged pressures. Poland recovered faster, supported by rate cuts, while the Czech Republic had the most stable costs.

DISCUSSION / POLICY IMPLICATIONS

Romania's delayed monetary easing prolonged high financing costs, increasing pressure on firms with variable-rate loans. The energy cap removal (July 2025) adds to liquidity pressures. High financing costs reduce SME investment in innovation. Credit contraction restricts start-ups' access to finance. High spreads create disadvantages versus Poland and the Czech Republic. Targeted policies are needed: guarantee programs, subsidized rates for innovative SMEs, and debt restructuring support.

CONCLUSION

The sequence of shocks in 2020-2025 has fundamentally transformed the corporate finance landscape. Romania has avoided the extreme volatility seen in Hungary and Poland, but persistently high interest rates and cost pressures have increased financial fragility, especially for indebted and energy-intensive firms. Resilience requires prudent policies and targeted support for SMEs.

KEYWORDS

Corporate indebtedness, macro financial shocks, transmission channels, monetary policy, Central and Eastern Europe

REFERENCES

1. Baldwin, R., & Weder di Mauro, B. (2020). Economics in the time of COVID-19. CEPR Press.

2. Bernanke, B. S., Gertler, M., & Gilchrist, S. (1999). The financial accelerator in a quantitative business cycle framework. In J. B. Taylor & M. Woodford (Eds.), Handbook of macroeconomics (Vol. 1, pp. 1341–1393). Elsevier.
3. Brunnermeier, M. K., & Koby, Y. (2019). The reversal interest rate (NBER Working Paper No. 25406). National Bureau of Economic Research.
4. Chiţu, L., et al. (2024). Monetary policy transmission in Romania. *BNR Occasional Papers*.
5. Czech National Bank. (2023). Financial stability report 2023. CNB.
6. European Central Bank. (2023). Financial stability review, November 2023. ECB.
7. Eurostat. (2023). GDP and inflation data for Central and Eastern Europe. European Commission.
8. Gourinchas, P.-O., et al. (2021). *COVID-19 and the global economy*. IMF World Economic Outlook.
9. International Monetary Fund. (2023). Regional economic outlook: Europe, October 2023. IMF.
10. Ivashina, V., Scharfstein, D., & Stein, J. (2018). Bank lending during the financial crisis. *Journal of Finance*.
11. Lian, C., & Ma, Y. (2021). Anatomy of corporate borrowing constraints (NBER Working Paper No. 29194). National Bureau of Economic Research.
12. National Bank of Hungary. (2023). Financial stability report, May 2023. MNB.
13. National Bank of Poland. (2023). Financial stability report, June 2023. NBP.
14. National Bank of Romania. (2023). Inflation report, November 2023. BNR.
15. National Bank of Romania. (2024). Inflation report, May 2024. BNR.
16. National Bank of Romania. (2025). Inflation report, February 2025. BNR.
17. National Institute of Statistics. (2023). Economic indicators – Statistical data. INS Romania.
18. Zlate, V. (2022). The impact of geopolitical shocks on emerging European economies. *Journal of Comparative Economics*, 50(4), 1021-1042.

VOLATILITY DYNAMICS ACROSS FINANCIAL ASSETS IN TIMES OF GEOPOLITICAL TURBULENCE: EVIDENCE FROM CRYPTOCURRENCIES, FIAT CURRENCIES AND GOLD

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INTRODUCTION

Volatility is a key feature of financial markets, particularly during periods of geopolitical uncertainty. The Russia-Ukraine conflict increased instability across asset markets, highlighting the need to understand how different financial assets respond to external shocks. While gold and fiat currencies have traditionally been viewed as reference assets, cryptocurrencies introduce additional complexity due to their decentralized structure, speculative behavior and sensitivity to market sentiment. This study compares volatility dynamics across cryptocurrencies, fiat currencies and gold, providing insights into financial market behavior and the challenges posed by digital financial innovation under conditions of heightened uncertainty.

LITERATURE REVIEW / THEORETICAL BACKGROUND

Volatility reflects risk, information incorporation and investor expectations, varying across asset classes according to their economic and institutional characteristics. Gold is often regarded as a safe-haven asset, although its effectiveness depends on the type of crisis (Baur and McDermott, 2010). Fiat currencies derive relative stability from monetary policy credibility and institutional frameworks. Cryptocurrencies, by contrast, are typically associated with higher volatility due to speculative dynamics, limited regulation and sentiment-driven trading. Existing studies consistently find significant differences between cryptocurrencies and traditional assets (Duarte, 2015; Klein et al., 2018;

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Corbet et al., 2019; Gopinath and Itskhoki, 2022). However, these assets are often analyzed separately, limiting direct comparisons and motivating an integrated assessment of volatility behavior during periods of geopolitical uncertainty (Danielsson et al., 2018; Klein et al., 2018).

METHODOLOGY

The analysis uses daily closing prices in Swiss francs for Bitcoin, Ethereum, Ripple, the US dollar, euro, Chinese renminbi and gold. The Swiss franc is adopted as a stable benchmark due to its traditional neutrality and reserve currency status. The sample is divided into pre-war and war periods around the outbreak of the Russia-Ukraine conflict in February 2022. Logarithmic returns are computed and stationarity is assessed using ADF and KPSS tests. Volatility dynamics are estimated through GARCH models, which capture conditional heteroskedasticity and persistence. Model selection relies on information criteria, and unconditional variances are calculated to compare average volatility across assets and periods.

RESULTS

The results reveal substantial differences in volatility across asset classes. Before the conflict, significant volatility is observed mainly in Ethereum, Ripple and the euro. Cryptocurrencies are consistently the most volatile assets, displaying unconditional volatility levels many times higher than those of fiat currencies and gold, together with stronger persistence effects. Fiat currencies exhibit the lowest volatility, reflecting the stabilizing role of institutional and monetary frameworks. Gold shows intermediate volatility. Following the outbreak of the conflict, volatility becomes significant across all assets, indicating increased uncertainty. Despite this shift, the relative ranking remains unchanged, with cryptocurrencies remaining the most unstable assets.

DISCUSSION / POLICY IMPLICATIONS

The findings highlight the importance of accounting for asset-specific characteristics when assessing financial stability under uncertainty. The persistent volatility of cryptocurrencies reinforces their speculative nature and suggests caution for risk-averse investors. The increase in volatility among fiat currencies during the conflict underlines the importance of credible monetary policy and effective institutional responses. Gold maintains diversification benefits but is not immune to market fluctuations. For policymakers, the results support closer monitoring of cross-asset volatility dynamics and the development of governance

frameworks capable of balancing digital financial innovation, investor protection and financial stability during periods of geopolitical stress.

CONCLUSION

This study compares volatility dynamics across cryptocurrencies, fiat currencies and gold before and after the onset of the Russia-Ukraine conflict. The results confirm that cryptocurrencies are consistently the most volatile assets, whereas fiat currencies display lower but rising volatility under stress conditions. Gold occupies an intermediate position, supporting its traditional role as a relatively stable asset. Although geopolitical shocks intensify volatility across all markets, fundamental differences between asset classes remain. The findings contribute to the literature on financial market behaviour under uncertainty and provide useful insights for investors, regulators and researchers examining the implications of digital financial innovation.

KEYWORDS

Cryptocurrencies, fiat currencies, GARCH models, geopolitical uncertainty, volatility

REFERENCES

1. Baur, D. G., & McDermott, T. K. (2010). Is gold a safe haven? International evidence. *Journal of Banking & Finance*, 34(8), 1886-1898.
2. Caldara, D., Conlisk, S., Iacoviello, M., & Penn, M. (2022). The effect of the war in Ukraine on global activity and inflation.
3. Corbet, S., Lucey, B., Urquhart, A., & Yarovaya, L. (2019). Cryptocurrencies as a financial asset: A systematic analysis. *International Review of Financial Analysis*, 62, 182-199.
4. Danielsson, J., Valenzuela, M., & Zer, I. (2018). Learning from history: Volatility and financial crises. *The Review of Financial Studies*, 31(7), 2774-2805.
5. Duarte, A. P. (2015). *O Sistema Monetário Internacional*. Leya.
6. Engle, R. F. (1982). Autoregressive conditional heteroscedasticity with estimates of the variance of United Kingdom inflation. *Econometrica: Journal of the econometric society*, 987-1007.
7. Francq, C., & Zakoian, J. M. (2019). *GARCH models: structure, statistical inference and financial applications*. John Wiley & Sons.
8. Gopinath, G., & Itskhoki, O. (2022). *Dominant currency paradigm: A review*. Handbook of international economics, 6, 45-90.

9. Klein, T., Thu, H. P., & Walther, T. (2018). Bitcoin is not the New Gold–A comparison of volatility, correlation, and portfolio performance. *International Review of Financial Analysis*, 59, 105-116.
10. Nakamoto, S. (2008). *Bitcoin: a peer-to-peer electronic cash system*. White paper.
11. Sözen, Ç. (2025). Volatility dynamics of cryptocurrencies: a comparative analysis using garch-family models. *Future Business Journal*, 11, 166.
12. Thomas, K. V. and Kumar, K. S. (2025). Investor sentiment and stock market volatility: A behavioral finance perspective. *GS WOW: Wisdom of Worthy Research Journal*, 4(1):37–50.

CORRUPTION, INSTITUTIONAL QUALITY AND FOREIGN DIRECT INVESTMENT IN NORTH MACEDONIA: A MIXED-METHODS ANALYSIS

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INTRODUCTION

Foreign direct investment (FDI) is an important tool for the growth of transition economies, yet its impact depends highly on both macroeconomic performance and institutional credibility. In this regard, this study examines whether corruption and governance quality effect the FDI attractiveness in North Macedonia as a small open economy, during 2007–2024, addressing a country-specific evidence gap.

LITERATURE REVIEW / THEORETICAL BACKGROUND

According to the economic literature, foreign direct investments are affected by macroeconomic factors as well as institutional quality. Corruption may reduce FDI because of higher transaction costs and uncertainty, but political stability and the rule of law may encourage investment. The literature is consistent about the "grabbing hand" model in relation to the interaction of corruption, FDI, and economic growth, as corruption creates uncertainty and transaction costs and can negatively affect FDI (Mauro, 1995; Wei, 2000; Habib & Zurawicki, 2002). There is some evidence for a "grease the wheels" effect in a short-term perspective (Egger & Winner, 2005). The role of overall governance quality is emphasized in recent literature, but findings based on country-specific evidence for North Macedonia are not abundant (Voka, 2015; Kuzmanoska Mirkovikj et al., 2024).

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METHODOLOGY

An empirical analysis is conducted by using annual World Bank WDI/WGI data for 2007–2024 through OLS model estimate FDI net inflows (% of GDP) against the Control of Corruption, macroeconomic controls, and governance indicators.

RESULTS

The main corruption model is insignificant (R^2=0.057). Thus, in the next model, by adding the macroeconomic controls raises R^2 to 0.719; GDP growth is positive and significant, while the corruption coefficient is significant only in conventional OLS and is not robust. The full model including the institutional factors shows R^2=0.932, but also severe multicollinearity (max VIF=85.57) that makes most institutional coefficients insignificant.

DISCUSSION / POLICY IMPLICATIONS

The evidence shows that corruption should not be seen as an isolated determinant of FDI. Quantitative evidence imply that that corruption operates through administrative inefficiency, inconsistent regulation, weak accountability, and legal uncertainty. Policy should prioritize transparent administration, regulatory consistency, judicial independence, and anti-corruption enforcement.

CONCLUSION

For the case of North Macedonia, FDI attractiveness reflects the nexus of macroeconomic conditions and institutional quality. While econometric data findings does not support the presence of a stand-alone corruption impact, it becomes clear that the poor quality of the institutions is the reason for the increased risk perception and lack of trust.

KEYWORDS

Foreign direct investment, corruption, institutional quality, governance, North Macedonia

REFERENCES

1. Egger, P., & Winner, H. (2005). Evidence on corruption as an incentive for foreign direct investment. European Journal of Political Economy, 21(4), 932–952.
2. Habib, M., & Zurawicki, L. (2002). Corruption and foreign direct investment. Journal of International Business Studies, 33(2), 291–307.

3. Kuzmanoska Mirkovikj, A., Gkasis, C., & Golitsis, P. (2024). Regulatory quality and foreign direct investment in North Macedonia. Theoretical Economics Letters, 14(6), 1–18.
4. Mauro, P. (1995). Corruption and growth. Quarterly Journal of Economics, 110(3), 681–712.
5. Voka, I. (2015). Institutional determinants of foreign direct investment in Macedonia: Evidence from panel data. International Journal of Business and Social Research, 5(5), 1–16.
6. Wei, S.-J. (2000). How taxing is corruption on international investors? Review of Economics and Statistics, 82(1), 1–11.
7. World Bank. (2024). World Development Indicators. World Bank.
8. World Bank. (2024). Worldwide Governance Indicators. World Bank.

II.

ENTREPRENEURSHIP AND INNOVATION ECOSYSTEMS

THE EVOLUTION OF ENTREPRENEURIAL ECOSYSTEMS: INSIGHTS FROM A BIBLIOMETRIC ANALYSIS

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INTRODUCTION

Entrepreneurship does not occur in isolation: it is shaped by a complex web of actors, institutions, and resources that together constitute what scholars call the entrepreneurial ecosystem (EE). Over the past two decades, EE has moved from a practitioner heuristic to one of the most vibrant concepts in entrepreneurship research, with scholarly output rising from a single publication in 2009 to more than 1,100 by 2023. Yet, despite this exponential growth, catalysed since 2015 by the foundational contributions of Stam (2015) and Spigel (2017), the field still lacks a consensus definition, overlooks emerging-economy contexts, and suffers from methodological fragmentation. This study aims to trace how the intellectual structure of EE research has evolved over the period 2006–2023 and to identify the field's dominant thematic trajectories, geographic biases, and remaining theoretical gaps. To this end, it conducts a comprehensive bibliometric analysis of the full corpus of 1,100 Scopus-indexed EE publications spanning this period.

LITERATURE REVIEW / THEORETICAL BACKGROUND

The EE concept traces back to Moore's (1993) ecosystem metaphor, drawn from biological ecology, and to Cohen's (2006) first academic application of the concept in the context of Silicon Valley's sustainable ecosystem. Isenberg's (2010) six-pillar framework gave the concept its early operational structure, while Stam (2015) and Spigel (2017) supplied the theoretical scaffolding that triggered the field's exponential growth after 2015. Subsequent work extended the concept toward digital transformation (Autio et al., 2018), ecosystem resilience under systemic shocks such as COVID-19 (Kuckertz et al., 2020), and sustainability (Cohen, 2006). Persistent gaps remain, however, in emerging-economy coverage and in what the

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literature terms causal theorisation, that is, a clear specification of the mechanisms through which ecosystem conditions produce entrepreneurial outcomes, and of how ecosystems evolve over time (Alvedalen & Boschma, 2017).

METHODOLOGY

Bibliographic data were extracted from Scopus in January 2024 using the query TITLE-ABS-KEY ("entrepreneurial ecosystem" OR "entrepreneurship ecosystem") for the period 2006–2023, yielding a final corpus of 1,100 peer-reviewed, English-language journal articles. Four complementary techniques were applied to this full corpus: descriptive publication analysis, co-citation analysis, bibliographic coupling, and keyword co-occurrence mapping. All network analyses were performed in VOSviewer (v1.6.19), with a co-citation threshold of 10 and a keyword frequency threshold of 5.

RESULTS

Publication output within this 1,100-article corpus grew from a single article in 2009 to more than 1,100 cumulative publications by 2023, following a markedly non-linear trajectory: a first, decisive acceleration in 2015–2016 coincided with the publication of Stam (2015) and Spigel (2017), whose foundational status is reflected in their citation counts (respectively over 1,200 and over 1,250 citations to date), and a second, milder acceleration followed 2020, associated with COVID-19-driven interest in ecosystem resilience. This punctuated growth pattern indicates that the field's evolution has been shaped less by gradual accumulation than by a small number of paradigm-shaping contributions, consistent with the progressive institutionalisation of a young research area. The United States (258 publications), the United Kingdom (159), and Germany (96) dominate output, and Small Business Economics (65 articles) and Sustainability (Switzerland) (45 articles) are the leading outlets. Network analyses identify five thematic clusters: innovation and technology, policy and institutions, sustainability, education and human capital, and investment and value creation, organised around three intellectual lineages anchored in the foundational works of Stam (2015) and Spigel (2017).

DISCUSSION / POLICY IMPLICATIONS

The field exhibits structural biases: Western dominance in research output, and the corresponding underrepresentation of African, Arab, and South Asian contexts, are both descriptive and normative problems. As Alvedalen and Boschma (2017) and Mubarak and Suomi (2022) argue, the dominant frameworks

developed in high-income settings carry embedded assumptions, for instance regarding the availability of formal venture capital and institutional density, that may generate misfit recommendations when exported to institutionally thinner settings. This suggests that policymakers in emerging economies need context-sensitive EE frameworks rather than direct transplants of Silicon Valley- or London-derived models. The post-2020 acceleration of ecosystem-resilience research further signals that existing frameworks, largely static and component-oriented, must be extended toward dynamic, resilience-oriented theorisation. Similarly, the field's growing engagement with digital transformation (Autio et al., 2018) challenges the traditionally territorially bounded conception of EE and calls for renewed conceptual work at the intersection of digital and physical ecosystem dynamics.

CONCLUSION

This study offers one of the most temporally comprehensive bibliometric portraits of EE research produced to date, covering the full period from the field's scholarly inception in 2006 through 2023. Its threefold contribution (complete temporal coverage, multi-method network analysis, and a structured critique of the field's geographic and methodological limitations) advances both the theoretical consolidation and the forward research agenda of the field. Three priority directions emerge: rigorous EE theorisation grounded in emerging-economy contexts, development of standardised cross-national measurement instruments, and sustained investigation of digital-physical ecosystem dynamics and resilience under systemic disruption.

KEYWORDS

Entrepreneurial ecosystem, bibliometric analysis, Scopus, co-citation, thematic clusters, sustainability

REFERENCES

1. Acs, Z. J., Stam, E., Audretsch, D. B., & O'Connor, A. (2017). The lineages of the entrepreneurial ecosystem approach. *Small Business Economics*, 49(1), 1–10.
2. Alvedalen, J., & Boschma, R. (2017). A critical review of entrepreneurial ecosystems research: Towards a future research agenda. *European Planning Studies*, 25(6), 887–903.
3. Audretsch, D. B., & Belitski, M. (2017). Entrepreneurial ecosystems in cities: Establishing the framework conditions. *Journal of Technology Transfer*, 42(6), 1030–1051.

4. Autio, E., Kenney, M., Mustar, P., Siegel, D., & Wright, M. (2014). Entrepreneurial innovation: The importance of context. *Research Policy*, 43(7), 1097–1108.
5. Autio, E., Nambisan, S., Thomas, L. D., & Wright, M. (2018). Digital affordances, spatial affordances, and the genesis of entrepreneurial ecosystems. *Strategic Entrepreneurship Journal*, 12(1), 72–95.
6. Cavallo, A., Ghezzi, A., & Balocco, R. (2019). Entrepreneurial ecosystem research: Present debates and future directions. *International Entrepreneurship and Management Journal*, 15(4), 1291–1321.
7. Cohen, B. (2006). Sustainable valley entrepreneurial ecosystems. *Business Strategy and the Environment*, 15(1), 1–14.
8. Donthu, N., Kumar, S., Mukherjee, D., Pandey, N., & Lim, W. M. (2021). How to conduct a bibliometric analysis: An overview and guidelines. *Journal of Business Research*, 133, 285–296.
9. Elia, G., Margherita, A., & Passiante, G. (2020). Digital entrepreneurship ecosystem. *Technological Forecasting and Social Change*, 150, 119791.
10. Isenberg, D. J. (2010). How to start an entrepreneurial revolution. *Harvard Business Review*, 88(6), 40–50.
11. Kuckertz, A., Brändle, L., Gaudig, A., Hinderer, S., Morales Reyes, C. A., Prochotta, A., Steinbrink, K. M., & Berger, E. S. C. (2020). Startups in times of crisis: A rapid response to the COVID-19 pandemic. *Journal of Business Venturing Insights*, 13, e00169.
12. Moore, J. F. (1993). Predators and prey: A new ecology of competition. *Harvard Business Review*, 71(3), 75–86.
13. Mubarak, M. F. H., & Suomi, S. (2022). Entrepreneurial ecosystems in developing countries. *Journal of Enterprising Communities*, 16(3), 427–451.
14. Spigel, B. (2017). The relational organization of entrepreneurial ecosystems. *Entrepreneurship Theory and Practice*, 41(1), 49–72.
15. Spigel, B., & Harrison, R. T. (2018). Toward a process theory of entrepreneurial ecosystems. *Strategic Entrepreneurship Journal*, 12(1), 151–168.
16. Stam, E. (2015). Entrepreneurial ecosystems and regional policy: A sympathetic critique. *European Planning Studies*, 23(9), 1759–1769.
17. Stam, E., & van de Ven, A. (2021). Entrepreneurial ecosystem elements. *Small Business Economics*, 56(2), 809–832.
18. Sussan, F., & Acs, Z. J. (2017). The digital entrepreneurial ecosystem. *Small Business Economics*, 49(1), 55–73.
19. Trabskaia, I., Gorgadze, A., Raudsaar, M., & Myyrylainen, H. (2023). A bibliometric analysis of social entrepreneurship and entrepreneurial ecosystems. *Administrative Sciences*, 13(3), 75.
20. Usai, S., Scuotto, V., Murray, A., & Massaro, M. (2021). Innovation and entrepreneurial ecosystems: A bibliometric analysis. *Management Decision*, 59(11), 2677–2696.
21. Zouaoui, Z., & Chaker, H. (2023). Reforming entrepreneurship ecosystems in the post-COVID-19 era. *Journal on African Entrepreneurial Development*, 15(2), 134–159.

CROSS-COUNTRY ANALYSIS OF START-UP AND INNOVATION ECOSYSTEMS IN THE WESTERN BALKAN COUNTRIES AND TÜRKIYE

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INTRODUCTION

The analysis examines the current state, dynamics, and potential of startup ecosystems — the innovation ecosystems supporting venture creation — by identifying key ecosystem actors, and assessing how economic, social, regulatory, and technological factors shape entrepreneurship. It evaluates ecosystem maturity, facilitators, and constraints, and highlights cross-regional opportunities. The focus is on EU enlargement countries, with similar historical, geographical, political and economic background, like Western Balkan Countries (WBC) and Türkiye.

LITERATURE REVIEW / THEORETICAL BACKGROUND

The theoretical background of start-ups and innovation ecosystems is based on stakeholder theory (Bryson, 2004), innovation ecosystem theory, and needs assessment approaches, complemented by co-creation principles. These frameworks, informed by prior country assessments (GIZ, 2023; Baycan & Arkali Olcay, 2021; Yıldırım & Keskin, 2020), enable systematic identification of relevant actors, assessment of their needs, and comparison of stakeholder categories across WB6 and Türkiye.

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METHODOLOGY

This study uses a qualitative approach based on secondary data from reports, policy documents, and academic literature published 2020–2025, covering WB6 (Albania, Bosnia and Herzegovina, Kosovo* Montenegro, North Macedonia, Serbia) and Türkiye. Data were collected through desk research and analyses using thematic and comparative methods to map stakeholders, and assess ecosystem maturity via institutional support, early-stage finance, university-industry commercialisation, and regulatory coherence.

RESULTS

Stakeholder mapping results, consistent with prior reports (GIZ, 2023; USAID Diaspora Invest, 2023), confirm that universities and public institutions play a central role while private investment remains less developed across WB6. The comparative analysis further finds Türkiye's stronger funding access and support systems (Baycan & Arkali Olcay, 2021) offer a transferable model, with cross-regional opportunities in high-growth sectors, knowledge exchange, and partnerships.

DISCUSSION / POLICY IMPLICATIONS

The discussion highlights uneven ecosystem development, with strong public-sector involvement but weak private investment and persistent structural challenges such as funding gaps and talent loss (World Bank, 2020; StartupBlink, 2025). Policy recommendations focus on improving governance, access to finance, university - industry collaboration modelled on Türkiye's techno park and incubation experience (Yıldırım & Keskin, 2020; Gürakan, 2024), regulatory frameworks, and cross-regional cooperation.

CONCLUSION

The results show diverse but unequally developed innovation ecosystems, with universities playing a central role and limited private investment in emerging regions. Key challenges include access to finance, regulatory barriers, and talent gaps. Opportunities exist in cross-regional collaboration, digital and green sectors, and partnerships. The study concludes that, despite structural differences, partner

* This designation is without prejudice to positions on status, and is in line with UNSCR 1244/1999 and the ICJ Opinion on the Kosovo declaration of independence.

ecosystems share similar challenges and complementary strengths. This provides a strong foundation for building an integrated innovation cross - country network.

KEYWORDS

Start-up, ecosystems, Western Balkan counties, Türkiye, cross-country analysis

REFERENCES

1. Baycan, T., & Arkali Olcay, G. (2021). Linking the performance of entrepreneurial universities to technoparks and university characteristics in Türkiye. REGION, 8(1), 97–117.
2. Bryson, J. M. (2004). What to do when stakeholders matter: Stakeholder identification and analysis techniques. Public Management Review, 6(1), 21–53. https://doi.org/10.1080/14719030410001675722
3. GIZ. (2023). Western Balkans startup ecosystem assessment report. https://wbstartupalliance.org/wp-content/uploads/2023/07/GIZWesternBalkansEcosystemAssessmentReport_compressed.pdf
4. Gürakan, E. (2024). The transformation of Türkiye's entrepreneurship ecosystem in 2024. TOPLUM Foundation.
5. StartupBlink. (2025). Global Startup Ecosystem Index – Bosnia and Herzegovina.
6. USAID Diaspora Invest. (2023). Roadmap for the development and roll-out of business angel investing in Bosnia and Herzegovina. https://f787.ba/Roadmap%20for%20Angel%20Investment%20in%20BiH.pdf
7. World Bank. (2020). Bosnia and Herzegovina – systematic country diagnostic update.
8. Yıldırım, F., & Keskin, G. (2020). Entrepreneurship ecosystem in Türkiye: Accelerators & incubation centers. Journal of Business, Economics and Finance, 9(1), 20–39.

WHY RESEARCH DOES NOT REACH THE MARKET: IDENTIFYING SYSTEMIC BARRIERS TO TECHNOLOGY TRANSFER THROUGH INNOVATION ECOSYSTEM INDICATORS

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INTRODUCTION

Technology transfer translates academic research into economic and societal value, supporting the "third mission" of universities (Lindelöf & Hellberg, 2025). Yet research excellence rarely translates into commercialization: the "European Paradox" shows strong European science struggles to reach the market (Argyropoulou et al., 2019). This gap is visible in the "valley of death," where promising technologies stall from insufficient funding and support (Ellwood et al., 2022). Increased resources alone do not resolve this: even with stronger support, securing the first major investment remains difficult (Ellwood et al., 2022). The research-to-market gap thus reflects broader institutional and systemic conditions, not resource constraints alone. This paper develops a conceptual framework identifying systemic barriers to research commercialization and maps them against European Innovation Scoreboard (EIS) indicators.

LITERATURE REVIEW / THEORETICAL BACKGROUND

Strong scientific performance and R&D investment do not guarantee marketable innovations. Commercialization remains difficult even with available support (Argyropoulou et al., 2019; Ellwood et al., 2022). The literature identifies barriers at two levels: within institutions (weak communication, limited entrepreneurial incentives, fragmented IP management), and at system level (gaps in early-stage funding, complex regulation, weak coordination among universities, industry, government and investors) (Ramesh, 2021; Good et al., 2020; Yang et al., 2025).

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Technology transfer is thus an outcome of interactions within an innovation ecosystem, whose alignment shapes commercialization. Scoreboards like the EIS capture research performance, finance, linkages and intellectual assets (European Commission, 2025), but the extent to which they capture institutional capabilities and governance remains unclear (Radosevic & Yoruk, 2022). Mapping barriers against EIS indicators can reveal measurement gaps.

METHODOLOGY

The paper develops a conceptual framework that links the key dimensions influencing the technology transfer process with existing innovation ecosystem indicators. First, the structured literature review is performed to identify the systemic barriers most encountered in the commercialization of research results. Second, these barriers are mapped to relevant indicators of the European Innovation Scoreboard framework (European Commission, 2025). Third, the resulting mapping is synthesized into a conceptual framework that systematizes the links between technology transfer factors and innovation ecosystem indicators, highlighting areas requiring improvement in the existing measurement system.

RESULTS

The proposed framework shows that existing innovation ecosystem indicators unevenly represent the systemic conditions influencing technology transfer. The EIS enables cross-country comparison through research performance (co-publications, highly cited publications), intellectual assets (patent, trademark, design applications), and finance and support (venture capital, R&D expenditure, government support), but captures selected inputs and outputs rather than the transfer process itself (European Commission, 2025). Institutional conditions remain weakly represented: the EIS does not capture TTO capabilities, IP governance, licensing practices or researcher incentives. Strong research, funding or patenting performance thus does not indicate that universities have the capacity to convert results into innovations. This reveals a measurement gap, showing that existing indicators offer only a partial understanding of the research-to-market process.

DISCUSSION / POLICY IMPLICATIONS

Europe is a world class scientific power, but this advantage cannot be converted into technological and economic performance (Argyropoulou et al., 2019). Results showed that EIS indicators do not provide enough information nor knowledge to

identify barriers to technology transfer. These indicators need to be complemented with organizational and governance-related indicators that could capture dynamics of innovation ecosystems by incorporating qualitative indicators (Cunningham & O'Reilly, 2018; Granstrand & Holgersson, 2020). Only then, proposed framework may support interests of stakeholders, including policymakers, universities and technology transfer offices, and help identifying structural gaps in order to improve evidence-informed technology transfer policies and support mechanisms.

CONCLUSION

The research-to-market gap cannot be fully understood through existing innovation ecosystem indicators alone. By linking these indicators with systemic barriers to technology transfer, the proposed framework offers a structured approach for understanding research commercialization conditions while highlighting important measurement gaps. The framework provides a foundation for more comprehensive assessments of technology transfer ecosystems and may support the development of more evidence-informed innovation policies.

KEYWORDS

Technology transfer, research commercialization, innovation ecosystem, innovation indicators, systemic barriers

REFERENCES

1. Argyropoulou, M., Soderquist, K. E., & Ioannou, G. (2019). Getting out of the European Paradox trap: Making European research agile and challenge driven. *European Management Journal*, 37(1). https://doi.org/10.1016/j.emj.2018.10.005
2. Cunningham, J. A., & O'Reilly, P. (2018). *Macro, meso and micro perspectives of technology transfer*. The Journal of Technology Transfer, 43, 545–557. https://doi.org/10.1007/s10961-018-9658-4
3. Ellwood, P., Williams, C., & Egan, J. (2022). Crossing the valley of death: Five underlying innovation processes. *Technovation*, 109. https://doi.org/10.1016/j.technovation.2020.102162
4. European Commission. (2025). *European Innovation Scoreboard 2025*. Publications Office of the European Union.
5. Good, M., Knockaert, M., & Soppe, B. (2020). A typology of technology transfer ecosystems: how structure affects interactions at the science–market divide. *The Journal of Technology Transfer*, *45*(5), 1405-1431. https://doi.org/10.1007/s10961-019-09745-w

6. Granstrand, O., & Holgersson, M. (2020). Innovation ecosystems: A conceptual review and a new definition. *Technovation, 90-91*. https://doi.org/10.1016/j.technovation.2019.102098
7. Lindelöf, P., & Hellberg, R. (2025). Development of university technology transfer ecosystems: An evolutionary analysis of policy, system, and organisational design [Preprint]. SSRN. https://doi.org/10.2139/ssrn.5270896
8. Radosevic, S., & Yoruk, E. (2022). Why composite innovation indexes fail to capture systemic bottleneck barriers in technology transfer: Evidence from Central and Eastern Europe. Technological Forecasting and Social Change, 182. https://doi.org/10.1016/j.techfore.2022.121810
9. Ramesh, S. (2021). Technology transfer: Bridging the gap between research and commercialization. International Journal of Research in Science & Engineering, 1(2), 50–54. https://doi.org/10.55529/ijrise.12.50.54
10. Tolin, G., Capella, F., Pedemonte, F., et al. (2026). Towards a governance of technology transfer: Fostering impact through goals, people, and resources. The Journal of Technology Transfer, 51, 741–769. https://doi.org/10.1007/s10961-025-10237-3
11. Yang, Q., Wang, C., Ying, H., Jianf. H., Fu, Z. (2025). Review on barriers and drivers of university–industry collaborative innovation: A stakeholder perspective. Sustainable Futures, 9.

INNOVATION FINANCE AND VENTURE CAPITAL IN ENTREPRENEURIAL ECOSYSTEMS: A FRAMEWORK FOR SUSTAINABLE SME GROWTH

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INTRODUCTION

Innovation-driven entrepreneurship is essential for economic growth and competitiveness (Schumpeter, 1934; Acs et al., 2017). However, limited access to innovation finance remains a major challenge for startups and small and medium-sized enterprises (SMEs) (Block et al., 2018; OECD, 2025). Existing studies often examine venture capital, innovation finance, and entrepreneurial ecosystems in isolation (Audretsch & Belitski, 2025; Clayton et al., 2023). This study addresses this gap by developing an integrated framework that explains how innovation finance and venture capital strengthen entrepreneurial ecosystems, enhance SME innovation performance, and support sustainable growth.

LITERATURE REVIEW / THEORETICAL BACKGROUND

This study is grounded in Entrepreneurial Ecosystem Theory (Acs et al., 2017; Spigel, 2017), Innovation Systems Theory (Schumpeter, 1934), and the Resource-Based View (Teece, 2018). These theories explain how innovation finance, venture capital, and institutional support foster SME innovation and competitiveness (Block et al., 2018; Cumming & Johan, 2013). However, existing research often examines these factors separately (Audretsch & Belitski, 2025; Clayton et al., 2023). This study integrates them into a unified conceptual framework for sustainable SME growth.

METHODOLOGY

This conceptual study employs a systematic literature review. A structured search was conducted in Scopus, Google Scholar, OECD, and World Bank databases using keywords: "innovation finance," "venture capital," "entrepreneurial ecosystems,"

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and "SME performance." The review focused on studies published between 2015 and 2025, incorporating seminal works where necessary. An initial pool of 85 articles was screened based on relevance, quality, and alignment with the research objectives, resulting in 45 core sources. Based on this synthesis, an integrated conceptual framework was developed.

RESULTS

The proposed framework integrates financial, institutional, and innovation perspectives to explain how innovation finance and venture capital strengthen entrepreneurial ecosystems. Unlike previous studies, it demonstrates how collaboration among investors, governments, universities, financial institutions, and SMEs enhances innovation, competitiveness, and resilience. Specifically, venture capital, angel investment, crowdfunding, and government innovation funds support R&D, technology adoption, commercialization, and global expansion, contributing to sustainable economic development.

DISCUSSION / POLICY IMPLICATIONS

The proposed framework offers practical guidance for policymakers, investors, and financial institutions. Policies should encourage venture capital, strengthen regulatory frameworks for alternative financing, expand public-private partnerships, and improve SME access to finance. Collaboration among universities, innovation hubs, and financial institutions should accelerate knowledge commercialization. The framework also provides a foundation for future empirical validation across different contexts.

CONCLUSION

This study develops an integrated conceptual framework explaining how innovation finance and venture capital promote sustainable SME growth within entrepreneurial ecosystems. The framework extends existing literature by integrating financial, institutional, and innovation perspectives while providing practical guidance for policymakers and a foundation for future empirical research.

KEYWORDS

Innovation finance, venture capital, entrepreneurial ecosystems, small and medium-sized enterprises (SMEs), sustainable economic development

REFERENCES

1. Acs, Z. J., Stam, E., Audretsch, D. B., & O'Connor, A. (2017). The lineages of the entrepreneurial ecosystem approach. *Small Business Economics*, 49(1), 1–10.
2. Ahluwalia, S., & Kassicieh, S. (2024). Pathways to success: The interplay of industry and venture capital clusters in entrepreneurial company exits. *Journal of Risk and Financial Management*, 17(4), 159. https://doi.org/10.3390/jrfm17040159
3. Andonova, V., Finchelstein, D., & García Duque, J. (2026). Nurturing unicorns and entrepreneurial ecosystems in Africa: Harnessing policy innovation for digital transformation. In P. G. Perez & A. M. L. Casanova (Eds.), *Unicorns from emerging economies: Creating value through technology and innovation* (pp. 282–306). Cambridge University Press.
4. Audretsch, D. B., & Belitski, M. (2025). *Entrepreneurial ecosystems in the post-pandemic era.* Small Business Economics.
5. Block, J. H., Colombo, M. G., Cumming, D., & Vismara, S. (2018). New players in entrepreneurial finance and why they are there. *Small Business Economics*, 50(2), 239–250.
6. Clayton, P., Feldman, M., & Montmartin, B. (2023). *Entrepreneurial finance and regional ecosystem emergence*. Small Business Economics. Advance online publication. https://doi.org/10.1007/s11187-023-00847-w
7. Cumming, D., & Johan, S. (2013). *Venture Capital and Private Equity Contracting: An International Perspective* (2nd ed.). Academic Press.
8. Cumming, D., & Zhan, F. (2024). Digital transformation and venture capital. *Journal of Corporate Finance.*
9. Isenberg, D. J. (2011). *The entrepreneurship ecosystem strategy as a new paradigm for economic policy.* Babson Entrepreneurship Ecosystem Project.
10. Mukherjee, A., Owen, R., Scott, J. M., & Lyon, F. (2024). Financing green innovation startups: A systematic literature review on early-stage SME funding. Venture Capital: *An International Journal of Entrepreneurial Finance*, 26(2), 149–175. https://doi.org/10.1080/13691066.2023.2295800
11. Noak, N. V., & Christian, L. (2025). Exploring spatial network structures in entrepreneurial ecosystems: A network and clustering analysis of global venture funding flows. Small Business Economics. Advance online publication. https://doi.org/10.1007/s11187-025-00994-2
12. Organisation for Economic Co-operation and Development (OECD). (2025). *Financing SMEs and Entrepreneurs 2025: An OECD Scoreboard*. OECD Publishing.
13. Owen, R., Vedanthachari, L. N., & Hussain, J. (2024). The role of the university entrepreneurial ecosystem in entrepreneurial finance: Case studies of UK innovation knowledge centres. Venture Capital: *An International Journal of Entrepreneurial Finance*, 26(3), 351–375. https://doi.org/10.1080/13691066.2024.2349519
14. Palacín-Sánchez, M. J., & Di Pietro, F. (2025). Linking financial ecosystem and the growth of young SMEs: Evidence from Spanish regions. *Review of Managerial Science*, 19, 1859–1888. https://doi.org/10.1007/s11846-024-00815-4

15. Qin, F., & Ertug, G. (2025). Oasis in the desert or icing on the cake? The impact of entrepreneurship accelerators across ecosystems. *Journal of International Business Studies*, 56, 659–676. https://doi.org/10.1057/s41267-025-00780-4

16. Schumpeter, J. A. (1934). *The Theory of Economic Development*. Harvard University Press.
17. Spigel, B. (2017). The relational organization of entrepreneurial ecosystems. Entrepreneurship *Theory and Practice*, 41(1), 49–72.
18. Teece, D. J. (2018). Business models and dynamic capabilities. *Long Range Planning*, 51(1),40–49.
19. World Bank. (2023). *Global Financial Development Report 2023*. World Bank.
20. World Intellectual Property Organization (WIPO). (2024). *Global Innovation Index 2024: Unlocking the promise of social entrepreneurship*. Geneva: WIPO. https://www.wipo.int/global_innovation_index/en/2024/

INSTITUTIONAL DRIVERS OF FINANCIAL SUSTAINABILITY AND OUTREACH IN MICROFINANCE: IMPLICATIONS FOR INCLUSIVE INNOVATION IN INDIA AND AFGHANISTAN

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INTRODUCTION

Microfinance institutions (MFIs) play a vital role in promoting financial inclusion, entrepreneurship, and sustainable economic development (Anthanasius & Opperman, 2023). Their effectiveness depends on institutional capacity to achieve financial sustainability while expanding outreach (Rallens, 2006). This study examines how institutional factors influence MFI performance in India and Afghanistan and explores the implications of improved financial sustainability and outreach for inclusive innovation within different socioeconomic and regulatory environments.

LITERATURE REVIEW / THEORETICAL BACKGROUND

Previous studies identify institutional efficiency, governance, portfolio quality, and operational scale as key determinants of MFI performance (Mersland & Øystein Strøm, 2009; Uddin, 2024). Sustainable MFIs expand access to finance, encourage entrepreneurial activity, and strengthen inclusive economic growth (Anthanasius & Opperman, 2023). However, comparative evidence between India and Afghanistan remains limited, particularly regarding how institutional characteristics effect the sustainability of microfinance institutions.

METHODOLOGY

The study employs a balanced panel dataset of ten MFIs (five from India and five from Afghanistan) covering FY2015–16 to FY2024–25. Financial sustainability is measured by Return on Assets (ROA), while outreach is measured by the number

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of active borrowers. Panel regression techniques, including Fixed Effects, Random Effects, and the Hausman test, are applied using Stata 19.

RESULTS

The financial sustainability model indicates that branch network expansion has a positive and statistically significant effect ($\beta = 0.521$, $p < 0.001$), while operating expenses exert a significant negative effect ($\beta = -0.013$, $p < 0.001$). Gross loan portfolio and institutional income show positive but statistically insignificant relationships. The outreach model further demonstrates that branch network expansion and gross loan portfolio significantly increase the number of active borrowers, highlighting the importance of institutional capacity in expanding financial inclusion. Furthermore, the negative and significant country effect for Afghanistan ($\beta = -1.322$, $p < 0.001$) suggests comparatively weaker institutional performance than Indian MFIs.

DISCUSSION / POLICY IMPLICATIONS

The findings suggest that strengthening institutional capacity enhances the financial sustainability and outreach of microfinance institutions. As a policy implication, improved outreach and access to finance can support inclusive innovation by enabling underserved populations and entrepreneurs to participate more effectively in economic activities. Policymakers should prioritize sound governance, operational efficiency, and supportive regulatory frameworks to strengthen MFI resilience, expand financial inclusion, and promote inclusive economic development, particularly in fragile economies.

CONCLUSION

Institutional capacity is a key driver of financial sustainability and outreach in microfinance institutions. Strengthening governance, improving operational efficiency, and expanding financial access can enhance financial inclusion and contribute to inclusive innovation by supporting entrepreneurship and economic participation among underserved populations. The study provides comparative evidence from India and Afghanistan that can inform policymakers and practitioners in designing sustainable microfinance strategies, particularly in developing and fragile economies.

KEYWORDS

Microfinance institutions, financial sustainability, inclusive innovation, financial inclusion, entrepreneurship

REFERENCES

1. Anthanasius, F. T., & Opperman, P. (2023). Financial inclusion and performance of MSMEs in Eswatini. International Journal of Social Economics, 50(11), 1551–1567. https://doi.org/10.1108/IJSE-10-2020-0689
2. Mersland, R., & Øystein Strøm, R. (2009). Performance and governance in microfinance institutions. Journal of Banking & Finance, 33(4), 662–669.
3. Nazim Uddin, Md., Bt. Saad, N., Bin Ismail, Y., & Nahar, L. (2024). Comparative analysis of microfinance governance: Implications for impact of social inequality and poverty reduction. In Sustainable Development. IntechOpen. https://doi.org/10.5772/intechopen.1004336
4. Rallens, T. (2006). Microfinance: Recent experience, future possibilities. Journal of Social, Political, and Economic Studies, 31(2), 197.

MOTIVATIONAL FACTORS AS PREDICTORS OF ENTREPRENEURIAL INTENTIONS: EVIDENCE FROM DEVELOPING COUNTRY

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INTRODUCTION

Entrepreneurship plays an important role in economic development, innovation, and employment creation (Shane et al., 2003). In transition economies such as Serbia, individuals often prefer employment in existing organizations rather than self-employment (Stefanović et al., 2010). Therefore, understanding motivational factors that influence entrepreneurial intentions is essential for encouraging entrepreneurial activity and sustainable economic growth (Shane et al., 2003).

LITERATURE REVIEW / THEORETICAL BACKGROUND

Entrepreneurial motivation has been examined through theoretical perspectives emphasizing both personal and environmental determinants (Carsrud & Brännback, 2011). Previous studies identify financial motives, professional development, autonomy, social support, personal achievement, and fear of failure as important drivers of entrepreneurial behavior (Al-Mamary & Alshallaqi, 2022; Brändle & Kuckertz, 2023; Burlea-Schiopoiu & Popovici, 2024; Hoogendoorn et al., 2024; McClelland, 1961; Morris et al., 2024). Entrepreneurial intentions are considered a precursor to entrepreneurial activity and are shaped by a combination of motivational, psychological, and contextual factors (Shane et al., 2003).

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METHODOLOGY

The empirical study was conducted using an online questionnaire administered to 81 respondents in the Republic of Serbia. Entrepreneurial intentions were analyzed in relation to six motivational factors: financial factors, professional development, autonomy and control, social factors, personal motivation and achievement, and fear of failure and obstacles. Spearman correlation analysis and multiple linear regression analysis were applied to examine relationships and predictive effects.

RESULTS

The findings reveal that five of the six examined motivational factors are positively and significantly related to entrepreneurial intentions. The strongest correlations were identified for personal motivation and achievement, financial factors, and professional development. Regression analysis demonstrated that financial factors, professional development, and fear of failure are statistically significant predictors. The final model explained 42% of the variance in entrepreneurial intentions.

DISCUSSION / POLICY IMPLICATIONS

The findings emphasize the importance of motivational determinants in shaping entrepreneurial intentions. Financial motives and opportunities for professional development appear to exert the strongest influence on entrepreneurial aspirations. These results suggest that entrepreneurship-support policies should prioritize educational initiatives, competency development programs, and institutional mechanisms aimed at strengthening entrepreneurial capabilities and encouraging business creation (Sun et al., 2023).

CONCLUSION

The study confirms the relevance of motivational factors in explaining entrepreneurial intentions within the Serbian context. Financial factors and professional development emerged as the most influential predictors, whereas social factors did not exhibit statistical significance. The findings contribute to the existing body of entrepreneurship research and provide practical implications for policymakers and institutions seeking to foster entrepreneurial development in transition economies.

KEYWORDS

Entrepreneurial intentions, motivation, entrepreneurship, financial factors, professional development

REFERENCES

1. Al-Mamary, Y. H., & Alshallaqi, M. (2022). Impact of autonomy, innovativeness, risk-taking, proactiveness, and competitive aggressiveness on students' intention to start a new venture. *Journal of Innovation & Knowledge*, 7(4), 100239.
2. Brändle, L., & Kuckertz, A. (2023). Inequality and entrepreneurial agency: how social class origins affect entrepreneurial self-efficacy. *Business & Society*, 62(8), 1586-1636.
3. Burlea-Schiopoiu, A., & Popovici, N. (2024). Social inclusion: A factor that influences the sustainable entrepreneurial behavior of Generation Z. *Administrative Sciences*, 14(3), 59.
4. Carsrud, A., & Brännback, M. (2011). Entrepreneurial motivations: What do we still need to know? *Journal of Small Business Management*, 49(1), 9–26.
5. Hoogendoorn, B., O'Hagan-Luff, M., Ramezani, S., & van Stel, A. (2024). Does self-employment provide a bridge to retirement?. *Cambridge Journal of Economics*, 48(4), 767-784.
6. McClelland, D. C. (1961). *The Achieving Society*. Van Nostrand.
7. Morris, M. H., Kuratko, D. F., Santos, S. C., & Soleimanof, S. (2024). Fear and the poverty entrepreneur: The paradox of failure and success. *Business Horizons*, 67(1), 41-54.
8. Shane, S., Locke, E. A., & Collins, C. J. (2003). Entrepreneurial motivation. *Human Resource Management Review*, 13(2), 257–279.
9. Stefanović, I., Prokić, S., & Ranković, L. (2010). Motivational and success factors of entrepreneurs: The evidence from a developing country. *Zbornik radova Ekonomskog fakulteta u Rijeci*, 28(2), 251–269.
10. Sun, J., Shi, J., & Zhang, J. (2023). From entrepreneurship education to entrepreneurial intention: Mindset, motivation, and prior exposure. *Frontiers in Psychology*, 14, 954118.

HEALTH CARE ENTREPRENEURSHIP IN FAMILY MEDICINE: PUSH AND PULL FACTORS SHAPING PRIVATE PRACTICE IN THE REPUBLIC OF SRPSKA/BOSNIA AND HERZEGOVINA

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INTRODUCTION

Family medicine (FM) represents a central component of primary health care (PHC) and the first point of contact between patients and the health system. The Republic of Srpska is a particularly relevant context for studying health care entrepreneurship in FM, as it is a privately owned FM that has developed through a slow, cautious transition, with limited entrepreneurial initiative among FMDs and the gradual creation of conditions for small-scale health care entrepreneurship.

LITERATURE REVIEW / THEORETICAL BACKGROUND

European health system reforms increasingly emphasize efficiency, managerial autonomy and market-oriented mechanisms (OECD, 1992; Osborne & Gaebler, 1992; Saltman & Durán, 2016; Saltman & Figueras, 1997). In PHC, these reforms included new organizational models, contracting, patient choice, performance measurement, and a stronger role for family medicine doctors (FMDs), often through self-employment and entrepreneurial models (Boerma & Fleming, 1998; Saltman et al., 2006; Sheaff et al., 2006; Weiner et al., 2002). The study is based on push-pull theory, where push factors refer to work-related constraints, while pull factors reflect the attractiveness of private practice (Lee, 1966). Push–pull theory is well suited to analyzing entrepreneurial decisions in family medicine, as

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it encompasses both the pressures that may drive physicians away from public-sector employment and the perceived benefits that attract them to private practice. Factors such as workload, time pressure, administrative demands, limited professional autonomy, inadequate recognition and burnout may function as push factors. In contrast, greater autonomy, improved work organization, more time for patients and enhanced opportunities for professional development may serve as pull factors towards self-employment or private practice.

METHODOLOGY

A qualitative design was applied. Data were collected through semi-structured interviews with 14 respondents from FM and private health care practice: employed FMDS, self-employed FMDs and owners of private health care institutions. This enabled comparison of employee, independent practice and managerial perspectives. Interviews were analyzed using thematic analysis, which allows systematic identification, coding, and interpretation of patterns in qualitative data (Braun & Clarke, 2006, 2022). Purposive sampling was used to select participants with relevant experience in employment, self-employment, or ownership within family medicine and private health care practice. This approach facilitated comparison among employee, independent practice, and managerial perspectives.

RESULTS

Findings show that entry into private FM is shaped by professional, organizational, economic and personal factors, not only income. Push factors include workload, time pressure, administrative demands, limited autonomy, poor recognition, and burnout. Pull factors include autonomy, better organization, time for patients and development. Employed FMDs value security without ownership risk; self-employed gain autonomy but face risk; owners stress regulation, contracts and sustainability.

DISCUSSION / POLICY IMPLICATIONS

The study shows that health care entrepreneurship also involves organizational and professional innovation, not just technological innovation. Family physicians employed in the public sector experience significant workload pressures, constrained professional autonomy and inadequate recognition. These factors may encourage a transition to private practice. Nevertheless, the expansion of private family medicine introduces governance challenges related to regulation, contracting and long-term sustainability. Policy should address professional

autonomy, workload, recognition, and support for group practice models, while ensuring that private provision is aligned with equity, quality, and continuity of care (André & Hermann, 2009; Saltman, 2003; Clarke et al., 2024; Muschell, 1996; WHO, 2020).

CONCLUSION

Private family medicine in the Republic of Srpska reflects different experiences: employment without ownership risk; self-employment with autonomy and uncertainty; and institutional entrepreneurship shaped by regulation, contracts, and sustainability. Motives go beyond income and include autonomy, better work organization and patient relationships. Policy should support clearer regulation, transparent contracting, and the integration of private providers and group practice models to balance autonomy, accountability, and continuity of care.

KEYWORDS

Health care entrepreneurship, family medicine, private practice, professional autonomy, mixed health systems

REFERENCES

1. André, C., & Hermann, C. (2009). *Privatisation and marketisation of health care systems in Europe*. In M. Frangakis, C. Hermann, J. Huffschmid, & K. Lóránt (Eds.), Privatisation against the European social model: A critique of European policies and proposals for alternatives (pp. 129–144). Palgrave Macmillan.
2. Boerma, W. G. W., & Fleming, D. M. (1998). The role of general practice in primary health care. The Stationery Office, on behalf of the World Health Organization Regional Office for Europe.
3. Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3(2), 77–101.
4. Braun, V., & Clarke, V. (2022). *Thematic analysis: A practical guide*. SAGE Publications.
5. Clarke, D., Cocozza, A., Appleford, G., Thabet, A., Ross, S., & Boggs, M. (2024). Data-driven governance and the private sector in mixed health systems. *BMJ Global Health*, 8, e014705. https://doi.org/10.1136/bmjgh-2023-014705
6. Lee, E. S. (1966). A theory of migration. *Demography*, 3(1), 47–57.
7. Muschell, J. (1996). Privatization—A balancing act. *World Health Forum*, 17(1), 37–41.
8. Organisation for Economic Co-operation and Development. (1992). The reform of health care: A comparative analysis of seven OECD countries.
9. Osborne, D., & Gaebler, T. (1992). Reinventing government: How the entrepreneurial spirit is transforming the public sector. Addison-Wesley Publishing Company.
10. Saltman, R. B. (2003). Melting public–private boundaries in European health systems. *European Journal of Public Health*, 13(1), 24–29.

11. Saltman, R. B., & Durán, A. (2016). Governance, government, and the search for new provider models. *International Journal of Health Policy and Management*, 5(1), 33–42. https://doi.org/10.15171/ijhpm.2015.198
12. Saltman, R. B., & Figueras, J. (1997). European health care reform: Analysis of current strategies. WHO Regional Office for Europe.
13. Sheaff, R., Gené-Badia, J., Marshall, M., & Švab, I. (2006). *The evolving public–private mix*. In R. B. Saltman, A. Rico, & W. G. Boerma (Eds.), Primary care in the driver's seat? Organizational reform in European primary care. Open University Press.
14. Weiner, J., Gillam, S., & Lewis, R. (2002). Organization and financing of British primary care groups and trusts: Observations through the prism of US managed care. *Journal of Health Services Research & Policy*, 7(1), 43–50.
15. World Health Organization. (2020). Engaging the private health service delivery sector through governance in mixed health systems: Strategy report of the WHO Advisory Group on the Governance of the Private Sector for Universal Health Coverage.

HUMAN CAPITAL BARRIERS AND ENTREPRENEURIAL POTENTIAL AMONG YOUTH: A CASE STUDY OF BITOLA, NORTH MACEDONIA

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INTRODUCTION

Youth aged 15-29 in North Macedonia experience varying degrees of labour-market vulnerability. This paper examines the extent to which human capital deficits linked to education, certification, skills-job mismatch and access to finances, constrain the entrepreneurial potential of youth in Bitola, based on an empirical sample, and identifies policy instruments capable of addressing them, with particular attention to disparities affecting Roma youth as a vulnerable category.

LITERATURE REVIEW / THEORETICAL BACKGROUND

OECD (2024) and ETF (2021) report Western Balkan youth NEET (Not in Employment, Education or Training) rates of approximately 25%, and a vertical skills mismatch, i.e. a discrepancy between workers' qualification levels and job requirements, of 13.2% in North Macedonia. Human capital theory (Becker, 1975; Heckman, 2006) and entrepreneurial-ecosystem theory (Isenberg, 2010; GEM, 2022) frame entrepreneurship as a corrective mechanism - a gap this study addresses empirically at a municipal level.

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METHODOLOGY

A mixed-methods design was applied in this research - a structured survey (N=668, or approximately 5% of Bitola's youth aged 15-29, including Roma and other vulnerable categories) with a moderated focus group (19 participants). It assesses human capital barriers and constructs a composite entrepreneurial-potential index (0-1), grounded in psychological capital theory (Luthans et al., 2015), from entrepreneurship-training interest, career-path clarity, self-efficacy and optimism.

RESULTS

Empirical findings link human capital deficits to entrepreneurial potential - the index averages 0.70 for certificate-holders vs 0.63 for those without and 0.52 for poorly prepared by education (57.5% and 17.7% of the sample), consistent with the national vertical skills mismatch. Roma score lower overall (0.60) vs Macedonian majority (0.69). NEET rises from 1.9% (15-19) to 31.5% (25-29). 41.5% cite financial support as a need, vs 61.8% among Roma, echoing long-term patterns (UNDP et al., 2017).

DISCUSSION / POLICY IMPLICATIONS

The rise in NEET rates with age suggests barriers, not diminishing ambition - failed job searches and, for some Roma youth, family duties may compound over time. Roma youth score 0.09 lower than the majority on the entrepreneurial-potential index (0-1 scale), yet about 31% higher in citing financial need, more reflecting poverty than business capital specifically; combined with regional credit constraints on youth SMEs (OECD, 2026), the policy should pair certification with basic economic security.

CONCLUSION

Human capital barriers, not a lack of ambition, account for the weaker entrepreneurial potential among the sampled youth in Bitola, particularly Roma and those transitioning into NEET status. Since attitudes differ little between sample's strata while financial security differs sharply, pairing certification with poverty-reduction measures, particularly among Roma, may free this latent potential for enterprise. These case-study findings can inform inclusive entrepreneurship policy more broadly.

KEYWORDS

NEET youth, human capital, entrepreneurship, social inclusion, North Macedonia

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REFERENCES

1. Becker, G. S. (1975). Human capital: A theoretical and empirical analysis, with special reference to education. University of Chicago Press.
2. European Training Foundation. (2021). Youth disengagement and skills mismatch in the Western Balkans (Working Paper).
3. Global Entrepreneurship Monitor. (2022). GEM global report 2021/2022. GEM Consortium.
4. Heckman, J. J. (2006). Skill formation and the economics of investing in disadvantaged children. Science, 312(5782), 1900-1902.
5. Isenberg, D. (2010). How to start an entrepreneurial revolution. Harvard Business Review, 88(6), 40-50.
6. Luthans, F., Youssef-Morgan, C. M., & Avolio, B. J. (2015). Psychological capital and beyond. Oxford University Press.
7. OECD. (2024). Western Balkans competitiveness outlook 2024: Regional profile. OECD Publishing.
8. OECD. (2026). SME Policy Index for Western Balkans and Türkiye 2026. OECD Publishing.
9. United Nations Development Programme, World Bank, & European Commission (2017). Regional Roma survey: Socio-economic position of Roma in the Western Balkans. UNDP.

EMPIRICAL ANALYSIS OF THE MULTIDIMENSIONAL YOUTH VULNERABILITY AS A BARRIER TO ENTREPRENEURIAL CAPACITY: EVIDENCE FROM NORTH MACEDONIA

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INTRODUCTION

Development of the youth entrepreneurial capacity is vastly hindered by their vulnerability as a multidimensional challenge that cannot be perceived as an isolated economic problem, but also encompasses social exclusion, spatial barriers, systemic discrimination, and psycho-emotional conditions. While conventional entrepreneurship policies focus on technical training and financial instruments, they often overlook how entrenched structural disadvantages constrain individual agency, risk-taking propensity, and opportunity recognition among young individuals. Capturing the multidimensional nature of youth vulnerability is therefore essential for identifying systemic barriers to enterprise creation and for designing more inclusive and resilient entrepreneurial ecosystems.

LITERATURE REVIEW / THEORETICAL BACKGROUND

Contemporary research conceptualizes vulnerability asa cumulative effect of interconnected economic, social, spatial, and psycho-emotional deprivations

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(Moro et al., 2021; Redmond et al., 2024). Within the entrepreneurship literature, these non-material and institutional barriers are increasingly recognized as primary deterrents that impede entrepreneurial self-efficacy, risk readiness, and innovation potential (Mensah & Dadzie, 2020; Ofosu-Appiah et al., 2025). Chronic disengagement and social exclusion not only restrict access to resource-bearing networks but also heighten psycho-emotional strain, diminishing proactive entrepreneurial behavior (Assmann & Broschinski, 2021; Fillia et al., 2025). Despite growing international interest in holistic youth welfare, empirical research in transitional economies still lacks standardized measurement tools to assess how these multifaceted vulnerabilities directly constrain entrepreneurial inclusion.

METHODOLOGY

The paper is based on quantitative research conducted on a representative sample of 2300 youth in 5 municipalities in North Macedonia, evaluated by the five separate aspects of vulnerability, such as economic and housing, institutional and social, spatial, psycho-emotional, and community risks. Based on the collected primary data, descriptive and statistical analyses are used for evaluating the indicator distributions and identify specific channels through which socioeconomic and psycho-emotional constraints translate into structural barriers to youth entrepreneurial capacity.

RESULTS

The primary results demonstrate that despite visible stability in basic indicators, such as 93% of youth living in their own house and 87% with health insurance, deep structural vulnerabilities severely limit entrepreneurial capacity. Economically, 66% of youth deeply depend on family financial support, 78% cannot cover unexpected emergency costs, directly restricting discretionary capital accumulation, startup funding, and tolerance for financial risk. Institutionally, high social passivity and institutional disengagement restrict access to business networks, mentorship, and support infrastructure. Furthermore, significant psycho-emotional strain, with 25% reporting severe stress, compromises entrepreneurial confidence and decision-making under uncertainty. These empirical findings demonstrate that youth entrepreneurial inactivity in North Macedonia is structurally rooted in risk aversion, limited social capital, and emotional distress rather than mere lack of business interest.

DISCUSSION / POLICY IMPLICATIONS

The results underline the necessity of shifting entrepreneurship policy from narrow microfinance and basic business training toward multidimensional support frameworks. Because family dependency and inability to absorb economic shocks severely limit risk readiness, enterprise-support interventions must integrate initial safety nets, micro-grants, and subsidized incubation. Furthermore, overcoming high institutional passivity and mental distress requires embedding psycho-social support, active mentoring networks, and digital skills development into local entrepreneurial ecosystems. Addressing these structural and non-material vulnerabilities is a prerequisite for enabling marginalized young people to convert potential into sustainable entrepreneurial ventures.

CONCLUSION

This study provides robust empirical evidence confirming that multidimensional youth vulnerability, particularly financial dependency, institutional isolation, and psycho-emotional distress, constitutes a formidable structural barrier to entrepreneurial capacity. By establishing a validated multidimensional assessment framework, the paper bridges the empirical gap between social vulnerability research and entrepreneurship studies. It offers strategic insights for policymakers to design targeted interventions that strengthen the inclusivity and effectiveness of youth entrepreneurial ecosystems.

KEYWORDS

Youth vulnerability, entrepreneurial capacity, entrepreneurial ecosystems, social exclusion, North Macedonia

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REFERENCES

1. Assmann, M. L., & Broschinski, S. (2021). Mapping young NEETs across Europe: Exploring the institutional configurations promoting youth disengagement from

education and employment. *Journal of Applied Youth Studies*, 4(2), 95–117. https://doi.org/10.1007/s43151-021-00046-6

2. Mensah, A. C., & Dadzie, J. (2020). Application of principal component analysis on perceived barriers to youth entrepreneurship. *American Journal of Theoretical and Applied Statistics.* 9(5), 187–196. https://doi.org/10.11648/j.ajtas.20200905.12
3. Moro, Á., Maiztegui-Oñate, C., & Solabarrieta, J. (2021). Vulnerability among European youth: A proposal for a multidimensional approach (2013–2017). *Sustainability*, 13(16), Article 9252. https://doi.org/10.3390/su13169252
4. Ofosu-Appiah, S., Boahen, P. A. N., & Agbenyegah, A. T. (2025). Socio-ecological barriers to youth entrepreneurship in sub-Saharan Africa: a systematic review of empirical evidence. *Journal of Innovation and Entrepreneurship*, 14(1), Article 32.
5. Redmond, G., Main, G., O'Donnell, A. W., Skattebol, J., Woodnman, R., Mooney, A., Wang, J., Turkmani, S., Thomson, C., & Brooks, F. (2024). Who excludes? Young People's Experience of Social Exclusion. *Journal of Social Policy*, 53(1), 236-259. https://doi.org/10.1017/S004727942200057X

WOMEN'S ENTREPRENEURSHIP AND EDUCATION: RESEARCH GROWTH, THEMATIC STRUCTURE AND FUTURE DIRECTIONS

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INTRODUCTION

Women's entrepreneurship supports inclusive growth, innovation and employment, while education can strengthen the capabilities needed to recognise opportunities and develop sustainable ventures. Yet women's entrepreneurial outcomes remain shaped by gendered financial, social and institutional constraints. This study maps the field's growth and structure, identifies future directions and examines how influential studies conceptualise education.

LITERATURE REVIEW / THEORETICAL BACKGROUND

Research links entrepreneurship education to entrepreneurial intentions, self-efficacy and perceived behavioural control, but its effects are often indirect, skill-specific and context-dependent (Nowiński et al., 2019; Westhead & Solesvik, 2016). Reviews further emphasise human and social capital, finance, networks and institutions, while evidence remains concentrated on intention rather than venture entry, performance or empowerment (Cardella et al., 2020; Lee et al., 2024).

METHODOLOGY

A Web of Science Core Collection topic search combining terms for women's entrepreneurship with education, training, financial literacy, mentoring, skills and support retrieved 623 English-language articles and reviews published in 2016–2025. Bibliometric performance and science-mapping analyses in R using

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Bibliometrix/Biblioshiny covered production, citations, sources, authorship, collaboration and themes. The ten most globally cited documents underwent structured qualitative analysis.

RESULTS

Publications rose from 26 in 2016 to 115 in 2025, with 17.96% annual growth. The 623 documents in 331 sources received 10,289 citations. The International Journal of Gender and Entrepreneurship led output, while the USA had the highest total number of citations. Four clusters covered intentions and education, gendered capabilities, ecosystems and support, and venture outcomes. The ten-paper synthesis found context-dependent, capability-mediated effects and limited evidence on realised outcomes.

DISCUSSION / POLICY IMPLICATIONS

Entrepreneurship education should not be reduced to course exposure. Its contribution appears strongest when programmes develop self-efficacy, perceived control, planning, resource marshalling and opportunity recognition. Effects vary with curriculum and social, institutional and national contexts. Universities and policymakers should combine practical, gender-responsive education with mentoring, networks, role models, financial access and wider ecosystem support.

CONCLUSION

Research on women's entrepreneurship and education is expanding rapidly but remains dispersed and more developed for intentions and perceived capabilities than for realised outcomes. Bibliometric mapping and qualitative synthesis support a capability- and ecosystem-based perspective. Future systematic reviews should assess how education, training and support interventions affect venture creation, survival, performance, resilience and economic empowerment.

KEYWORDS

Women's entrepreneurship, entrepreneurship education, entrepreneurial intention, entrepreneurial capabilities, bibliometric analysis

REFERENCES

1. Andriamahery, A., & Qamruzzaman, M. (2022). Do access to finance, technical know-how, and financial literacy offer women empowerment through women's

entrepreneurial development? Frontiers in Psychology, 12, Article 776844. https://doi.org/10.3389/fpsyg.2021.776844
2. Aria, M., & Cuccurullo, C. (2017). bibliometrix: An R-tool for comprehensive science mapping analysis. Journal of Informetrics, 11(4), 959–975. https://doi.org/10.1016/j.joi.2017.08.007
3. Cardella, G. M., Hernández-Sánchez, B. R., & Sánchez-García, J. C. (2020). Women entrepreneurship: A systematic review to outline the boundaries of scientific literature. Frontiers in Psychology, 11, Article 1557. https://doi.org/10.3389/fpsyg.2020.01557
4. Dey, S. K., Sharma, D., & Dash, S. (2024). Impact of entrepreneurship education on entrepreneurial intention among female students of Odisha. SEDME (Small Enterprises Development, Management & Extension Journal), 51(1), 63–72. https://doi.org/10.1177/09708464231209456
5. Donthu, N., Kumar, S., Mukherjee, D., Pandey, N., & Lim, W. M. (2021). How to conduct a bibliometric analysis: An overview and guidelines. Journal of Business Research, 133, 285–296. https://doi.org/10.1016/j.jbusres.2021.04.070
6. Hasan, R., Ashfaq, M., Parveen, T., & Gunardi, A. (2023). Financial inclusion—Does digital financial literacy matter for women entrepreneurs? International Journal of Social Economics, 50(8), 1085–1104. https://doi.org/10.1108/IJSE-04-2022-0277
7. Islam, M. M., & Alharthi, M. (2024). Business environment's impact on female students' entrepreneurial intentions: Gender analysis. South African Journal of Business Management, 55(1), a3962. https://doi.org/10.4102/sajbm.v55i1.3962
8. Lee, Y., Liguori, E. W., Sureka, R., & Kumar, S. (2024). Women's entrepreneurship education: A systematic review and future agenda. Journal of Management History, 30(4), 576–594. https://doi.org/10.1108/JMH-11-2023-0117
9. Meeralam, E. A., & Adeinat, I. (2022). Understanding the role of universities in fostering female entrepreneurship in the emerging ecosystem. Gender in Management: An International Journal, 37(3), 388–404. https://doi.org/10.1108/GM-02-2021-0041
10. Mozahem, N. A. (2021). Gender differences in entrepreneurial self-efficacy: An educational perspective. The International Journal of Management Education, 19(3), 100535. https://doi.org/10.1016/j.ijme.2021.100535
11. Nowiński, W., Haddoud, M. Y., Lančarič, D., Egerová, D., & Czeglédi, C. (2019). The impact of entrepreneurship education, entrepreneurial self-efficacy and gender on entrepreneurial intentions of university students in the Visegrad countries. Studies in Higher Education, 44(2), 361–379. https://doi.org/10.1080/03075079.2017.1365359
12. Paunovic, I., & Musial, K. (2024). Gender gap in entrepreneurial intention, reasoning, self-efficacy and education preferences among university students: An Entrepreneurial Event Theory perspective. Journal of Women's Entrepreneurship and Education, (3–4), 93–111. https://doi.org/10.28934/jwee24.34.pp93-111
13. Pergelova, A., Angulo-Ruiz, F., Manolova, T. S., & Yordanova, D. (2023). Entrepreneurship education and its gendered effects on feasibility, desirability and intentions for technology entrepreneurship among STEM students. International

Journal of Gender and Entrepreneurship, 15(2), 191–228. https://doi.org/10.1108/IJGE-08-2022-0139
14. Piva, E., & Rovelli, P. (2022). Mind the gender gap: The impact of university education on the entrepreneurial entry of female and male STEM graduates. Small Business Economics, 59(1), 143–161. https://doi.org/10.1007/s11187-021-00525-1
15. Slavinski, T., Todorović, M., Vukmirović, V., & Montenegro, A. M. (2020). Women, entrepreneurship and education: Descriptive bibliometric analysis based on the Scopus database. Journal of Women's Entrepreneurship and Education, (3–4), 181–201. https://doi.org/10.28934/jwee20.34.pp181-201
16. Tumba, N. J., Onodugo, V. A., Akpan, E. E., & Babarinde, G. F. (2022). Financial literacy and business performance among female micro-entrepreneurs. Investment Management and Financial Innovations, 19(1), 156–167. https://doi.org/10.21511/imfi.19(1).2022.12
17. Wang, R., & Liu, R. (2024). Factors influencing female students' entrepreneurial intention in vocational colleges: A multi-group analysis based on household income. PLOS ONE, 19(5), e0304232. https://doi.org/10.1371/journal.pone.0304232
18. Westhead, P., & Solesvik, M. Z. (2016). Entrepreneurship education and entrepreneurial intention: Do female students benefit? International Small Business Journal, 34(8), 979–1003. https://doi.org/10.1177/0266242615612534

ENHANCING WOMEN ENTREPRENEURS' INNOVATION THROUGH KNOWLEDGE MANAGEMENT: A CONCEPTUAL FRAMEWORK

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INTRODUCTION

The role of women entrepreneurs is becoming increasingly relevant in the modern world economic system; however, they tend to be underrepresented in high-potential growth-oriented industries, which require innovative thinking (Strawser et al., 2021). Numerous women-owned businesses still experience a lack of access to networks, mentoring services, and investment funds, which hinders innovation capabilities (Brush et al., 2019; Olsson & Bernhard, 2021). Considering the role of knowledge in fostering innovative activities (Nonaka, 1994; Audretsch et al., 2020), it is crucial to investigate how a systemic approach to managing knowledge could help to address innovation limitations associated with knowledge. In spite of that, this link is rarely addressed in current research. In order to integrate the fields of gender, entrepreneurship, innovation, and knowledge management into one conceptual model, researchers have recently urged to develop conceptual frameworks for such an approach (Henry et al., 2021; Paoloni et al., 2020; Mari et al., 2024). The present paper seeks to respond to this research agenda by suggesting a conceptual framework based on knowledge acquisition, sharing, storage, and application processes.

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LITERATURE REVIEW / THEORETICAL BACKGROUND

Prior research shows that knowledge management supports firms' innovativeness and performance (Darroch, 2005; Du Plessis, 2007; Audretsch et al., 2020), with knowledge acquisition, sharing, storage, and application constituting its core processes (Nonaka, 1994; Gold et al., 2001). Research on women's entrepreneurship indicates that women entrepreneurs face knowledge-based and network barriers – limited networking capacity and restricted entry into technology-intensive sectors – that hinder opportunity recognition and innovation (Brush et al., 2019; Strawser et al., 2021) and contribute to the innovation gender gap (Huang et al., 2022). Digital communities and women-specific networks offer alternative knowledge sources that can help overcome these obstacles (McAdam et al., 2020; Olsson & Bernhard, 2021; Kelly & McAdam, 2022; Lemaire et al., 2023). Nevertheless, the relationship between knowledge management processes and innovation among women entrepreneurs remains theoretically fragmented and empirically untested, motivating the proposed framework.

METHODOLOGY

This is a conceptual, theory-development study following an abductive approach, iterating between existing theory and patterns observed in the literature. The framework was developed in three steps. First, we conducted a targeted review of peer-reviewed articles across three literature streams – knowledge management, strategic management (particularly the knowledge-based view and dynamic capabilities), and women's entrepreneurship – selecting studies that address knowledge processes, innovation, or gender-specific entrepreneurial constraints. Second, the selected literature was thematically synthesized to identify the key constructs: the four knowledge management processes (acquisition, sharing, storage, application), knowledge-based capital (human, social, and organizational), dynamic capabilities, and innovation outcomes. Third, through abductive reasoning we linked these constructs into an integrated framework specifying how coordinated knowledge management processes convert knowledge-based assets into dynamic capabilities that enable innovation in women-led ventures (Nonaka, 1994; Paoloni et al., 2020; Henry et al., 2021).

RESULTS

According to the proposed model, successful coordination of knowledge management processes in women-led enterprises generates important knowledge-based capital through various dimensions, including human, social, and organizational aspects, thus ensuring dynamic capabilities, for example,

flexible opportunity identification and resource reallocation. For example, knowledge sharing practices result in the development of the knowledge culture (Kelly & McAdam, 2022; Olsson & Bernhard, 2021), and institutional memory is maintained by means of codifying the knowledge accumulated. Thus, through the integration of different sources of knowledge and its innovative use, female-led organizations may implement continuous innovations. In such a way, all these knowledge management processes lead to an innovative capability, which allows the organizations headed by women to gain competitive advantage even amid resource scarcity (Audretsch et al., 2020; Huang et al., 2022).

DISCUSSION / POLICY IMPLICATIONS

Theoretically, the framework conceptualizes knowledge management as an integrated capability of interconnected processes rather than a set of isolated activities, explaining why their systematic coordination raises innovativeness among women entrepreneurs facing resource and institutional constraints (Audretsch et al., 2020; Paoloni et al., 2020). It thereby advances entrepreneurship and innovation theory by positioning knowledge management as a driver of adaptability and resilience. From a policy perspective, support for women entrepreneurs should extend beyond financial instruments to interventions that build knowledge management capabilities, such as training, mentoring, and network development.

CONCLUSION

This conceptual study proposes a framework explaining how the integrated management of knowledge acquisition, sharing, storage, and application enhances innovation in women-led ventures. Future empirical research could validate the model by operationalizing its constructs through established scales and testing the hypothesized chain – from knowledge management processes through knowledge-based capital and dynamic capabilities to innovation – using survey-based structural equation modeling, complemented by comparative case studies of women-led ventures across diverse entrepreneurial and institutional contexts.

KEYWORDS
Women entrepreneurs, innovation, knowledge management, knowledge management processes, women entrepreneurship

REFERENCES

1. Audretsch, D. B., Belitski, M., Caiazza, R., & Lehmann, E. E. (2020). Knowledge management and entrepreneurship. *International Entrepreneurship and Management Journal*, 16(2), 373–385.
2. Brush, C. G., Edelman, L. F., Manolova, T. S., & Welter, F. (2019). A gendered look at entrepreneurship ecosystems. *Small Business Economics*, 53(2), 393–408.
3. Darroch, J. (2005). Knowledge management, innovation and firm performance. *Journal of Knowledge Management*, 9(3), 101-115.
4. Du Plessis, M. (2007). The role of knowledge management in innovation. *Journal of Knowledge Management*, 11(4), 20-29.
5. Durst, S., Edvardsson, I. R., & Foli, S. (2023). Knowledge management in SMEs: a follow-up literature review. *Journal of Knowledge Management*, 27(11), 25–58.
6. Gold, A. H., Malhotra, A., & Segars, A. H. (2001). Knowledge management: An organizational capabilities perspective. *Journal of Management Information systems*, 18(1), 185-214.
7. Henry, C., Coleman, S., Foss, L., & Orser, B. J. (2021). Richness in diversity: Towards more contemporary research conceptualisations of women's entrepreneurship. *International Small Business Journal*, 39(7), 609–618.
8. Huang, Y., Li, P., Wang, J., & Li, K. (2022). Innovativeness and entrepreneurial performance of female entrepreneurs. *Journal of Innovation & Knowledge*, 7(4), 100257.
9. Kelly, G., & McAdam, M. (2022). Scaffolding liminality: The lived experience of women entrepreneurs in digital spaces. *Technovation*, 118, 102537.
10. Lemaire, S., Bertrand, G., Haddad, G., Razgallah, M., Maalaoui, A., & Cavallo, F. (2023). Knowledge transfer from and within digital incubators: Does the context of entrepreneurship matter? The case of women entrepreneurs in France. *Journal of Knowledge management*, 27(10), 2642–2670.
11. Mari, M., Poggesi, S., Abatecola, G., & Essers, C. (2024). Women entrepreneurs and innovation: Retrospect and prospect. *Journal of Innovation & Knowledge*, 9(1), 100519.
12. McAdam, M., Crowley, C., & Harrison, R. T. (2020). Digital girl: Cyberfeminism and the emancipatory potential of digital entrepreneurship in emerging economies. *Small Business Economics*, 55(1), 349–362.
13. Nonaka, I. (1994). A dynamic theory of organizational knowledge creation. *Organization Science*, 5(1), 14–37.
14. Olsson, A.-K., & Bernhard, I. (2021). Keeping up the pace of digitalization in small businesses – Women entrepreneurs' knowledge and use of social media. *International Journal of Entrepreneurial Behavior & Research*, 27(2), 378–396.
15. Paoloni, M., Coluccia, D., Fontana, S., & Solimene, S. (2020). Knowledge management, intellectual capital and entrepreneurship: A structured literature review. *Journal of Knowledge Management,* 24(8), 1797–1818.

16. Strawser, J. A., Hechavarría, D. M., & Passerini, K. (2021). Gender and entrepreneurship: Research frameworks, barriers and opportunities for women entrepreneurship worldwide. *Journal of Small Business Management*, 59(S1), S1–S15

BRIDGING THE GENERATIONAL AND DIGITAL DIVIDE: BUSINESS PROCESS INNOVATION AS ENTREPRENEURIAL DRIVER IN SERBIAN FAMILY SMES

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INTRODUCTION

Digitalisation is a key driver of competitiveness in the SME sector (OECD, 2021; Bianchini & Lasheras Sancho, 2025), where family firms play a significant role. Business process innovation (BPI) is increasingly recognised as a mechanism supporting organisational adaptation and long-term development. However, its role in fostering entrepreneurial behaviour within family firms remains insufficiently explored, particularly in transition economies such as Serbia. While previous research has predominantly examined entrepreneurship as an antecedent of innovation, this study proposes the reverse perspective, arguing that digitalisation-driven BPI may stimulate entrepreneurial behaviour through the lens of generational dynamics in family firm management.

LITERATURE REVIEW / THEORETICAL BACKGROUND

According to the Oslo Manual (OECD/Eurostat, 2018), business process innovation (BPI) supports organisational adaptation and development. In family firms, innovation is shaped by the ability - willingness paradox, as concerns related to preserving control may limit innovation potential (Rondi et al., 2019). Digital transformation influences entrepreneurial practices (Corvello et al., 2022), while family beliefs and generational dynamics shape innovation choices and readiness

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for change (Manzano-García et al., 2023). Evidence from literature highlights the relevance of BPI and generational factors in family firm innovation (Paunović et al., 2023; Urbaníková et al., 2020), providing a basis for examining how digitalisation-driven BPI influences entrepreneurial behaviour in Serbian family SMEs.

METHODOLOGY

The study adopts a conceptual, literature-based design integrating research on business process innovation, digital transformation and family firms. Based on the identified theoretical relationships, it develops an analytical framework for future empirical research on how digitalisation-driven BPI may influence entrepreneurial behaviour in Serbian family SMEs. The framework focuses on three dimensions: business process innovation, digital transformation and generational dynamics, and formulates propositions for future empirical testing.

RESULTS

The principal outcome of the study is an analytical framework that explains the mechanisms through which digitalisation-driven business process innovation may foster entrepreneurial behaviour in Serbian family SMEs. The framework integrates technological, organisational and generational dimensions, suggesting that generational dynamics may influence the extent to which BPI translates into entrepreneurial renewal. It further formulates testable propositions for future empirical research on the relationship between digitalisation, BPI and entrepreneurial behaviour in family firms.

DISCUSSION / POLICY IMPLICATIONS

The proposed framework highlights BPI and digitalisation as potential drivers of entrepreneurial renewal in family SMEs. It suggests that support measures should combine digital skills development, advisory services and financial instruments while recognising differences among generations involved in family firm management. Intergenerational leadership transitions may represent strategic opportunities for encouraging business process innovation and digital transformation.

CONCLUSION

This study provides an analytical perspective on the relationship between digitalisation-driven BPI and entrepreneurial behaviour in Serbian family SMEs. By

proposing business process innovation as a potential driver of entrepreneurial behaviour and incorporating generational dynamics, it extends current understanding of entrepreneurial renewal in family firms operating in transition economies. Future empirical research should validate the proposed relationships and examine their applicability in different institutional contexts.

KEYWORDS

Business process innovation, entrepreneurship, family firms, digitalisation, generational dynamics

REFERENCES

1. Bianchini, M., & Lasheras Sancho, M. (2025). *SME digitalisation for competitiveness: The 2025 OECD D4SME Survey*. OECD SME and Entrepreneurship Papers, No. 68. OECD Publishing. https://doi.org/10.1787/197e3077-en
2. Corvello, V., De Carolis, M., Verteramo, S., & Steiber, A. (2022). The digital transformation of entrepreneurial work. International Journal of Entrepreneurial Behavior & Research, 28(5), 1167–1183. https://doi.org/10.1108/IJEBR-01-2021-0067
3. Manzano-García, G., Neveu, J.-P., Bañuelos Campo, A., & Ayala-Calvo, J. C. (2023). Family firms types based on beliefs. European Research on Management and Business Economics, 29(2), 100225. https://doi.org/10.1016/j.iedeen.2023.100225
4. OECD/Eurostat. (2018). Oslo Manual 2018: Guidelines for collecting, reporting and using data on innovation (4th ed.). OECD Publishing/Eurostat.
5. OECD. (2021). The digital transformation of SMEs. OECD Publishing. https://doi.org/10.1787/bdb9256a-en
6. Paunović, M., Mosurović Ružičić, M., & Lazarević Moravčević, M. (2023). Business process innovations in family firms: Evidence from Serbia. Journal of Family Business Management, 13(1), 166–184. https://doi.org/10.1108/JFBM-03-2022-0044
7. Rondi, E., De Massis, A., & Kotlar, J. (2019). Unlocking the innovation potential of family firms: An assessment tool. Entrepreneur & Innovation Exchange. https://doi.org/10.32617/372-5d653a75968b8
8. Urbaníková, M., Štubňová, M., Papcunová, V., & Hudáková, J. (2020). Analysis of innovation activities of Slovak small and medium-sized family businesses. Administrative Sciences, 10(4), 80. https://doi.org/10.3390/admsci10040080

AI AND IOT AS TOOLS FOR OPTIMISING WINE PRODUCTION: A BUSINESS MODEL PERSPECTIVE FOR INNOVATION MANAGEMENT

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INTRODUCTION

The wine sector faces climate variability, labor scarcity, input-cost volatility and stronger demands for traceability, sustainability and consistent quality. Artificial intelligence (AI) and the Internet of Things (IoT) can respond to these pressures by transforming vineyard, cellar and market data into operational and strategic decisions. However, their value is not merely technical. For innovation management, the key issue is how AI and IoT reshape the business model of wine production: how value is proposed to customers, created across vineyard and winery processes, delivered through trusted digital evidence, and captured through cost reduction, premium positioning, lower risk and new service-based revenues. This extended abstract proposes an integrated AI-IoT framework for wine producers, technically grounded but centered on business model transformation.

LITERATURE REVIEW / THEORETICAL BACKGROUND

Precision viticulture studies (Pero et al., 2024; Hnatiuc et al., 2025; Stojanova et al., 2025) confirm field-level technical feasibility but remain confined to individual production stages. Cellar monitoring research (Kontogiannis et al., 2025) extends feasibility to post-harvest processes yet similarly stops short of the full value chain. Supply-chain and quality-control integration studies (Adamashvili et al., 2024; Izquierdo-Bueno et al., 2024) extend the scope beyond the winery. Drawing on Teece's (2010) business model framework, subsequent adoption research (Kasimati et al., 2024; Marolla et al., 2025; Ingrassia et al., 2026) shows that organisational readiness, digital culture and value capture, not technical

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sophistication, determine implementation success. The absence of an integrated framework linking technical capabilities to business model transformation across the full wine production chain motivates this study.

METHODOLOGY

This study follows a conceptual framework-development design. A systematic literature search (April–June 2026) in IEEE Xplore, MDPI and related databases identified 11 empirical studies organised into four clusters. Using abductive logic, cluster evidence was translated into a four-phase innovation-management methodology: (1) AI-IoT opportunity mapping into wine-sector use cases from vineyard monitoring to customer-facing traceability, (2) business model design defining value proposition, creation, delivery and capture across three adoption paths, internal optimisation, quality and sustainability differentiation, and platform-based services, (3) technical integration specifying a modular sensor-cloud-AI architecture, and (4) validation through KPIs linking technical performance to business outcomes. Winery pilot studies are proposed as the next step for empirical validation.

RESULTS

The framework yields five conceptual outputs: a reference model integrating vineyard, cellar and supply-chain data into a single decision layer; a business model canvas for smart wine production structured around sustainability, quality assurance, traceability and resilience; a KPI set converting technical performance into managerial evidence; a staged adoption roadmap for SME wineries, from low-cost monitoring to predictive analytics; and a value-capture logic combining production savings, premium positioning and advisory services. These are conceptual propositions, not empirically verified findings. Existing literature provides indirect support through sensor-based water management (Finco et al., 2022), sustainability gains (Kasimati et al., 2024) and AI as an emerging innovation capability (Marolla et al., 2025; Ingrassia et al., 2026).

DISCUSSION / POLICY IMPLICATIONS

AI and IoT should not be introduced as isolated tools but as components of a business model for innovation. For individual wineries, the entry point is the specific economic problem, water scarcity, disease risk, fermentation variability, labour constraints, certification pressure or market differentiation — rather than technology itself. For cooperatives and regional clusters, the opportunity lies in shared infrastructure, common data standards and analytics-as-a-service models

that lower adoption barriers. Policy should address not only technical but also business model readiness, stakeholder alignment and sustainability contribution, through pilot incentives, digital-skills training, interoperable data governance, cybersecurity-by-design and multi-stakeholder living labs.

CONCLUSION

AI and IoT can optimise wine production from vineyard to bottle, but their highest strategic value lies in reshaping the business model rather than replacing individual tools. The proposed conceptual framework integrates precision viticulture, intelligent winery operations and data-driven market positioning through three adoption paths: operational efficiency, quality and sustainability differentiation, and platform-based services. It contributes a novel perspective linking technical AI-IoT capabilities to business model transformation in the wine sector, an integration absent from existing literature. Future research should validate the framework through winery pilots and quantify return on digital investment across individual, cooperative and regional adoption scenarios.

KEYWORDS

Artificial intelligence, Internet of Things, wine production, precision viticulture, business model

REFERENCES

1. Adamashvili, N., Zhizhilashvili, N., & Tricase, C. (2024). The integration of the Internet of Things, artificial intelligence, and blockchain technology for advancing the wine supply chain. *Computers*, 13(3), 72. https://doi.org/10.3390/computers13030072
2. Finco, A., Bentivoglio, D., Chiaraluce, G., Alberi, M., Chiarelli, E., Maino, F., & Mantovani, L. (2022). Combining precision viticulture technologies and economic indices to sustainable water use management. *Water*, 14(9), 1493. https://doi.org/10.3390/w14091493
3. Hnatiuc, M., Alpetri, D., Sintea, S.-R., Hnatiuc, B., Raicu, G. M., Paun, M., & Dina, I. (2025). AIoT monitoring for early identification of diseases in grapevines: Complete study. IEEE Access, 13, 80258-80271. https://doi.org/10.1109/ACCESS.2025.3567454
4. Ingrassia, M., Chironi, S., Chinnici, P., Bacarella, S., & Baviera-Puig, A. (2026). Factors influencing artificial intelligence adoption in wine marketing. Agriculture, 16(10), 1085. https://doi.org/10.3390/agriculture16101085
5. Izquierdo-Bueno, I., Moraga, J., Cantoral, J. M., Carbú, M., Garrido, C., & González-Rodríguez, V. E. (2024). Smart viniculture: Applying artificial intelligence for improved winemaking and risk management. Applied Sciences, 14(22), 10277. https://doi.org/10.3390/app142210277

6. Kasimati, A., Papadopoulos, G., Manstretta, V., Giannakopoulou, M., Adamides, G., Neocleous, D., Vassiliou, V., Savvides, S., & Stylianou, A. (2024). Case studies on sustainability-oriented innovations and smart farming technologies in the wine industry. Agronomy, 14(4), 736. https://doi.org/10.3390/agronomy14040736
7. Kontogiannis, S., Tsoumani, M., Kokkonis, G., Pikridas, C., & Kotseridis, Y. (2025). Proposed SmartBarrel system for monitoring and assessment of wine fermentation processes using IoT nose and tongue devices. Sensors, 25(13), 3877. https://doi.org/10.3390/s25133877
8. Marolla, G., Sabbagh, P., & McDermott, O. (2025). Leveraging artificial intelligence for innovation in wineries: A global study. British Food Journal, 1-19. https://doi.org/10.1108/BFJ-03-2025-0317
9. Pero, C., Bakshi, S., Nappi, M., & Tortora, G. (2024). IoT-driven machine learning for precision viticulture optimization. IEEE Journal of Selected Topics in Applied Earth Observations and Remote Sensing, 17, 2437-2447. https://doi.org/10.1109/JSTARS.2023.3345473
10. Stojanova, S., Volk, M., Balkovec, G., Kos, A., & Stojmenova Duh, E. (2025). The future of vineyard irrigation: AI-driven insights from IoT data. Sensors, 25(12), 3658. https://doi.org/10.3390/s25123658
11. Teece, D. J. (2010). Business models, business strategy and innovation. Long Range Planning, 43(2-3), 172-194. https://doi.org/10.1016/j.lrp.2009.07.003

GENDER DIVERSITY, FIRM SIZE AND INNOVATION PERFORMANCE: EVIDENCE FROM MACEDONIAN ENTERPRISES

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INTRODUCTION

Gender-inclusive innovation ecosystems are increasingly recognized as drivers of sustainable economic development in transition economies. While gender-diverse leadership has been associated with stronger strategic decision-making and innovation, evidence from post-socialist contexts remains limited. This study examines how female top management and firm size jointly influence firms' innovation performance in North Macedonia.

LITERATURE REVIEW / THEORETICAL BACKGROUND

Research suggests gender-diverse leadership enhances learning, strategic decision-making, and innovation capacity, yet transition economies present persistent institutional barriers for female-led firms. Building on Upper Echelons Theory (Hambrick & Mason, 1984) and empirical evidence linking female leadership to innovation (Torchia et al., 2011; Post & Byron, 2015), this study examines whether female top management influences innovation performance in North Macedonia and if firm size conditions it.

METHODOLOGY

The study uses pooled firm-level microdata from the World Bank Enterprise Surveys for North Macedonia (2013, 2019, and 2023). A multiple logistic regression model is estimated to examine whether the presence of a female top manager is associated with the probability of introducing products or services that

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are new to the market. To capture whether the effect of female leadership varies across organizational contexts, an interaction term between female top management and firm size is included.

RESULTS

Female top management alone is not significantly associated with innovation performance. However, the interaction between female leadership and firm size is significant. Female-led small firms show substantially lower odds of introducing market-novel products (OR=0.372; p=0.047), indicating that organizational scale shapes the relationship between gender diversity and innovation.

DISCUSSION / POLICY IMPLICATIONS

The findings suggest that increasing female representation in leadership positions alone may not be sufficient to improve innovation performance in transition economies. Instead, the effectiveness of female leadership appears to depend on the organizational resources available to firms. Policies should therefore complement gender equality initiatives with targeted support for female-led SMEs through improved access to finance, innovation funding, technology incubators and business scaling opportunities.

CONCLUSION

Using pooled World Bank Enterprise Survey data, this study shows that the relationship between female leadership and innovation depends on firm size. While female-led firms demonstrate innovation potential, structural constraints associated with smaller enterprises appear to limit the commercialization of innovative products. Strengthening innovation ecosystems therefore requires policies that support both women's leadership and enterprise growth.

KEYWORDS

Female management, innovation performance, transition economies, Western Balkans, logistic regression

REFERENCES

1. Hambrick, D. C., & Mason, P. A. (1984). Upper echelons: The organization as a reflection of its top managers. *Academy of Management Review*, 9(2), 193–206. https://doi.org/10.2307/258434

2. Post, C., & Byron, K. (2015). Women on boards and firm financial performance: A meta-analysis. *Academy of Management Journal*, 58(5), 1546–1571. https://doi.org/10.5465/amj.2013.0319
3. Torchia, M., Calabrò, A., & Huse, M. (2011). Women directors on corporate boards: From tokenism to critical mass. *Journal of Business Ethics, 102*, 299–317. https://doi.org/10.1007/s10551-011-0815-z

THE AI ADOPTION DIVIDE ACROSS EUROPEAN ENTERPRISES

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INTRODUCTION

Artificial intelligence (AI) is central to Europe's digital transition, yet diffusion is uneven across firms. In 2025, 19.95% of EU enterprises used AI; uptake was 17% among small enterprises, 30.36% among medium enterprises and 55.03% among large enterprises (Eurostat, 2026). This 38.03% gap between SMEs and large enterprises may weaken inclusive innovation, productivity and competitive convergence. The paper examines the adoption divide and its policy implications.

LITERATURE REVIEW / THEORETICAL BACKGROUND

AI adoption depends on complementary resources, human skills and organizational capabilities rather than technology alone (Mikalef & Gupta, 2021). AI-readiness research emphasizes strategic alignment, resources, knowledge, culture and data (Jöhnk et al., 2021). SME evidence similarly identifies a need for policy support to close digital and skills gaps between smaller and larger firms (OECD, 2025). The paper positions unequal AI diffusion as a capability-building challenge.

METHODOLOGY

The study conducts a descriptive comparative secondary-data analysis of Eurostat's 2025 enterprise AI statistics, complemented by OECD and European Commission policy documents (European Commission, 2026) and a targeted literature review. RQ1 asks how AI adoption differs by firm size; RQ2 examines the principal reported barriers; RQ3 identifies policy directions for inclusive diffusion.

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Statistics are interpreted descriptively, while the literature and policy documents are thematically coded.

RESULTS

A pronounced size gradient is observed: AI use among large enterprises (55.03%) exceeds that of small firms (17%) by 38.03 percentage points; medium-firm uptake is 30.36% (Eurostat, 2026). Among enterprises considering but not using AI, leading reported barriers are lack of relevant expertise (70.89%), unclear legal consequences (52.52%) and data-protection/privacy concerns (48.83%). The results indicate a capability and governance gap.

DISCUSSION / POLICY IMPLICATIONS

The findings support an Inclusive AI Diffusion Framework combining: (1) targeted AI and data-skills support; (2) accessible technical advisory services and digital innovation hubs; (3) affordable access to cloud, data and testing infrastructure; and (4) proportionate regulatory guidance. Policy should differentiate support by firm size and capability, because uniform instruments may reinforce rather than reduce the advantage of large enterprises.

CONCLUSION

The study documents a substantial enterprise-size divide in EU AI use and answers RQ1 by quantifying the gap, RQ2 by identifying skills, legal clarity and privacy as leading barriers, and RQ3 by proposing a differentiated policy framework. AI diffusion should be treated as an innovation-system challenge: adoption must be paired with capabilities, advisory support and proportionate governance to enable SMEs to realize AI's economic value.

KEYWORDS

Artificial intelligence, SMEs, digital transformation, innovation policy, technology adoption

REFERENCES

1. European Commission. (2026). Digital Decade policy programme. Shaping Europe's digital future. https://digital-strategy.ec.europa.eu/en/policies/digital-decade-policy-programme
2. Eurostat. (2026). Artificial intelligence by size class of enterprise (isoc_eb_ai) [Data set]. European Commission. https://doi.org/10.2908/isoc_eb_ai

3. Jöhnk, J., Weißert, M., & Wyrtki, K. (2021). Ready or not, AI comes—An interview study of organizational AI readiness factors. Business & Information Systems Engineering, 63, 5–20. https://doi.org/10.1007/s12599-020-00676-7
4. Mikalef, P., & Gupta, M. (2021). Artificial intelligence capability: Conceptualization, measurement calibration, and empirical study on its impact on organizational creativity and firm performance. Information & Management, 58(3), 103434. https://doi.org/10.1016/j.im.2021.103434
5. OECD. (2025). Generative AI and the SME workforce: New survey evidence. OECD Publishing. https://doi.org/10.1787/2d08b99d-en

PROJECT MATURITY AS AN ENABLER OF INNOVATION IMPLEMENTATION IN FINANCIAL INSTITUTIONS

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INTRODUCTION

Financial institutions invest heavily in digital innovation, yet implementation often underperforms because technological adoption is not matched by organizational execution capabilities. Unlike many other sectors, they work under strict regulatory, cybersecurity, data-protection, governance, and operational-resilience requirements that increase project complexity. This study examines project maturity as an enabler of converting intrapreneurial ideas into implemented and sustainable innovations.

LITERATURE REVIEW / THEORETICAL BACKGROUND

Intrapreneurship explains internal idea generation (Pinchot, 1985), while the resource-based view treats project capabilities as organizational resources (Barney, 1991). Project maturity models formalize governance and continuous improvement (Kerzner, 2019). Empirical research, however, reports context-dependent links between maturity and performance, emphasizing organizational culture and careful use of maturity assessments (Yazici, 2009; Brookes et al., 2014).

METHODOLOGY

The review incorporates seminal foundations alongside key sources published between 2009 and 2024. Evidence was organized around project outcomes, governance, capabilities, and digital transformation. As the sources differ in scope

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and measurement and are mainly cross-industry, the study identifies associations and implications for financial institutions rather than testing causal effects.

RESULTS

The synthesis shows that project maturity is plausibly associated with improved execution, but the relationship is not uniform. PMI (2024) reports an 8.3 percentage-point performance advantage where organizations provide at least three project-work enablers. McKinsey (2018) and the Standish Group (2020) document low transformation and project success rates, while Yazici (2009) and Brookes et al. (2014) indicate that culture, context, and model design condition maturity outcomes.

DISCUSSION / POLICY IMPLICATIONS

For financial institutions, project maturity supports innovation through portfolio selection, sponsorship, risk control, coordination, and learning. These capabilities matter because innovation must comply with regulatory, cybersecurity, data-protection, governance, and operational-resilience requirements. Failure creates financial, compliance, reputational, and operational risks. Governance should therefore reflect project uncertainty and regulatory exposure rather than impose rigid procedures.

CONCLUSION

Project maturity should be viewed as an enabling, not restrictive, condition for innovation implementation. The synthesis indicates that technology investment is more likely to create value when supported by governance, capabilities, and adaptive execution. Financial institutions should therefore develop maturity while preserving flexibility for experimentation. Future research should test the proposed relationships using institution-level survey or case-study data.

KEYWORDS

Project management maturity, innovation implementation, financial institutions, intrapreneurship, digital transformation

REFERENCES

1. Barney, J. B. (1991). Firm resources and sustained competitive advantage. *Journal of Management*, *17*(1), 99-120. https://doi.org/10.1177/014920639101700108

2. Brookes, N., Butler, M., Dey, P., & Clark, R. (2014). The use of maturity models in improving project management performance: An empirical investigation. *International Journal of Managing Projects in Business*, *7*(2), 231-246. https://doi.org/10.1108/IJMPB-03-2013-0007
3. Kerzner, H. (2019). *Using the project management maturity model: Strategic planning for project management* (3rd ed.). Wiley.
4. McKinsey & Company. (2018). *Unlocking success in digital transformations*. McKinsey & Company.
5. Pinchot, G. (1985). *Intrapreneuring: Why you don't have to leave the corporation to become an entrepreneur*. Harper & Row.
6. Project Management Institute. (2024). *Pulse of the profession 2024: The future of project work*. Project Management Institute.
7. Standish Group. (2020). *CHAOS report: Beyond infinity*. The Standish Group International.
8. Yazici, H. J. (2009). The role of project management maturity and organizational culture in perceived performance. *Project Management Journal*, *40*(3), 14-33. https://doi.org/10.1002/pmj.20121

ARTIFICIAL INTELLIGENCE AND FUTURE WORKFORCE COMPETENCIES: PERSPECTIVES OF VOCATIONAL STUDENTS AND ENTREPRENEURIAL FIRMS IN SERBIA

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INTRODUCTION

Artificial intelligence is transforming education and business, creating new demands for workforce competencies. Recent analyses suggest that competitiveness increasingly depends on critical thinking, adaptability and continuous learning rather than on technological proficiency alone (World Economic Forum, 2023). This paper examines how vocational students and entrepreneurial firms perceive competencies relevant for participation in an AI-driven economy.

LITERATURE REVIEW / THEORETICAL BACKGROUND

Recent studies indicate that generative AI is reshaping workforce preparation and organizational learning, requiring new digital, entrepreneurial and adaptive competencies (OECD, 2026; Salam et al., 2026). AI literacy includes critical evaluation and responsible use of technology (Ng et al., 2021), while entrepreneurial competence frameworks emphasize initiative, creativity and adaptability as drivers of innovation and competitiveness (Bacigalupo et al., 2016).

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METHODOLOGY

This extended abstract presents selected findings from a broader doctoral study. Quantitative data were collected from 650 vocational secondary school students through a structured questionnaire and analyzed using descriptive statistics, Pearson correlations and multiple regression. Qualitative evidence was obtained from 27 owners, directors and managers of entrepreneurial firms through a short questionnaire, open questions and semi-structured interviews, and analyzed thematically.

RESULTS

Students perceive AI as supporting faster feedback (M=3.85), data analysis and innovation (M=3.43), idea generation (M=3.38), and practical skills (M=3.31), while noting overreliance risk (M=3.57). Regression showed competency development (β=.587) and personalized learning (β=.233) predict perceived labor-market alignment. Surveyed employers emphasize critical thinking, problem solving, adaptability, data interpretation, continuous learning and practical experience in AI-shaped work contexts.

DISCUSSION / POLICY IMPLICATIONS

The results suggest that students perceive AI's value primarily through its support for transferable competencies relevant across school and work contexts. Surveyed entrepreneurs similarly emphasize practical application, critical judgment and continuous learning. Consistent with recent discussions on digital transformation and human capital development (OECD, 2026; Salam et al., 2026), policy initiatives should strengthen AI literacy, workforce competencies and school–firm cooperation.

CONCLUSION

Both vocational students and entrepreneurial firms recognize the importance of competencies that enable individuals to use AI critically, creatively and responsibly. The findings suggest that the development of such competencies may support workforce preparedness and innovation capacity. Effective AI integration should therefore be understood not only as a technological issue, but also as a strategic challenge of human capital development and cooperation between education and business.

KEYWORDS

Artificial intelligence, human capital, workforce competencies, vocational education, entrepreneurship

REFERENCES

1. Bacigalupo, M., Kampylis, P., Punie, Y., & Van den Brande, G. (2016). *EntreComp: The Entrepreneurship Competence Framework*. Luxembourg: Publications Office of the European Union.
2. Ng, D. T. K., Leung, J. K. L., Chu, S. K. W., & Qiao, M. S. (2021). Conceptualizing AI literacy: An exploratory review. *Computers and Education: Artificial Intelligence*, 2, 100041. https://doi.org/10.1016/j.caeai.2021.100041
3. OECD. (2026). *OECD Digital Education Outlook 2026: Exploring Effective Uses of Generative AI in Education.* Paris: OECD Publishing. https://doi.org/10.1787/062a7394-en
4. Salam, M., Radović-Marković, M., Farooq, M. S., Marković, D., & Vučeković, M. (2026). Artificial intelligence driven digital transformation mediating the relationship between artificial intelligence readiness and business process efficiency. *Transactions on Internet Research*, 22(2), 32–41. https://doi.org/10.58245/ipsi.tir.2602.04
5. World Economic Forum. (2023). *The Future of Jobs Report 2023. Geneva: World Economic Forum*. https://www.weforum.org/publications/the-future-of-jobs-report-2023/

BUILDING ORGANIZATIONAL CAPABILITIES IN FDI COMPANIES THROUGH STRATEGIC HUMAN RESOURCE MANAGEMENT, ORGANIZATIONAL CULTURE AND ORGANIZATIONAL ETHICS: EVIDENCE FROM REPUBLIC OF NORTH MACEDONIA

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INTRODUCTION

Foreign direct investment (FDI) is a key driver of innovation, organizational transformation and competitiveness. However, the benefits of FDI depend on organizations' ability to transform transferred knowledge and corporate practices into organizational capabilities. This study examines how Strategic Human Resource Management (SHRM), organizational culture and organizational ethics interact to support the development of organizational capabilities in FDI companies operating in the transition economy of the Republic of North Macedonia.

LITERATURE REVIEW / THEORETICAL BACKGROUND

The existing literature recognizes FDI as a source of knowledge transfer and organizational development (Dunning, 1993; Wang & Blomström, 1992), while

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SHRM, organizational culture and organizational ethics are acknowledged as key organizational mechanisms supporting organizational effectiveness (Paauwe & Boon, 2009; Chatman & O'Reilly, 2016; Roy et al., 2024). However, limited attention has been given to how these mechanisms interact in transforming FDI spillover effects into organizational capabilities, particularly in transition economies. This study addresses this gap by examining how the interaction of these organizational mechanisms contributes to the development of organizational capabilities in FDI companies operating in North Macedonia.

METHODOLOGY

The study applies a qualitative research design based on semi-structured interviews conducted over a six-month period in 2025. Primary data were collected through semi-structured interviews using purposive sampling with HR managers from five FDI companies (three service and two manufacturing companies) and representatives of three business chambers, including two national chambers and one representing foreign investors, thereby capturing both organizational and institutional perspectives. Secondary data from the National Bank, the Central Registry and the State Statistical Office were used to provide contextual information. The collected data were analyzed using thematic analysis to identify recurring themes and patterns related to organizational capabilities, SHRM, organizational culture and organizational ethics.

RESULTS

The analysis revealed a consistent organizational pattern across all three dimensions examined. Rather than applying corporate policies uniformly, FDI companies continuously align global corporate standards with the local institutional and business context. This dynamic alignment was evident in HR management practices, organizational culture and organizational ethics, where corporate frameworks provided consistency while local organizations adapted their implementation. The findings indicate that this pattern reflects a hybrid governance approach through which organizational capabilities are developed. Within this framework, SHRM, organizational culture and organizational ethics operate as complementary organizational mechanisms that embed FDI spillover effects into the local organizational context, thereby supporting the development of organizational capabilities.

DISCUSSION / POLICY IMPLICATIONS

These findings are consistent with previous research on international HRM (Collings et al., 2007; Cooke et al., 2020; Farndale et al., 2017), while extending these perspectives by showing that organizational capabilities are strengthened through the continuous alignment of corporate standards with local contexts. Consistent with Jiang and Messersmith (2018), Schein and Schein (2021), and Martin and Cullen (2006), the findings demonstrate that SHRM, organizational culture and organizational ethics jointly operate within a hybrid governance approach that supports the development of organizational capabilities. The findings also have practical implications for FDI companies. They suggest reinforcing the strategic role of HR, organizational culture and ethical practices to support the effective adaptation of global corporate standards to local conditions. Such an approach can strengthen organizational trust, employee integration and the consistent implementation of corporate policies.

CONCLUSION

This study advances the literature on FDI, strategic human resource management and organizational capabilities by demonstrating that organizational capabilities are developed through the continuous alignment of global corporate standards with local institutional and organizational contexts, rather than through the transfer of corporate practices alone. By integrating SHRM, organizational culture and organizational ethics within a single analytical framework, the study provides a more comprehensive explanation of how organizational capabilities are developed in FDI companies operating in transition economies. These findings offer both theoretical and practical insights for multinational companies seeking to balance global consistency with local responsiveness.

KEYWORDS

Foreign Direct Investment (FDI), organizational capabilities, Strategic Human Resource Management (SHRM), organizational culture, organizational ethics

REFERENCES

1. Chatman, J. A., & O'Reilly, C. A. (2016). Paradigm lost: Reinvigorating the study of organizational culture. *Research in Organizational Behavior, 36*, 199–224.
2. Collings, D. G., Scullion, H., & Morley, M. J. (2007). Changing patterns of global staffing in the multinational enterprise: Challenges to the conventional expatriate assignment

and emerging alternatives. *Journal of World Business, 42*(2), 198–213. https://doi.org/10.1016/j.jwb.2007.02.005
3. Cooke, F. L., Schuler, R., & Varma, A. (2020). Human resource management research and practice in Asia: Past, present and future. *Human Resource Management Review, 30*(4), 100778.
4. Dunning, J. H. (1993). *Multinational enterprises and the global economy*. Addison-Wesley.
5. Farndale, E., Raghuram, S., Gully, S. M., Liu, X., Phillips, J. M., & Vidović, M. (2017). A vision of international HRM research. *The International Journal of Human Resource Management, 28*(12), 1625–1639. https://doi.org/10.1080/09585192.2017.1308416
6. Jiang, K., & Messersmith, J. G. (2018). On the shoulders of giants: A meta-review of strategic human resource management. *The International Journal of Human Resource Management, 29*(1), 6–33.
7. Martin, K. D., & Cullen, J. B. (2006). Continuities and extensions of ethical climate theory: A meta-analytic review. *Journal of Business Ethics, 69*(2), 175–194.
8. Paauwe, J., & Boon, C. (2009). Strategic HRM: A critical review. In D. G. Collings & G. Wood (Eds.), *Human resource management: A critical approach* (pp. 38–54). Routledge.
9. Roy, A., Newman, A., Round, H., & Bhattacharya, S. (2024). Ethical culture in organizations: A review and agenda for future research. *Business Ethics Quarterly, 34*(1), 97–138.
10. Schein, E. H., & Schein, P. A. (2021). *Organizational culture and leadership* (6th ed.). John Wiley & Sons.
11. Wang, J.-Y., & Blomström, M. (1992). Foreign investment and technology transfer: A simple model. *European Economic Review, 36*(1), 137–155. https://doi.org/10.1016/0014-2921(92)90044-N

CONFIGURATIONAL CONDITIONS OF COMMUNICATION AND STRESSORS AS DETERMINANTS OF EMPLOYEE CHANGE READINESS

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INTRODUCTION

Employees in small and medium-sized enterprises (SMEs) often work under high work demands, which is especially pronounced during organizational change (Oreg et al., 2011). This can lead to stress, and to change resistance that can slow down the change acceptance process. But even though it is commonly believed that stress constrains the change implementation, several studies have found that in certain situations it can also be a motivator for better performance (Cavanaugh et al., 2000). Understanding these nuances is important for SMEs because they operate with limited resources and under informal internal practices.

LITERATURE REVIEW / THEORETICAL BACKGROUND

The study is based on the premises of Conservation of Resources (COR) theory (Hobfoll, 1989) that observes internal communication as organizational resource. It serves as a motivator during the change processes. To complement the theoretical lens, the challenge-hindrance stressor framework (Cavanaugh et al., 2000) helps explain the way work stressors can positively mobilize change readiness.

METHODOLOGY

The study was based on data collected from 454 Croatian SME employees. It examined four conditions: two communication resources (Tkalac Verčič et al., 2009; Sun et al., 2023) and two workplace stressors (Misra & Stokols, 2012; Burr et al., 2019). The outcome variable was readiness for change (Bouckenooghe et al., 2009). Data were analyzed using Fuzzy-set Qualitative Comparative Analysis (fsQCA) (Cangialosi, 2023) and Necessary Condition Analysis (NCA) (Dul, 2016).

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RESULTS

Results showed that several pathways lead to high readiness for change, identifying communication resources as necessary, but not sufficient. Stressors were identified as contributing elements, which is consistent with the challenge-hindrance stressor framework.

DISCUSSION / POLICY IMPLICATIONS

Internal communication resources proved to be an important element of employee change readiness, which contributes to organizational and change management theories. In addition, the study showed that workplace stressors do not necessarily lead to change resistance. Employees in SMEs can be ready to change in high-demanding work environments, provided they have adequate resources and support.

CONCLUSION

In the contemporary workplace, communication resources and stressors interact in multiple ways. By investing in high quality internal communication, SMEs can prepare their employees to better handle and accept change. Future studies are encouraged to examine these effects through longitudinal research and extend the sample to include larger companies and public sector contexts.

KEYWORDS

Employee readiness for change, internal communication, fsQCA, NCA, workplace stress, SMEs

REFERENCES

1. Bouckenooghe, D., Devos, G., & van den Broeck, H. (2009). Organizational Change Questionnaire—Climate of Change, Processes, and Readiness: Development of a new instrument. *The Journal of Psychology: Interdisciplinary and Applied*, 143(6), 559–599.
2. Burr, H., Berthelsen, H., Moncada, S., Nübling, M., Dupret, E., Demiral, Y., Oudyk, J., Kristensen, T. S., Llorens, C., Navarro, A., Lincke, H. J., Bocéréan, C., Sahan, C., Smith, P., Pohrt, A., & international COPSOQ Network (2019). The Third Version of the Copenhagen Psychosocial Questionnaire. *Safety and health at work*, 10(4), 482–503.
3. Cangialosi, N. (2023). Fuzzy-Set Qualitative Comparative Analysis (fsQCA) in Organizational Psychology: Theoretical Overview, Research Guidelines, and A Step-By-Step Tutorial Using R Software. *The Spanish Journal of Psychology*, 26, e21

4. Cavanaugh, M. A., Boswell, W. R., Roehling, M. V., & Boudreau, J. W. (2000). An empirical examination of self-reported work stress among U.S. managers. *Journal of Applied Psychology*, 85(1), 65–74.
5. Crawford, E. R., LePine, J. A., & Rich, B. L. (2010). Linking job demands and resources to employee engagement and burnout: A theoretical extension and meta-analytic test. *Journal of Applied Psychology*, 95(5), 834–848.
6. Dul, J. (2016). Necessary Condition Analysis (NCA): Logic and Methodology of "Necessary but Not Sufficient" Causality: Logic and Methodology of "Necessary but Not Sufficient" Causality. *Organizational Research Methods*, 19(1), 10-52
7. Hobfoll, S. E. (1989). Conservation of resources: A new attempt at conceptualizing stress. *American Psychologist*, 44(3), 513–524.
8. Misra, S., & Stokols, D. (2012). Psychological and health outcomes of perceived information overload. *Environment and Behavior*, 44(6), 737–759.
9. Oreg, S., Vakola, M., & Armenakis, A. (2011). Change recipients' reactions to organizational change: A 60-year review of quantitative studies. *Journal of Applied Behavioral Science*, 47(4), 461–524.
10. Sun, R., Li, J.-Y. Q., Lee, Y., & Tao, W. (2023). The Role of Symmetrical Internal Communication in Improving Employee Experiences and Organizational Identification During COVID-19 Pandemic-Induced Organizational Change. *International Journal of Business Communication*, 60(4), 1398-1426.
11. Tkalac Verčič, A., Pološki Vokić, N., & Sinčić Ćorić, D. (2009). Development of the Internal Communication Satisfaction Questionnaire. *Društvena istraživanja*, 18 (1-2 (99-100)), 175-202

SURVIVING THE PAST IS NOT ENOUGH: A PILOT STUDY OF HISTORICAL THREATS AND EXPECTED LONGEVITY AMONG CZECH CENTENARIAN FIRMS

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INTRODUCTION

Centenarian firms offer a rare setting for examining how organizations maintain continuity through wars, regime shifts, and market transformations. Corporate longevity encompasses survival, renewal, and sustainable value creation rather than organizational age alone (Ahmad et al., 2019; Fernández Moya et al., 2020; Riviezzo et al., 2022). This study examines whether experience of past crises strengthens firms' confidence in their ability to endure for another century.

LITERATURE REVIEW / THEORETICAL BACKGROUND

Prior research associates corporate longevity with effective governance, institutional quality, heritage stewardship, intergenerational legacy, and organizational resilience (Burghausen & Balmer, 2015; Zattoni et al., 2020; Radu-Lefebvre et al., 2024; Yilmaz et al., 2024). However, historical experience may either foster organizational learning or reinforce strategic rigidity. Accordingly, the framework distinguishes retrospective historical resilience from prospective adaptive capability.

METHODOLOGY

An exploratory mixed-method pilot study combined AI-assisted knowledge discovery and desk research with a questionnaire survey of 31 Czech centenarian organizations. Historical continuity was verified across legal entities, brands and production traditions (Nesiba, 2026). Descriptive statistics assessed perceived threats and expected survival, while qualitative content analysis identified adaptive practices associated with future optimism.

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RESULTS

The post-1989 economic transformation was perceived as the most consequential historical threat, followed by nationalization and World War II. More than 80% of respondents expected their organization or brand to survive for another century. However, the cumulative number of reported historical crises was not associated with stronger confidence in future continuity. Instead, higher expectations of longevity were linked to innovation, long-term investment, managerial continuity, and succession planning.

DISCUSSION / POLICY IMPLICATIONS

Past survival appears to strengthen confidence in future continuity only when historical experience is translated into adaptive renewal. This interpretation is consistent with research on firm survival, digital competitiveness, centenarian adaptation, value transmission, and strategic evolution (Esteve-Pérez et al., 2018; Panza et al., 2018; Rossato & Castellani, 2020; Kang, 2022; Suddaby et al., 2023; Welsh et al., 2024). Policy support should integrate heritage preservation with innovation and succession planning.

CONCLUSION

The pilot study suggests that organizational age and accumulated exposure to historical crises are insufficient predictors of expected longevity. Adaptive capability may serve as the link between historical resilience and future organizational continuity, consistent with cross-country evidence on family business growth (Miroshnychenko et al., 2021). Future research should test this framework using larger international samples, verified measures of organizational continuity, and longitudinal data.

KEYWORDS

Centenarian firms, corporate longevity, historical resilience, adaptive capability, organizational continuity

REFERENCES

1. Ahmad, S., Omar, R., & Quoquab, F. (2019). Corporate sustainable longevity: Scale development and validation. *SAGE Open*, 9(1), 1–15. https://doi.org/10.1177/2158244018822379

2. Burghausen, M., & Balmer, J. M. T. (2015). Corporate heritage identity stewardship: A corporate marketing perspective. *European Journal of Marketing*, 49(1/2), 22–61. https://doi.org/10.1108/EJM-06-2014-0380
3. Esteve-Pérez, S., Pieri, F., & Rodriguez, D. (2018). Age and productivity as determinants of firm survival over the industry life cycle. *Industry and Innovation*, 25(2), 167–198. https://doi.org/10.1080/13662716.2017.1291329
4. Fernández Moya, M., Fernández-Pérez, P., & Lubinski, C. (2020). Standing the test of time: External factors influencing family firm longevity in Germany and Spain during the twentieth century. *Journal of Evolutionary Studies in Business*, 5(1), 221–264. https://doi.org/10.1344/JESB2020.1.J073
5. Kang, M. Y. (2022). What makes companies to survive over a century? The case of Dongwha Pharmaceutical in the Republic of Korea. *Sustainability*, 14(2), 946. https://doi.org/10.3390/su14020946
6. Miroshnychenko, I., De Massis, A., Miller, D., & Barontini, R. (2021). Family business growth around the world. Entrepreneurship *Theory and Practice*, 45(4), 682–708. https://doi.org/10.1177/1042258720913028
7. Nesiba, J. (2026). Century-old companies and brands in the Czech Republic. In J. Nesiba & J. Smolík (Eds.), *Region in the development of society: Proceedings of the 13th international scientific conference* (pp. 226–234). Mendel University in Brno. https://doi.org/10.11118/978-80-7701-082-5-0226
8. Panza, L., Ville, S., & Merrett, D. (2018). The drivers of firm longevity: Age, size, profitability and survivorship of Australian corporations, 1901–1930. *Business History*, 60(2), 157–177. https://doi.org/10.1080/00076791.2017.1293041
9. Radu-Lefebvre, M., Davis, J. H., & Gartner, W. B. (2024). Legacy in family business: A systematic literature review and future research agenda. *Family Business Review*, 37(1), 18–59. https://doi.org/10.1177/08944865231224506
10. Riviezzo, A., Garofano, A., Mignone, G., & Napolitano, M. R. (2022). Survivors: A tentative mapping of centenarian firms around the world. *Corporate Governance and Research & Development Studies*, (1). https://doi.org/10.3280/CGRDS1-2022OA13774
11. Rossato, C., & Castellani, P. (2020). The contribution of digitalisation to business longevity from a competitiveness perspective. *The TQM Journal*, 32(4), 617–645. https://doi.org/10.1108/TQM-02-2020-0032
12. Suddaby, R., Ng, W., Vershinina, N., Markman, G., & Cadbury, M. (2023). Sacralization and the intergenerational transmission of values in Cadbury. *Family Business Review*, 36(3), 296–314. https://doi.org/10.1177/08944865231188788
13. Welsh, D. H. B., Llanos-Contreras, O., & Hebles, M. (2024). Effectuation and strategic evolution for sustainable longevity: The case of a 19th-generation family firm. International *Journal of Entrepreneurial Behavior & Research*, 30(4), 834–855. https://doi.org/10.1108/IJEBR-07-2023-0684
14. Yilmaz, Y., Raetze, S., de Groote, J., & Kammerlander, N. (2024). Resilience in family businesses: A systematic literature review. *Family Business Review*, 37(1), 60–88. https://doi.org/10.1177/08944865231223372

15. Zattoni, A., Dedoulis, E., Leventis, S., & van Ees, H. (2020). Corporate governance and institutions: A review and research agenda. *Corporate Governance: An International Review*, 28(6), 465–487. https://doi.org/10.1111/corg.12347

THE ROLE OF EXTERNAL KNOWLEDGE ACQUISITION IN FOSTERING INNOVATION AND DIGITALIZATION AMONG SMES IN NORTH MACEDONIA: EVIDENCE FROM BEEPS VI

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INTRODUCTION

In recent years, SMEs have been turning more and more towards external knowledge as a means of addressing resource limitations and boosting innovation and digitalization. While external knowledge acquisition is often addressed in innovation literature, examples from transition economies are scarce. This paper analyzes the effect of external knowledge acquisition, innovation, and digitalization of SMEs in North Macedonia based on the BEEPS VI dataset.

LITERATURE REVIEW / THEORETICAL BACKGROUND

Based on the knowledge-based view approach, absorptive capacity and open innovation approach, external knowledge could be considered as a resource for strategy in case of its use as an augmentation of the capabilities that exist internally in SMEs. However, there is little evidence about SMEs from North Macedonia in this context.

METHODOLOGY

Quantitative secondary data, collected in BEEPS VI by the World Bank and EBRD (2020), is employed in the study. By following the criteria set for filtering of samples in the wider research design, the sample consists of 240 SMEs from North Macedonia in various industries and geographical locations. Descriptive statistics, cross tabulation, Chi-square tests, correlations and regressions are employed to analyse knowledge acquisition, innovation and digitalisation using IBM SPSS Statistics.

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RESULTS

There is clear evidence that there exists a positive relationship between external knowledge acquisition and innovation and digitalization. Small and medium enterprises, which invest in external knowledge, exhibit more involvement in innovation and digitalization. There exist significant differences in cross tabulations and Chi square analyses, while correlation and regression analyses show positive relationships for innovation and digitalization.

DISCUSSION / POLICY IMPLICATIONS

The results emphasize the need to develop knowledge transfer processes in the innovation system of North Macedonia. Support for cooperation between universities and companies, innovation vouchers, and digital transformation might enhance access of SMEs to external knowledge. On the company level, building absorptive capacity is essential for translating external knowledge into innovations and digital capabilities.

CONCLUSION

The study provides evidence that external knowledge acquisition is positively associated with innovation and digitalization among the analyzed SMEs in North Macedonia. The findings underline the value of external knowledge networks for resource-constrained firms and contribute to research on innovation ecosystems in transition economies. As the 240 firms constitute an analytical sample, broader generalizations to all SMEs in North Macedonia should be made cautiously.

KEYWORDS

SMEs, innovation, digitalization, North Macedonia

REFERENCES

1. Audretsch, D. B., Belitski, M., & Caiazza, R. (2021). Startups, innovation and knowledge spillovers. The Journal of Technology Transfer, 46(6), 1995–2016. https://doi.org/10.1007/s10961-021-09882-1
2. Castells, M. (2010). The rise of the network society (2nd ed.). Wiley-Blackwell.
3. Chesbrough, H. W. (2003). Open innovation: The new imperative for creating and profiting from technology. Harvard Business School Press.
4. Cohen, W. M., & Levinthal, D. A. (1990). Absorptive capacity: A new perspective on learning and innovation. Administrative Science Quarterly, 35(1), 128–152. https://doi.org/10.2307/2393553

5. Crossan, M. M., & Apaydin, M. (2010). A multi-dimensional framework of organizational innovation: A systematic review of the literature. Journal of Management Studies, 47(6), 1154–1191. https://doi.org/10.1111/j.1467-6486.2009.00880.x
6. Damanpour, F. (1991). Organizational innovation: A meta-analysis of effects of determinants and moderators. Academy of Management Journal, 34(3), 555–590. https://doi.org/10.2307/256406
7. Durmishi, C. T. (2024). Embracing digitalization in SMEs in North Macedonia: An innovative approach and performance (Doctoral dissertation, International Balkan University).
8. Nambisan, S., Lyytinen, K., Majchrzak, A., & Song, M. (2017). Digital innovation management: Reinventing innovation management research in a digital world. MIS Quarterly, 41(1), 223–238. https://doi.org/10.25300/MISQ/2017/41:1.03
9. OECD & Eurostat. (2018). Oslo Manual 2018: Guidelines for collecting, reporting and using data on innovation (4th ed.). OECD Publishing. https://doi.org/10.1787/9789264304604-en
10. Scuotto, V., Del Giudice, M., Garcia-Perez, A., Orlando, B., & Ciampi, F. (2023). A spillover effect of entrepreneurial orientation on technological innovation capabilities among SMEs. Technological Forecasting and Social Change, 186, 122145. https://doi.org/10.1016/j.techfore.2022.122145
11. Tidd, J., Bessant, J., & Pavitt, K. (2020). Managing innovation: Integrating technological, market and organizational change (7th ed.). Wiley.
12. Vial, G. (2019). Understanding digital transformation: A review and a research agenda. The Journal of Strategic Information Systems, 28(2), 118–144. https://doi.org/10.1016/j.jsis.2019.01.003
13. World Bank & European Bank for Reconstruction and Development. (2020). Business Environment and Enterprise Performance Survey (BEEPS VI): Methodology and data documentation. World Bank.

STRATEGIC HRM IN WOMEN-LED VENTURES: A CONCEPTUAL FRAMEWORK FOR INNOVATION AND COMPETITIVE ADVANTAGE

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INTRODUCTION

Women-led ventures increasingly contribute to innovation, yet female entrepreneurs face persistent constraints in capital, networks and market access (Audretsch et al., 2022; Jennings & Brush, 2013). Internal strategies for offsetting these constraints remain under-theorised. This conceptual study integrates the Resource-Based View (RBV), dynamic capabilities and strategic HRM (SHRM) to propose how women-led ventures may leverage human capital for innovation and competitive advantage.

LITERATURE REVIEW / THEORETICAL BACKGROUND

RBV holds that valuable, inimitable human capital may underpin sustained advantage (Barney, 1991; Gerhart & Feng, 2021), although deployment appears to matter more than possession (Delery & Roumpi, 2017). Dynamic capabilities theory adds the capacity to sense, seize and reconfigure resources (Teece et al., 1997). SHRM research suggests that internally consistent HR bundles shape human capital and climate (Becker & Gerhart, 1996; Bowen & Ostroff, 2004; Lepak & Snell, 2002).

METHODOLOGY

The study follows a conceptual, theory-building design integrating strategic management, HRM and entrepreneurship literature. Using abductive logic, we

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compare and reconcile the RBV, dynamic capabilities and SHRM streams to construct an explanatory framework, with the HRM system as the focal unit of analysis. Nothing is tested empirically; the output is a set of theoretical propositions (P1-P4) advanced for future examination.

RESULTS

We propose that strategically aligned HRM systems are associated with firm-specific human and social capital (P1) which, mobilised through high-involvement practices, relates to sensing, seizing and reconfiguring capabilities (Collins & Smith, 2006) (P2). The framework suggests that dynamic capabilities mediate the HRM-innovation link (Ho et al., 2024) (P3), and that resource constraints strengthen it (P4). No causal relationships are claimed.

DISCUSSION / POLICY IMPLICATIONS

The framework positions HRM as a strategic rather than an administrative function (Chadwick & Flinchbaugh, 2021) and specifies dynamic capabilities as the mechanism that may link HR systems to innovation (Apascaritei & Elvira, 2022). It suggests founders may benefit from coherent HR design rather than from adopting more practices. For policy, it implies that HR capability-building could complement finance- and network-oriented support.

CONCLUSION

The framework yields four testable propositions. P1-P3 may be examined with established measures of HRM system strength, human capital configurations and dynamic capabilities in women-led SMEs, while P4 invites a moderated-mediation design. For founders, HR system coherence rather than the number of practices is the actionable variable; for policy, HR capability-building is a fundable intervention. The propositions remain untested.

KEYWORDS

Women entrepreneurs, strategic human resource management, dynamic capabilities, innovation, competitive advantage

REFERENCES

1. Apascaritei, P., & Elvira, M. M. (2022). Dynamizing human resources: An integrative review of SHRM and dynamic capabilities research. Human Resource Management Review, 32(4), 100878.

2. Audretsch, D. B., Belitski, M., & Brush, C. G. (2022). Innovation in women-led firms: An empirical analysis. Economics of Innovation and New Technology, 31(1–2), 90–110.
3. Barney, J. (1991). Firm resources and sustained competitive advantage. Journal of Management, 17(1), 99–120.
4. Becker, B. E., & Gerhart, B. (1996). The impact of human resource management on organizational performance: Progress and prospects. Academy of Management Journal, 39(4), 779–801.
5. Bowen, D. E., & Ostroff, C. (2004). Understanding HRM–firm performance linkages: The role of the "strength" of the HRM system. Academy of Management Review, 29(2), 203–221.
6. Chadwick, C., & Flinchbaugh, C. (2021). Searching for competitive advantage in the HRM–firm performance relationship. Academy of Management Perspectives, 35(2), 181–207.
7. Collins, C. J., & Smith, K. G. (2006). Knowledge exchange and combination: The role of human resource practices in the performance of high-technology firms. Academy of Management Journal, 49(3), 544–560.
8. Delery, J. E., & Roumpi, D. (2017). Strategic human resource management, human capital and competitive advantage: Is the field going in circles? Human Resource Management Journal, 27(1), 1–21.
9. Gerhart, B., & Feng, J. (2021). The resource-based view of the firm, human resources, and human capital: Progress and prospects. Journal of Management, 47(7), 1796–1819.
10. Ho, M., Soo, C., Tian, A., & Teo, S. T. T. (2024). Influence of strategic HRM and entrepreneurial orientation on dynamic capabilities and innovation in small- and medium-sized enterprises. International Small Business Journal, 42(5), 611–640.
11. Jennings, J. E., & Brush, C. G. (2013). Research on women entrepreneurs: Challenges to (and from) the broader entrepreneurship literature? Academy of Management Annals, 7(1), 663–715.
12. Lepak, D. P., & Snell, S. A. (2002). Examining the human resource architecture: The relationships among human capital, employment, and human resource configurations. Journal of Management, 28(4), 517–543.
13. Teece, D. J., Pisano, G., & Shuen, A. (1997). Dynamic capabilities and strategic management. Strategic Management Journal, 18(7), 509–533.

FAMILY BUSINESS REGULATION IN SLOVAKIA: BETWEEN LEGAL RECOGNITION AND PRACTICAL ADOPTION

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INTRODUCTION

Family businesses constitute a significant part of the Slovak economy and play an important role in employment, regional development, innovation diffusion, and intergenerational wealth creation. As important actors within regional entrepreneurship and innovation ecosystems, family firms contribute to economic resilience and long-term sustainable development. Since 2023, Slovakia has introduced a specific legislative framework regulating family businesses through Act No. 112/2018 Coll. This paper examines the legal foundations of family entrepreneurship and evaluates the practical effectiveness of the adopted regulatory model within the broader context of entrepreneurial ecosystem development.

LITERATURE REVIEW / THEORETICAL BACKGROUND

Theoretical approaches define family businesses through family ownership, management participation, and succession continuity (Chrisman et al., 2005). Within entrepreneurship and innovation ecosystem theory, family firms are recognized as important contributors to local economic stability, knowledge

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transfer, resilience, and innovation capacity (Pütz & Werner, 2023; Yilmaz et al., 2024). Recent studies have also highlighted their role in promoting sustainable development, corporate social responsibility, and long-term value creation (Patuelli et al., 2022; Stock et al., 2024). Legislative support is considered a key factor influencing their long-term sustainability, governance structures, and integration into entrepreneurial ecosystems (Parada et al., 2026). The Slovak legal framework introduced formal definitions of family businesses, established recognition mechanisms, and linked registered family enterprises with obligations related to positive social impact and family value preservation (Act No. 112/2018 Coll.).

METHODOLOGY

The study applies qualitative legal and institutional analysis. Primary sources include Act No. 112/2018 Coll. on the Social Economy and Social Enterprises, related amendments, and publicly available information from the Ministry of Labour, Social Affairs and Family of the Slovak Republic. The analysis focuses on legal definitions, registration mechanisms, eligibility criteria, and practical implementation outcomes. Particular attention is devoted to assessing the extent to which the regulatory framework supports the development of family entrepreneurship within the national entrepreneurial ecosystem.

RESULTS

The research identified a two-tier system consisting of recorded and registered family businesses. While the legislation provides clear legal definitions and recognition procedures, practical adoption remains virtually non-existent. An analysis of the official Register of Family Businesses and the Records of Family Businesses revealed that, at the time of the study, zero family businesses had been registered and zero family businesses had been recorded under the respective legal mechanisms (Ministry of Labour, Social Affairs and Family of the Slovak Republic, 2026). These figures demonstrate an absence of practical adoption despite the existence of a comprehensive legislative framework. This suggests a substantial gap between the legislative intention to support family entrepreneurship and the real willingness of family firms to utilize the available legal framework. Key barriers include mandatory reinvestment requirements, extensive administrative obligations, strict eligibility criteria, and the absence of direct economic incentives for participating enterprises.

DISCUSSION / POLICY IMPLICATIONS

The analysis reveals a discrepancy between legislative objectives and business practice. Despite the establishment of a comprehensive legal framework intended to strengthen family entrepreneurship and support its long-term sustainability, the complete absence of recorded and registered family businesses indicates that the current model has not achieved meaningful practical uptake. Consequently, its contribution to the development of the entrepreneurship and innovation ecosystem remains limited. The current framework places substantial obligations on family firms without offering sufficient compensatory benefits. Policymakers should consider introducing tax incentives, reducing administrative complexity, strengthening succession-support measures, and promoting networking opportunities that would facilitate greater integration of family businesses into regional innovation and entrepreneurship ecosystems.

CONCLUSION

Slovakia has established one of the first comprehensive legal definitions of family businesses within its existing corporate framework. However, the complete absence of officially recorded and registered family businesses demonstrates that legal recognition alone is insufficient to motivate firms to seek formal status. The current framework therefore has a negligible practical impact on the development of family entrepreneurship and its contribution to entrepreneurship and innovation ecosystems. Future policy development should focus on balancing regulatory oversight with tangible economic and administrative benefits while creating conditions that foster innovation, succession continuity, and sustainable growth of family enterprises.

KEYWORDS

Business succession, Family business, Family entrepreneurship, Legislation, Slovakia.

REFERENCES

1. Act No. 112/2018 Coll. on the Social Economy and Social Enterprises, as amended.
2. Chrisman, J. J., Chua, J. H., & Sharma, P. (2005). Trends and directions in the development of a strategic management theory of the family firm. Entrepreneurship Theory and Practice, 29(5), 555–575.
3. Farooq, M., Noor, A., & Naeem, M. (2023). Does family ownership moderate the relationship between board characteristics and corporate social responsibility? Evidence from an emerging market. *Asian Journal of Business Ethics*, *12*(1), 71-99.

4. Ministry of Justice of the Slovak Republic. (2025). Slov-Lex legal information system. Retrieved from https://www.slov-lex.sk
5. Ministry of Labour, Social Affairs and Family of the Slovak Republic. (2025). Register of family businesses. Retrieved from https://registre.socialnaekonomika.gov.sk
6. Miroshnychenko, I., De Massis, A., Barontini, R., & Testa, F. (2022). Family firms and environmental performance: A meta-analytic review. *Family Business Review*, *35*(1), 68-90.
7. Parada, M. J., Gimeno, A., Samara, G., & Saris, W. (2026). The adoption of governance mechanisms in family businesses: an institutional lens. *Journal of Family Business Management*, *16*(1), 148-165.
8. Patuelli, A., Carungu, J., & Lattanzi, N. (2022). Drivers and nuances of sustainable development goals: Transcending corporate social responsibility in family firms. *Journal of Cleaner Production*, *373*, 133723.
9. Pütz, L., & Werner, A. (2023). Absorptive capacity in family firms: a systematic literature review. *Review of Managerial Science*, *18*(2), 577-632.
10. Stock, C., Pütz, L., Schell, S., & Werner, A. (2024). Corporate social responsibility in family firms: Status and future directions of a research field. *Journal of Business Ethics*, *190*(1), 199-259.
11. Sun, J., Pellegrini, M. M., Dabić, M., Wang, K., & Wang, C. (2024). Family ownership and control as drivers for environmental, social, and governance in family firms. *Review of Managerial Science*, *18*(4), 1015-1046.
12. Yilmaz, Y., Raetze, S., Groote, J. D., & Kammerlander, N. (2024). Resilience in family businesses: a systematic literature review. *Family Business Review*, *37*(1), 60-88.
13. Zapata-Cantu, L., Sanguino, R., Barroso, A., & Nicola-Gavrilă, L. (2023). Family business adapting a new digital-based economy: opportunities and challenges for future research. *Journal of the Knowledge Economy*, *14*(1), 408-425.

III.

DIGITAL AND GREEN TRANSFORMATION

TWIN TRANSITION IN TOURISM: EVIDENCE FROM EU COUNTRIES

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INTRODUCTION

The twin transition, integrating green and digital transformation, has become a strategic priority for enhancing the sustainability and competitiveness of tourism in the European Union (European Comission, 2022b; Jones, 2023; Terzi et al., 2023; Faggian et al., 2025; Bekele & Raj, 2025). However, EU member states differ considerably in their progress across these two dimensions. This study evaluates and compares their performance by assessing achievements in green and digital tourism transition.

LITERATURE REVIEW / THEORETICAL BACKGROUND

Previous studies have mainly examined green and digital transitions separately (Benedetti et al., 2023; Gorina et al., 2024), with limited attention to their joint assessment in tourism. Building on the twin transition framework (González-Rodríguez & Díaz-Fernández, 2025; Jones, 2023; Jakab et al., 2023), this study integrates both dimensions into a unified benchmarking framework, enabling the identification of distinct tourism transition profiles across EU countries.

METHODOLOGY

The analysis covers 27 EU countries using 2023 EU Tourism Dashboard indicators (EU Tourism Dashboard, 2024). Entropy-based PROMETHEE method was applied (Brans & Vincke, 1985; Pantović et al., 2026). Countries ranked in the top 13 in

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both green and digital pillars were classified as Leaders, those in the bottom 14 in both as Laggards, and the others as Green- or Digital-Oriented (Popović et al., 2025).

RESULTS

Denmark, Malta, Sweden, Cyprus, Lithuania, and Austria, emerged as Twin Transition Leaders. Greece, Italy, Croatia, Bulgaria, Czechia, Luxembourg, and Latvia formed the Green-Oriented group, while Portugal, Ireland, Hungary, the Netherlands, Belgium, Spain, and Finland were identified as Digital-Oriented countries. Slovakia, Estonia, Romania, Poland, France, Slovenia, and Germany were classified as Twin Transition Laggards. The results indicate distinct transition profiles among EU countries.

DISCUSSION / POLICY IMPLICATIONS

The observed differences among country groups likely reflect unequal investment in digital and green transformation, differences in governance capacity and policy priorities, and variations in tourism structure and development levels. Therefore, Green-Oriented countries should strengthen digital capacities, Digital-Oriented countries environmental performance, while Twin Transition Laggards require integrated policy support (European Commission, 2022a).

CONCLUSION

The proposed classification provides a practical framework for benchmarking EU tourism systems according to their twin transition performance. It contributes to a better understanding of cross-country differences in green and digital development and provides a useful basis for designing targeted policy measures. The framework may also support monitoring future progress and facilitate more coordinated policy actions aimed at achieving balanced advancement across both transition dimensions.

KEYWORDS

Twin transition, tourism, PROMETHEE, entropy method, European Union

REFERENCES

1. Bekele, H., & Raj, S. (2025). Digitalization and digital transformation in the tourism industry: a bibliometric review and research agenda. *Tourism Review, 80*(4), 894-913. https://doi.org/10.1108/TR-07-2023-0509

2. Benedetti, I., Guarini, G., & Laureti, T. (2023). Digitalization in Europe: A potential driver of energy efficiency for the twin transition policy strategy. *Socio-Economic Planning Sciences, 89*, 101701. https://doi.org/10.1016/j.seps.2023.101701
3. Brans, J. P., & Vincke, P. (1985). A preference ranking organisation method: The PROMETHEE method for multiple criteria decision-making. *Management Science, 31*(6), 647-656. https://doi.org/10.1287/mnsc.31.6.647
4. EU Tourism Dashboard. (2024). *Available at:* https://tourism-dashboard.ec.europa.eu
5. European Commission (2022a). *Transition pathway for tourism*. Publications Office of the European Union. https://doi.org/10.2873/344425
6. European Commission, Joint Research Centre (2022b). *Towards a green and digital future: Key requirements for successful twin transitions in the European Union*. Publications Office of the European Union. https://data.europa.eu/doi/10.2760/977331
7. Faggian, A., Marzucchi, A., & Montresor, S. (2025). Regions facing the 'twin transition': Combining regional green and digital innovations. *Regional Studies, 59*(1), 2398555. https://doi.org/10.1080/00343404.2024.2398555
8. González-Rodríguez, M. R., & Díaz-Fernández, M. C. (2025). Benchmarking tourism digitalization in the EU: evidence from a multi-criteria approach. *Management Decision*, 1-19. https://doi.org/10.1108/MD-05-2025-1288
9. Gorina, G., Chernega O., & Kozhuklova, T. (2024). Monitoring of the European tourism ecosystem green transition. *VISNYK of Donetsk National University of Economics, 81*(2), 95-106. https://doi.org/10.33274/2079-4819-2024-81-2-95-106
10. Jakab, G., Szabó, T., & Varró, A. (2023). Macroeconomic impacts of the "Fit for 55" package of proposals. *15th International Scientific Conference „Environmental and Energy Economics: Climate change mitigation and adaptation, green transition, circular economy"*, Institute of Economic Sciences, Belgrade, 77-79. ISBN 978-86-89465-74-7
11. Jones, P. (2023). Towards a green and digital transition for European tourism. *Athens Journal of Tourism, 10*(4), 281-294. https://doi.org/10.30958/ajt.10-4-3
12. Pantović, D., Lojanica, N., Bojnec, Š., & Gričar, S. (2026). Assessing Disparities in Climate and Energy Agri-Environmental Indicators Among EU Countries Using the PROMETHEE–GAIA Method and the Entropy Index. *Agriculture, 16*(4), 463. https://doi.org/10.3390/agriculture16040463
13. Popovic, G., Fedajev, A., Mitic, P., & Meidute-Kavaliauskiene, I. (2025). An ADAM-based approach to unveiling entrepreneurial ecosystems in selected European countries. *Management Decision, 63*(4), 1262-1291. https://doi.org/10.1108/MD-12-2023-2420
14. Terzi, A., Sherwood, M., & Singh, A. (2023). European industrial policy for the green and digital revolution. *Science and Public Policy, 50*(5), 842-857. https://doi.org/10.1093/scipol/scad018

DIGITAL AND GREEN TRANSFORMATION OF THE COAL REGION: PROSPECTS FOR STARA ZAGORA AS A BALKAN HYDROGEN HUB

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INTRODUCTION

The digital-green transition is understood not as a parallel deployment of digital and low-carbon technologies, but as a common transformation of production, infrastructure, management and skills. In Stara Zagora, this interdependence is critical: the decarbonization of the Maritsa East complex requires innovative solutions, traceability and coordination to connect industrial diversification, new employment and social sustainability.

LITERATURE REVIEW / THEORETICAL BACKGROUND

The theoretical framework combines sustainability transitions, regional innovation systems, digital twins and life-cycle thinking. A multi-level perspective explains how pressures destabilize carbon-intensive regimes and create space for niche experiments (Geels, 2002; Markard et al., 2012; Köhler et al., 2019). Regional innovation research focuses on actors' networks, knowledge sharing and institutional capacity, while sectoral connectivity links energy production to mobility and public services (Markard, 2018). Digital twins allow for trackable monitoring and simulation between interdependent assets. Life-cycle thinking extends systemic boundaries to upstream resources and downstream impacts (Sharma et al., 2022). The combined framework connects the technological configuration with coordination, learning and measurable sustainability outcomes.

METHODOLOGY

The study is an applied, politically oriented single case study of ZAHYR and the coal region of Stara Zagora. The empirical base includes official project and policy documents, technical parameters of infrastructure and peer-reviewed publications on sustainable transitions and hydrogen valleys. Through structured

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content analysis, data on technological configuration, participants, market readiness and management are extracted. LCA is adapted at territorial level through a system boundary covering storage, distribution and end-use. The transition is assessed through KPIs for hydrogen emissions, energy and water consumption, production and costs, employment and local suppliers. SWOT analysis, comparison with European hydrogen valleys and scenarios up to 2035 baseline, accelerated and limited are used, which determine the stage and dynamics of the transformation.

RESULTS

The design configuration of ZAHYR connects the production and use of green hydrogen. Two electrolysers with a total capacity of 5 MW, powered by a 20 MW photovoltaic park, form an urban module with two charging stations, 10 buses, two trucks and a 1 MW fuel cell for public lighting and an industrial module in Maritsa East for mixing hydrogen in a gas turbine. The analysis establishes three functions: demonstrating local chain of production - distribution - end-use, testing of transport, municipal and industrial applications, and accumulating knowledge and skills for scaling. In the context of the European Green Deal, ZAHYR is a core for low-carbon modernization of energy specialization, economic diversification and attracting partners and investments. Connecting a university, public authorities, transport operators and industry creates an institutional basis for a future Balkan hydrogen hub (European Commission, Directorate-General for Energy, 2024).

DISCUSSION / POLICY IMPLICATIONS

The results suggest that policy needs to focus on market shaping and implementation capacity. Municipal and industrial procurement can turn planned applications into measurable costs, while common operating and safety standards can reduce coordination risks. The responsibility for technical, environmental and socio-economic monitoring must be assigned through a regional data protocol. Supplier training and development must be linked to the commissioning stages so that public support generates local opportunities. Expansion to greater production and cross-border cooperation must follow proven reliability, use and cost-effectiveness. This sequence links project training to investment decisions and reduces the risk of underutilised infrastructure.

CONCLUSION

The research contributes to a reproducible analytical structure that separates the planned components, territorial prerequisites and transformation outcomes. Its value lies in the conversion of heterogeneous design information into a project-level dataset suitable for LCA and comparison with other hydrogen valleys. As implementation progresses, the evaluation matrix needs to be updated with monitored hydrogen production and use, capacity utilisation, life-cycle emissions, costs, employment effects and involvement of local suppliers. The evidence obtained would allow tests for environmental additionality, economic viability and regional value creation, without relying on preliminary expectations.

KEYWORDS

Digital-green transformation, hydrogen hub, Stara Zagora, just transition, regional innovation system

REFERENCES

1. European Commission, Directorate-General for Energy. (2024). *Supporting clean hydrogen development in Stara Zagora: A case study of hydrogen valleys in the Netherlands and Poland*. Publications Office of the European Union.
2. Geels, F. W. (2002). Technological transitions as evolutionary reconfiguration processes: A multi-level perspective and a case-study. *Research Policy, 31*(8–9), 1257–1274. https://doi.org/10.1016/S0048-7333(02)00062-8
3. Köhler, J., Geels, F. W., Kern, F., Markard, J., Wieczorek, A., Alkemade, F., Avelino, F., Bergek, A., Boons, F., Fünfschilling, L., Hess, D., Holtz, G., Hyysalo, S., Jenkins, K., Kivimaa, P., Martiskainen, M., McMeekin, A., Mühlemeier, M. S., Nykvist, B., ... Wells, P. (2019). An agenda for sustainability transitions research: State of the art and future directions. *Environmental Innovation and Societal Transitions, 31*, 1–32. https://doi.org/10.1016/j.eist.2019.01.004
4. Markard, J. (2018). The next phase of the energy transition and its implications for research and policy. *Nature Energy, 3*(8), 628–633. https://doi.org/10.1038/s41560-018-0171-7
5. Markard, J., Raven, R., & Truffer, B. (2012). Sustainability transitions: An emerging field of research and its prospects. *Research Policy, 41*(6), 955–967 https://doi.org/10.1016/j.respol.2012.02.013
6. Sharma, A., Kosasih, E., Zhang, J., Brintrup, A., & Calinescu, A. (2022). Digital twins: State of the art theory and practice, challenges, and open research questions. *Journal of Industrial Information Integration, 30*, 100383

TOWARD A CIRCULAR ECONOMY IN NORTH MACEDONIA: INSTITUTIONAL FRAMEWORK, PRIORITY SECTORS, AND FINANCING CHALLENGES

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INTRODUCTION

The circular economy (CE) offers a sustainable alternative to the linear economic model by promoting resource efficiency, waste minimization, and sustainable production. For the Republic of North Macedonia, CE transition represents both an environmental necessity and a strategic opportunity, particularly in the context of EU accession. This paper examines sectoral opportunities and financing constraints shaping the country's circular transition.

LITERATURE REVIEW / THEORETICAL BACKGROUND

The CE concept builds on the principle of maintaining the value of products, materials, and resources as long as possible while minimizing waste. Literature identifies institutional readiness, sectoral transformation, and sustainable finance as key enablers of CE transition, particularly in economies undergoing regulatory alignment. In this context, the EU Taxonomy and Green Deal provide the main regulatory architecture for directing capital toward circular activities in EU-accession countries.

METHODOLOGY

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The paper applies a qualitative methodology based on secondary data analysis. Academic literature, policy documents, institutional reports, and strategic frameworks from international organizations and national institutions were reviewed to examine the institutional framework, priority sectors, sustainable finance mechanisms, and key barriers related to CE transition in the Republic of North Macedonia.

RESULTS

The analysis identifies gradual progress in CE transition in North Macedonia, reflected in environmental reforms, climate commitments, and emerging green finance instruments. Five sectors demonstrate strong circular potential: construction, biomass and food, textiles, mining and metallurgy, and cultural and creative industries. However, significant barriers remain, including fragmented governance, weak infrastructure, low recycling rates, and underdeveloped sustainable finance mechanisms.

DISCUSSION / POLICY IMPLICATIONS

Accelerating CE transition requires a comprehensive national strategy aligned with EU policies, stronger institutional coordination, and modernization of the legislative framework. The identified priority sectors can realize their circular potential only if supported by adequate financing. Expanding sustainable finance instruments, including a national green finance taxonomy, increased green lending, and improved ESG reporting, is essential for mobilizing investments into circular transition.

CONCLUSION

The CE transition has the potential to foster Macedonia's sustainable economic growth, environmental protection, innovation, and EU integration. CE strategy, objectives, and measures must be treated in parallel with the financial needs of the transition at both micro and macro levels. Addressing institutional weaknesses and structural constraints through coordinated policy reforms and improved financing mechanisms is essential for achieving a resilient and resource-efficient economy.

KEYWORDS

Circular economy, sustainable finance, priority sectors, institutional framework, North Macedonia

REFERENCES

1. Boshkovska, D., Daniloska, N., & Petkovska, M. T. (in press). Institutional readiness for sustainable finance implementation under the EU regulatory framework: Evidence from North Macedonia. Economic Development.
2. Boshkovska, D., & Daniloska, N. (2025). Priority sectors for the Macedonian transition to a circular economy: Strategic pathways for sustainable transformation. Economic Development, 27(3), 22–33. https://doi.org/10.55302/ED25320b
3. Central Bank of the Republic of North Macedonia. (2023). Mid-term plan for integrating climate risks into the financial system 2023–2025. CBNM. https://www.nbrm.mk/content/National-Bank's-Medium-Term-Climate-Change-Action-Plan-for-2023-2025.pdf
4. Daniloska, N., & Boshkovska, D. (2025). Advancing the circular economy in the Republic of North Macedonia: Principles, policies, and strategic actions. Economic Development, 27(1–2), 108–123. https://doi.org/10.55302/ED251-2108d
5. Ellen MacArthur Foundation. (2024). Circular economy principles. Ellen MacArthur Foundation. https://www.ellenmacarthurfoundation.org/circular-economy-principles
6. European Commission. (2020). A new circular economy action plan for a cleaner and more competitive Europe. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52020DC0098
7. European Commission. (2023). Circular economy action plan progress report. https://eur-lex.europa.eu/resource.html?uri=cellar:9903b325-6388-11ea-b735-01aa75ed71a1
8. European Commission. (2024). *Overview of sustainable finance.*
9. European Environment Agency. (2025). Europe's environment and climate: Knowledge for resilience, prosperity and sustainability report: Country profile—North Macedonia. https://www.eea.europa.eu/en/europe-environment-2025/countries/north-macedonia
10. Macedonian Stock Exchange. (2021). Corporate governance code for companies listed on the Macedonian Stock Exchange. https://www.mse.mk/Repository/%D0%9A%D0%BE%D0%B4%D0%B5%D0%BA%D1%81/KKU%20na%20angliski%20final.pdf
11. Ministry of Finance of the Republic of North Macedonia. (2023). Green bonds as a new financial instrument on the domestic capital market, with the prospectus for its first issue being published. https://arhiva.finance.gov.mk/2023/09/28/mof-green-bonds-as-a-new-financial-instrument-on-the-domestic-capital-market-with-the-prospectus-for-its-first-issue-being-published/?lang=en
12. Organisation for Economic Co-operation and Development. (2023). A roadmap towards circular economy of North Macedonia. OECD Publishing. https://doi.org/10.1787/1973c88c-en

13. Paic, J. (2025). EBRD boosts support for green investments in North Macedonia. https://www.ebrd.com/home/news-and-events/news/2025/ebrd-boosts-support-for-green-investments-in-north-macedonia.html
14. Regional Cooperation Council. (2024). Sustainable finance and EU taxonomy challenges in the Western Balkans. RCC. https://www.rcc.int/download/docs/Sustainble%20Finance%20and%20Taxonomy%20in%20WB.pdf
15. Schroeder, P., Anggraeni, K., & Weber, U. (2019). The relevance of circular economy practices to the Sustainable Development Goals. Journal of Industrial Ecology, 23(1), 77–95. https://doi.org/10.1111/jiec.12732
16. Todevski, D. (2017). Financing the concept of the circular economy. IDEA Int. J. Sci. Arts, 1(2017)2, 49–54. https://www.researchgate.net/publication/360190926_Finansirane_na_konceptot_na_cirkularna_ekonomija
17. United Nations Educational, Scientific and Cultural Organization. (2025). UNESCO global report on cultural policies, Culture: The missing SDG. https://doi.org/10.58337/REJU6051
18. World Bank. (2023). *North Macedonia country climate and development report.*
19. World Bank. (2024). North Macedonia climate public finance review: Integrating climate change perspectives into fiscal policy. https://documents1.worldbank.org/curated/en/099060724174031856/pdf/P1792641 0e12380611804e15fc4ec12793b.pdf

GREEN GOVERNANCE DEFICITS AND CLIMATE FINANCE INTEGRITY AT THE LOCAL LEVEL: EVIDENCE FROM MUNICIPALITIES IN NORTH MACEDONIA

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INTRODUCTION

Local governments are key to the green transition, yet their capacity to govern climate finance transparently remains under-examined in small, transition economies. This study addresses this gap by analyzing nine pilot local governments in North Macedonia. As an EU candidate, the country faces a contradiction: it is committed to the Green Agenda but struggles to translate national goals locally due to fiscal dependency, low capacity, and no budget tagging.

LITERATURE REVIEW / THEORETICAL BACKGROUND

This paper builds on Ostrom's polycentric model (2010), where decentralized systems optimize climate action, though local benefits depend on fiscal and administrative capacity. We draw on fiscal decentralization theory (Martinez-Vazquez, 2021) to analyze climate expenditure and transfers; under-resourced mandates often cause governance failures. Finally, we integrate climate-responsive PFM frameworks (PEFA, 2024) and corruption risk tools (UNGP, 2013) to trace risks across the budget cycle.

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METHODOLOGY

Using a mixed-methods design, this paper examines a geographically representative sample of nine pilot local governments in North Macedonia. It triangulates four data sources: municipal surveys, key informant interviews, budget analysis, and strategic document reviews. The analysis applies an adapted subnational PEFA Climate framework and a corruption risk assessment tool (UNGP, 2013) to map and evaluate structural risk factors across all four phases of the municipal budget cycle.

RESULTS

All nine municipalities scored low on the PEFA Climate scale, showing underdeveloped PFM systems. Climate spending is fragmented across programs without tagging, and formal Environment Programs show negligible funding and chronic under-execution. Climate strategies are weakly linked to annual budgets, with stark capacity gaps between large urban and small rural units. Corruption risks across planning, execution, reporting, and audit phases are highly relevant in all nine cases.

DISCUSSION / POLICY IMPLICATIONS

Weak strategy-budget links and fragmentation create an information vacuum, raising corruption risks across the budget cycle. This indicates that decentralizing climate mandates without resources yields governance failures rather than polycentric innovation. The central budget circular lacks tagging provisions, blocking tracking. Reforms must pass the Law on Climate Action, introduce climate-conditional transfers, provide capacity grants, and mandate outcome reporting to ensure transparency.

CONCLUSION

This paper maps subnational climate finance governance in North Macedonia. The pilot units show identical low ratings, fragmented budgets, weak strategy links, and minimal anti-corruption safeguards. It shows local climate strategies fail without targeted PFM infrastructure investments and risk management. These systemic local deficits undermine and delay EU accession alignment and the country's commitments under the Green Agenda for the Western Balkans.

KEYWORDS

Climate finance governance, public financial management, decentralisation, green transformation, corruption risks

REFERENCES

1. Betsill, M. M., & Bulkeley, H. (2006). Cities and the multilevel governance of global climate change. *Global Governance*, 12(2), 141–159.
2. Bulkeley, H., & Newell, P. (2023). *Governing Climate Change* (3rd ed.). Routledge. https://doi.org/10.4324/9781003219828
3. de Mello, L., & Ter-Minassian, T. (2024). Subnational investments in mitigation and adaptation to climate change: Some financing and governance issues. *Public Finance Review*, 52(3), 1–34.
4. European Commission. (2024). North Macedonia 2024 report. Directorate General for Neighbourhood and Enlargement Negotiations.
5. Fischer, H. W. (2021). Decentralization and the governance of climate adaptation: Situating community-based planning within broader trajectories of political transformation. *World Development*, 140, Article 105335. https://doi.org/10.1016/j.worlddev.2020.105335
6. Gans-Morse, J., et al. (2024). Decentralization and corruption in public service delivery. *Journal of Public Administration Research and Theory*, 34(2), 238–258.
7. Martinez-Vazquez, J. (2021). *Adapting fiscal decentralization design to combat climate change (International Center for Public Policy Working Paper Series at AYSPS, GSU Paper No. 2105).* Andrew Young School of Policy Studies, Georgia State University. https://ideas.repec.org/p/ays/ispwps/paper2105.html
8. Martinez-Vazquez, J., Smoke, P., & Yilmaz, S. (Eds.). (2025). *Decentralized governance and climate change*. Edward Elgar Publishing.
9. Nikolov, M., Garvanlieva Andonova, V., Petrovska, A. M., Jandrevska, M., & Mitevski, I. (2026). *Baseline assessment: Climate finance in North Macedonia — An analysis of public financial management processes in the context of the budget cycle*. Center for Economic Analyses (CEA). cea.org.mk
10. OECD. (2020). *Green budgeting and tax policy tools to support a green recovery*. OECD Policy Responses to Coronavirus (COVID-19). OECD Publishing. https://doi.org/10.1787/bd02ea23-en
11. Ostrom, E. (2010). Polycentric systems for coping with collective action and global environmental change. *Global Environmental Change*, 20(4), 550–557. https://doi.org/10.1016/j.gloenvcha.2010.07.004
12. PEFA Secretariat. (2024). *Supplementary framework for assessing climate-responsive public financial management (PEFA Climate).* World Bank / PEFA. https://www.pefa.org/resources/supplementary-framework-assessing-climate-responsive-public-financial-management

13. Ring, I. (2008). Integrating local ecological services into intergovernmental fiscal transfers: The case of the ecological ICMS in Brazil. *Land Use Policy*, 25(4), 485–497. https://doi.org/10.1016/j.landusepol.2007.11.001
14. Transparency International. (2024). *Climate governance integrity programme: Corruption and climate finance.* TI Secretariat.
15. United Nations Global Compact (UNGP). (2013). A guide for anti-corruption risk assessment. UNODC.
16. World Bank, & United Nations Capital Development Fund. (2024). Local governments climate finance instruments: Global experiences and prospects in developing countries. World Bank. https://doi.org/10.1596/41417

SUSTAINABLE DEVELOPMENT IN SERBIA (1987-2026): IDEAS AND PRACTICE

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INTRODUCTION

Sustainable development has become a central framework for analysing environmental problems in relation to economic growth and development planning. 'The concept of sustainable development is a direct attempt to resolve this dichotomy [the tension between economic growth and environmental protection] by sending the message that it is possible to have economic development whilst also protecting the environment' (Carter, 2007, pp. 207–208). This concept was defined in a 1987 report: 'Sustainable development is development that meets the needs of present without compromising the ability of future generations to meet their own needs' (Blewitt, 2008, p. 15; Holden et al., 2018, p. 1). This paper aims to reconstruct the formation of the idea of sustainable development in Serbia and to discover the concrete plans and programmes of action related to this approach. This paper is the first historical overview of the concept of sustainable development in Serbia from the 1990s to the present.

LITERATURE REVIEW / THEORETICAL BACKGROUND

The international literature on sustainable development is vast and draws on various disciplines, including ecology, ecological economics, social ecology and environmental history. Monographs and edited volumes that explain the concept include *The Imperatives of Sustainable Development: Needs Justice, Limits* (Holden et al., 2018) and *Understanding Sustainable Development* (Blewitt, 2008). As environmental history of Serbia is an under-researched field, there is a lack of historical analysis of how the concept developed and was implemented in Serbia.

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METHODOLOGY

As an environmental historian, I apply qualitative historical source analysis methods to examine various sources. This paper traces the evolution and changes of the concept of sustainable development in Serbian textual sources from its appearance to the present day. These sources include newspapers, including *Borba* (1994–1997, 2001–2006, 2009), as well as development plans, sustainability programmes and other documents, including the 2008 National Strategy for Sustainable Development (Službeni glasnik, 2008). These sources are combined with Serbian literature on sustainability, including the interdisciplinary monograph *Životna sredina i održivi razvoj* (Đukanović, 1996) and articles such as 'Srbija 2030: Agenda održivog razvoja – izazovi i ograničenja'(Vučić, 2022).

RESULTS

Preliminary research shows that some scientists in the Federal Republic of Yugoslavia recognised the importance of sustainability, an important topic in the leading newspaper *Borba* (*Borba,* 18. 1. 1995; *Borba*, 5. 6. 1997). The FRY passed the Law on the Environment and ratified 53 international sustainability treaties (*Borba*, 5. 6. 1997). However, economic instruments for environmental protection were in early stages in 1996. With financial aid from the Swedish government, a Serbian sustainability strategy was planned for 2004 but adopted in 2008. The global financial crisis posed an obstacle to implementation (Đukić, 2010). A setback was the closure of the Ministry for Environmental Protection, after two years (*Borba*, 5. 2. 2005). Legislation evolved over the past six years, with the 2021 Law on Climate Change (Vučić, 2022). However, finishing a development plan related to sustainability, monitoring the Sustainable Development Goals (SDGs) and better coordination between partners working on measures and state institutions are lacking (Državna revizorska institucija, 2023).

DISCUSSION / POLICY IMPLICATIONS

The historical overview identifies several significant episodes in the development of the concept of sustainability in Serbia, that are relevant to policy makers nowadays. Some of these could be analysed further in future research. While Serbia achieved legislative progress on the path to sustainability in recent years, the country's debate on sustainability is much older, but the 1990s discourse on sustainable development is often overlooked. Good and bad examples of sustainability practice could be identified and used for future research and project planning.

CONCLUSION

The history of environmental policies is highly relevant for climate change mitigation and attempts at a green transition. These histories can help societies avoid repeating past mistakes and learn from positive examples of environmental policy. Similarly, the history of the concept of sustainable development in Serbia, helps us understand the challenges its implementation faces today. During the 1990s and early 2000s, some Serbian scientists and politicians advocated sustainability. Legislation, participation in international sustainability treaties and debates and local initiatives developed, but pressing financial issues such as unemployment and economic transition were primary concerns and larger actions towards sustainability were postponed. Dealing with the effects of the 2008 financial crisis was a significant challenge for Serbia's sustainable development (Đukić, 2010). Over the last six to ten years, Serbia's legal and institutional framework for sustainability developed significantly. However, the implementation of this legislation and the 2030 Agenda still faces several difficulties.

KEYWORDS

Sustainable development, sustainability, economic growth, environmental protection, development plans

REFERENCES

1. Blewitt, J. (2008). *Understanding Sustainable Development*. Earthscan.
2. Carter, N. (2007). *Politics of the Environment: Ideas, Activism, Policy*. Cambridge University Press.
3. Državna revizorska institucija. (2023). *Izveštaj o reviziji svrsishodnosti poslovanja. Ciljevi održivog razvoja: Spremnost Republike Srbije za implementaciju Agende 2030. Državna revizorska institucija.*
4. Đukanović, M. (1996). *Životna sredina i održivi razvoj*. ELIT.
5. Đukić, P. (2010). Ekonomska dimenzija ekološke racionalnosti: koncept održivog razvoja Srbije. *Ekološki izazovi Srbije. Radovi sa okruglog stola održanog na Paliću,* ur. Dušan Torbica. Otvoreni univerzitet Subotica.
6. Holden, E. et all. (2018). *The Imperatives of Sustainable Development. Needs, Justice, Limits*. Routledge.
7. Nacionalna strategija održivog razvoja. *Službeni glasnik Republike Srbije*, br. 57/2008.
8. Vučić, V. (2022). Srbija 2030: Agenda održivog razvoja-izazovi i ograničenja. *Horizonti menadžmenta I (1)*, 53–75.

DO EUROPEAN REGIONS CONVERGE IN CARBON INTENSITY? THE ROLE OF CLIMATE-DRIVEN ENERGY DEMAND

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INTRODUCTION

The transition to a climate-neutral economy requires European regions to improve the carbon efficiency of their energy systems while adapting to heterogeneous climatic conditions. Carbon intensity reflects the emissions generated per unit of economic output and provides a useful indicator of energy system decarbonization. This study examines whether European NUTS-2 regions converge in carbon intensity and whether climate-driven energy demand influences the convergence process.

LITERATURE REVIEW / THEORETICAL BACKGROUND

Convergence in carbon emissions, energy intensity and environmental performance has been examined mainly at the national level (El-Montasser et al., 2015; Payne & Apergis, 2021; Dogah & Churchill, 2022; Bera & Syed, 2025; Kongkuah & Alessa, 2025). Recent studies emphasize regional decarbonization (Ju et al., 2025; Vagnini et al., 2025). However, regional carbon intensity convergence remains largely unexplored, particularly regarding climate exposure and spatial spillovers.

METHODOLOGY

The analysis uses a panel of 200 European NUTS-2 regions over 2000–2024. Carbon intensity is measured as greenhouse gas emissions relative to economic output. Conditional β-convergence is estimated using two-way fixed effects with

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Driscoll–Kraay standard errors, controlling for labor market conditions, industrial structure and climate-driven energy demand, captured by Heating and Cooling Degree Days (CLR). Spatial dependence is examined using Moran's I and spatial panel models (SEM/SDM).

RESULTS

The results indicate significant conditional convergence in regional carbon intensity (β = -0.123), with an estimated half-life of approximately 5.3 years. Climate-driven energy demand, labor market conditions and industrial structure significantly influence the convergence process. Regions with higher initial carbon intensity exhibit slower convergence than low-carbon regions. Spatial analysis reveals significant spatial dependence while supporting the main convergence findings.

DISCUSSION / POLICY IMPLICATIONS

The results underline the importance of adapting energy transition policies to regional conditions. Targeted investments in clean energy, industrial decarbonization and energy efficiency should prioritize carbon-intensive regions, while coordinated regional policies can exploit spatial spillovers and support a more balanced transition across Europe. Climate-driven energy demand should also be considered when designing regional decarbonization strategies.

CONCLUSION

This study provides new evidence of conditional convergence in carbon intensity across European NUTS-2 regions while accounting for climate-driven energy demand and spatial dependence. The findings highlight the importance of regional heterogeneity in the energy transition and demonstrate that integrating convergence and spatial analysis can provide valuable insights for designing more effective decarbonization policies.

KEYWORDS

Carbon intensity, decarbonization, conditional β-convergence, energy transition, spatial dependence

REFERENCES

1. Bera, S., & Syed, Q. R. (2025). Drivers of residential energy intensity convergence: A dynamic panel data analysis. Energy, 316, 134384.

2. Dogah, K. E., & Churchill, S. A. (2022). Carbon emissions convergence and determinant analysis: evidence from ASEAN countries. Journal of Environmental Management, 323, 116299.
3. El-Montasser, G., Inglesi-Lotz, R., & Gupta, R. (2015). Convergence of greenhouse gas emissions among G7 countries. Applied Economics, 47(60), 6543-6552.
4. Ju, B., Chen, Z., Geng, Y., Xing, P., Han, L., Wang, L., & Wei, W. (2025). Mapping regional disparities in the global shift toward decarbonized power systems. Carbon Neutrality, 4(1), 1-14.
5. Kongkuah, M., & Alessa, N. (2025). Renewable energy and carbon intensity: Global evidence from 184 countries (2000–2020). Energies, 18(13), 3236.
6. Payne, J. E., & Apergis, N. (2021). Convergence of per capita carbon dioxide emissions among developing countries: evidence from stochastic and club convergence tests. Environmental Science and Pollution Research, 28(26), 33751-33763.
7. Vagnini, C., Canal Vieira, L., Longo, M., & Mura, M. (2025). Regional drivers of industrial decarbonisation: a spatial econometric analysis of 238 EU regions between 2008 and 2020. Regional Studies, 59(1), 2380369.

TRANSPORTATION SECTOR TRANSFORMATION AND ROMANIA'S ENERGY SOVEREIGNTY IN THE CONTEXT OF A JUST ENERGY TRANSITION

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INTRODUCTION

Transport transformation constitutes a strategic dimension of the energy transition, linking decarbonisation with technological innovation, energy security, and long-term resilience. Although existing research extensively addresses transport emissions, electrification, and renewable-energy deployment, the role of transportation in strengthening national energy sovereignty remains insufficiently integrated into the Romanian context. This study addresses this gap by conceptualising transport not only as a sector subject to decarbonisation, but also as a strategic mechanism for reducing external energy dependence and reinforcing energy autonomy. It develops an integrated framework connecting transport electrification, renewable-energy integration, sustainable fuels, digital infrastructure, and coordinated policy interventions with Romania's energy resilience. Accordingly, the analysis extends the conventional decarbonisation perspective toward the broader nexus of transport transformation, just transition, and energy sovereignty.

LITERATURE REVIEW / THEORETICAL BACKGROUND

Transport decarbonisation has become integral to the EU climate-neutrality agenda, increasingly linking emission mitigation with energy security and sovereignty. Reducing fossil-fuel dependence while expanding domestic renewable-energy use can reinforce strategic energy autonomy (Wetzel et al., 2023). Electrification, renewable fuels, and integrated energy systems are therefore critical to resilient low-carbon mobility (Tian et al., 2023). Technological innovation and policy coordination further condition this transition: electrification and efficiency can reduce transport energy demand and emissions (Krause et al., 2020), while AI-based forecasting may improve energy-demand planning (Lei et

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al., 2025). For Romania, renewable-energy potential provides a basis for strengthening energy resilience (Mănescu & Tous, 2025), although institutional fragmentation and governance constraints may hinder an effective just transition (Volintiru & Nicola, 2024).

METHODOLOGY

Existing studies address technological, environmental, and energy-security dimensions separately, providing limited insight into their systemic interdependencies within a just transition framework. This study addresses this gap by conceptualising transport transformation as a multidimensional determinant of energy sovereignty, integrating electrification, renewable-energy deployment, infrastructure modernisation, technological innovation, and governance capacity. Applied to Romania, the framework examines how these interconnected dimensions may reduce external energy dependence, reinforce strategic resilience, and facilitate a socially balanced transition. The study thereby reframes transport from a decarbonisation challenge into a strategic component of resilient energy-system transformation.

RESULTS

This study employs a qualitative policy-oriented analytical framework integrating recent scientific evidence with European and Romanian strategic policy documents. Rather than providing a descriptive overview of transport decarbonisation, the analysis investigates the interdependencies between transport sector transformation and national energy sovereignty. The assessment focuses on six strategic dimensions: transport electrification, renewable energy integration, sustainable fuels, infrastructure modernisation, technological innovation, and governance capacity. These dimensions are analysed from the perspective of their combined contribution to reducing fossil fuel dependence and enhancing long-term energy resilience in Romania.

DISCUSSION / POLICY IMPLICATIONS

The findings suggest that transport policy should be considered an integral component of Romania's long-term energy security strategy rather than an isolated environmental policy domain. Achieving this objective requires coordinated investments in renewable electricity generation, electric mobility infrastructure, alternative fuels, and digital transport technologies. Equally important are institutional reforms capable of improving policy coherence across the energy, transport, and industrial sectors. By integrating these policy

dimensions, Romania could simultaneously accelerate decarbonisation, reduce external energy dependence, enhance industrial competitiveness, and strengthen strategic resilience against future geopolitical and energy market disruptions.

CONCLUSION

The transport sector development in Romania is an important component of the country's transition to a secure, competitive and sustainable energy system. The analysis indicates that the effectiveness of transport transformation depends on the simultaneous development of renewable energy capacity, intelligent infrastructure, and coherent governance mechanisms capable of reducing dependence on imported fossil fuels while enhancing the resilience of the national energy system. From a policy perspective, the analysis highlights the need for a coherent governance framework that integrates transport, energy, and industrial policies to maximize the benefits of the transition. Accelerating transport electrification, expanding renewable energy infrastructure, investing in intelligent mobility systems, and strengthening institutional coordination should therefore be considered complementary priorities for enhancing Romania's long-term energy sovereignty.

KEYWORDS

Energy sovereignty, transportation sector, just energy transition, sustainable mobility, renewable energy, transport electrification

REFERENCES

1. Krause, J., Thiel, C., Tsokolis, D., Samaras, Z., Rota, C., Ward, A., ... & Verhoeve, W. (2020). EU road vehicle energy consumption and CO2 emissions by 2050–Expert-based scenarios. *Energy Policy*, 138, 111224.
2. Lei, H., Guo, Y., & Khan, N. (2025). Forecasting energy use and efficiency in transportation: Predictive scenarios from ANN models. *International Journal of Hydrogen Energy*, 106, 1373-1384.
3. Mănescu, A. M., & Tous, V. B. (2025). Energy Security and Green Transition in Times of Economic Turmoil: Comparative Insights from Romania and Spain. *Romanian Economic Journal*, 28(91).
4. Tian, X., An, C., & Chen, Z. (2023). The role of clean energy in achieving decarbonization of electricity generation, transportation, and heating sectors by 2050: A meta-analysis review. *Renewable and Sustainable Energy Reviews*, 182, 113404.
5. Volintiru, C., & Nicola, S. (2024). Limitations of coordinative europeanisation in the just transition mechanism in Romania. *Competition & Change*, 28(3-4), 474-493.

6. Wetzel, M., Gils, H. C., & Bertsch, V. (2023). Green energy carriers and energy sovereignty in a climate neutral European energy system. *Renewable Energy*, 210, 591-603.

PATH EXTENSION OR SPATIAL RECONFIGURATION? DIVERGENT ADAPTATION STRATEGIES TO THE EV TRANSITION: EVIDENCE FROM HUNGARY AND POLAND

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INTRODUCTION

The transition towards electric mobility is reshaping global automotive value chains, production geographies and industrial policies. Central and Eastern European (CEE) economies face the challenge of preserving their positions within European automotive production while adapting to changing technologies. This paper compares Hungary and Poland to explain why two integrated peripheral automotive economies have followed markedly different adaptation paths during the transition to electromobility.

LITERATURE REVIEW / THEORETICAL BACKGROUND

We combine global value chains (GVCs), path dependence, industrial upgrading and FDI theories. Existing research explains the growing role of batteries and Asian investors in the restructuring of automotive GVCs but pays less attention to the spatial strategies of country-level adaptations. We argue that EV-related FDI follows different adaptation logics depending on inherited industrial structures, state strategies and domestic capabilities, producing distinct developmental outcomes.

METHODOLOGY

The paper adopts a comparative qualitative case-study approach. It combines investment data, company-level information, spatial mapping of EV-related investments and expert interviews (14 in Poland and 20 in Hungary with firms, experts and policymakers). The comparison focuses on investor nationality, spatial

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distribution, industrial policy, domestic supplier integration and value-chain positioning.

RESULTS

The comparison identifies two adaptation pathways. Poland follows path extension, concentrating EV investments in existing automotive regions and building on established supplier networks. Hungary pursues spatial reconfiguration, attracting Asian battery producers to new industrial hubs. While Hungary expanded capacity more rapidly, Poland shows stronger domestic embeddedness. Both models involve trade-offs between competitiveness, upgrading and dependency.

DISCUSSION / POLICY IMPLICATIONS

Successful integration into emerging EV value chains does not automatically lead to industrial upgrading. While Poland's model favours stronger embeddedness and incremental upgrading, Hungary's strategy enables rapid capacity expansion but increases external dependence and structural vulnerabilities. The comparison suggests that green industrial policies should complement FDI attraction with measures supporting domestic supplier development, innovation capabilities and regional resilience.

CONCLUSION

Integrated peripheral economies can follow different spatial adaptation pathways during technological transitions. Rather than treating EV-related FDI as a homogeneous phenomenon, it distinguishes between path extension and spatial reconfiguration as alternative development strategies. The comparison highlights that long-term competitiveness depends less on the volume of attracted FDI than on the extent to which FDI becomes embedded in domestic innovation systems and regional economies.

KEYWORDS

Electric vehicles, foreign direct investment, global value chains, industrial policy, Central and Eastern Europe

REFERENCES

1. Coe, N. M., Kelly, P. F., & Yeung, H. W. C. (2020). Networks: How is the world's economy interconnected? In Economic geography: A contemporary introduction (3rd ed., pp. 102–134). Wiley-Blackwell.
2. Dunning, J. H. (1988). The eclectic paradigm of international production: A restatement and some possible extensions. *Journal of International Business Studies*, 19(1), 1–31. https://doi.org/10.1057/palgrave.jibs.8490372
3. Dunning, J. H., & Lundan, S. M. (2008). Multinational enterprises and the global economy (2nd ed.). Edward Elgar.
4. Garcia, M., Paz, M. J., & Rísquez, M. (2024). Analysis of the transition to electric vehicles in Europe from a core-periphery approach. *Structural Change and Economic Dynamics*, 69, 652–663. https://doi.org/10.1016/j.strueco.2024.03.010
5. Humphrey, J. & Schmitz, H. (2004). "Chain governance and upgrading: taking stock," Chapters, in: Hubert Schmitz (ed.), Local Enterprises in the Global Economy, chapter 13, Edward Elgar Publishing.
6. Ledebur, K., Bartuska, L., Friesenbichler, K., & Klimek, P. (2026). Predicting the emergence of the EV industry: A product space analysis across regions and firms. *Journal of Cleaner Production*, 538, 147348.
7. Pavlínek, P. (2023). Transition of the automotive industry towards electric vehicle production in the East European integrated periphery. *Empirica*, 50(1), 35–73. https://doi.org/10.1007/s10663-022-09554-9
8. Szabó, J., Deák, A., Szalavetz, A., & Túry, G. (2023). The Hungarian automobile industry: Towards an understanding of the transition to electromobility. In: Galgóczi, B. (ed) On the way to electromobility – a green(er) but more unequal future? ETUI aisbl, Brussels. pp. 241-264.
9. Szalavetz, A., & Sass, M. (2023). Disentangling the semi-periphery: evolutionary trajectories and perspectives of the Austrian and Hungarian automotive industries. *Post-Communist Economies*, 35(3), 211–235. https://doi.org/10.1080/14631377.2023.2171179

ENVIRONMENTAL EFFICIENCY ASSESSMENT OF SERBIAN NON-METALLIC INDUSTRY - A DEA BASED APPROACH

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INTRODUCTION

This study aims to evaluate the environmental efficiency of ceramic, brick, tile, and cement manufacturing enterprises listed in the Pollutant Release and Transfer Register (PRTR) in Serbia between 2014 and 2020 by employing Data Envelopment Analysis (DEA). We focus on the non-metallic mineral products industry, given its relatively high emission levels and energy intensity. In this context, environmental efficiency requires manufacturing enterprises to maximise desirable outputs while minimising undesirable inputs that contribute to environmental degradation.

LITERATURE REVIEW / THEORETICAL BACKGROUND

DEA-based assessments of environmental efficiency span diverse industries and regions, ranging from early studies on the cement industry of worldwide countries (Oggioni et al., 2011; Riccardi et al., 2012; Muhammad et al., 2018; Dirik et al., 2019) to recent, large-scale applications (Debbarma et al., 2025; Issa et al., 2025; Aprilinda and Kusumawardani, 2026; Hossain et al., 2026). DEA-applied studies often incorporate emissions as undesirable input or output variables to measure their impact on the efficiency of enterprises or national economies. To the best of our knowledge, our study is among the first to apply DEA to assess the environmental efficiency of the non-metallic mineral products industry in Serbia, a highly relevant sector due to its significant energy intensity and emission levels.

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METHODOLOGY

The DEA model, originally developed by Charnes et al. (1978), is applied in this study to evaluate the environmental efficiency scores of the sampled Serbian enterprises as decision-making units (DMUs). The DEA model specifies total air emissions, material costs, and energy and fuel costs as inputs, while total revenue serves as the single output. Revenue and material, electricity and fuel cost data are obtained from the Serbian Business Registers Agency, and air emissions data from the Serbian Environmental Protection Agency (PRTR register). An input-oriented DEA model under variable returns to scale (VRS) is applied, as enterprises generally have greater control over the utilisation of inputs than over the level of outputs. The VRS assumption accounts for differences in the scale of operations across enterprises and provides estimates of pure technical efficiency.

RESULTS

The results indicate that, during the observed period, enterprises in the cement industry achieved the highest efficiency (annual average 0.8774), followed by the ceramics industry (0.8733) and the brick and tiles industry (0.5953). Efficiency scores range from 0 to 1, with a score of 1 indicating optimal efficiency. The efficiency of cement enterprises and ceramic manufacturers was relatively stable over the analyzed period, while brick and tiles manufacturers noticed significant changes in annual efficiency scores. The observed differences across industries may reflect variations in production technologies, resource utilisation, and environmental management practices. The relatively high and stable efficiency of cement and ceramics enterprises suggests more consistent resource management and production processes, whereas the greater variability observed in the brick and tile industry may indicate differences in operational practices, technological capabilities, or adaptation to changing market and environmental conditions.

DISCUSSION / POLICY IMPLICATIONS

DEA efficiency analysis can help policymakers align environmental regulation with EU standards and encourage managers in emission and resource-intensive industries to improve environmental efficiency. As the results reveal considerable differences in environmental efficiency across the analyzed industries, policy measures should be tailored to industry-specific needs. In particular, enterprises in the brick and tiles industry, which exhibited the lowest average efficiency, should be encouraged to adopt alternative raw materials, invest in energy-efficient technologies, and implement more effective resource management practices. Meanwhile, the relatively high and stable efficiency achieved by

enterprises in the cement and ceramics industries suggests that their practices could serve as benchmarks for less efficient industries. By promoting targeted environmental policies and disseminating of best practices, enterprises can improve both their environmental and economic performance while strengthening their long-term competitiveness and reputation.

CONCLUSION

The research results indicate that cement manufacturers achieved the highest efficiency, whereas brick and tile enterprises were the least efficient, presenting opportunities for additional emission reductions and cost savings through improved resource use. Performance measurement and benchmarking enhance informed decision-making and drive sustainable growth. Future research could expand the analysis to include additional industrial sectors in Serbia or conduct a comparative study of these industries across Western Balkan countries.

KEYWORDS

Environmental efficiency, DEA approach, Serbian manufacturing enterprises, non-metallic mineral products industry

REFERENCES

1. Aprilinda, K. A., & Kusumawardani, D. (2026). Energy Efficiency in the Ceramic and Clay Building Materials Industry in Indonesia. *Journal of Mathematics Instruction, Social Research and Opinion*, *5*(1), 863-878.
2. Charnes, A., Cooper, W. W., & Rhodes, E. (1978). Measuring the efficiency of decision-making units. *European journal of operational research*, *2*(6), 429-444.
3. Debbarma, J., Kumar, V., & Ekundayo, D. (2025). Measuring carbon emission efficiency in a developing country: a comparative study of sustainability initiatives and nonsustainability initiatives of manufacturing firms. *Business Strategy and the Environment*, *34*(8), 9672-9699.
4. Dirik, C., Şahin, S., & Engin, P. (2019). Environmental efficiency evaluation of Turkish cement industry: an application of data envelopment analysis. *Energy Efficiency*, *12*(8), 2079-2098.
5. Hossain, M. A., Hassan, S. R., Islam, M., & Imam, M. F. (2026). Impact of organizational practices on environmental efficiency: a two-stage data envelopment analysis approach. *Discover Environment*, *4*(1), 157.
6. Issa, B., Ben Abdallah, S., & Gabsi, F. B. (2025). Relationship Between Socio-Efficiency, Eco-Efficiency, and Financial Performance of European Companies: A Sector Study. *Journal of Risk and Financial Management*, *18*(4), 171.

7. Lahouel, B. B. (2016). Eco-efficiency analysis of French firms: a data envelopment analysis approach. *Environmental Economics and Policy Studies*, *18*(3), 395-416.
8. Mirmozaffari, M. (2019). Eco-efficiency evaluation in two-stage network structure: case study: cement companies. *Iranian Journal of Optimization*. In press. (hal-02277847), https://hal.science/hal-02277847/.
9. Muhammad, A., Rao, T., & Farooq, Q. (2018). DEA Window Analysis with slack-based measure of Efficiency in Indian Cement Industry. *Statistics, Optimization & Information Computing*, *6*(2), 292-302.
10. Nagy, O. T., Darabos, É., Mártha, B. B., & Kiss, A. (2025). Performance analysis of Hungarian food industry enterprises using the DEA method. *Analele Universităţii Din Oradea*, 263. https://doi.org/10.47535/1991auoes34(1)021.
11. Oggioni, G., Riccardi, R., & Toninelli, R. (2011). The cement industry: Eco-eciency country comparison using data envelopment analysis. *Journal of Statistics and Management Systems*, *14*(6), 1067-1102.
12. Riccardi, R., Oggioni, G., & Toninelli, R. (2012). Efficiency analysis of world cement industry in presence of undesirable output: application of data envelopment analysis and directional distance function. *Energy Policy*, *44*, 140-152.
13. SBRA - Serbian Business Registers Agency, The Financial Statements Register, available on: https://fin.apr.gov.rs/JavnaPretraga
14. SEPA - Serbian Environmental Protection Agency, Pollutant Release and Transfer Register, available on: https://sepa.gov.rs/emisije-u-vazduh/.
15. Tu, H., Dai, W., & Xiao, X. (2022). Study on the environmental efficiency of the Chinese cement industry based on the undesirable output DEA model. *Energies*, *15*(9), 3396.

RESEARCH OF POTENTIAL USE OF PATENT DOCUMENTATION FOR NEARLY ZERO ENERGY HOMES

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INTRODUCTION

The global housing sector accounts for approximately 36% of total energy consumption and nearly 40% of CO_2 emissions, making the transition to nearly zero energy buildings (NZEBs) a critical sustainability priority. Despite advances in green building technologies, widespread adoption are constrained by high R&D costs and limited access to proven solutions. With over 150 million publicly accessible patent documents, a vast repository of validated technical knowledge remains largely underutilized in sustainable construction. This work project addresses this gap by proposing a systematic methodology for identifying, extracting, adapting, and integrating freely accessible patent documentation into scalable NZEB models. The methodology leverages artificial intelligence (AI)-including natural language processing (NLP), machine learning classification, and semantic search- to automate large-scale patent screening and technology matching, significantly reducing the time and expertise required to build a comprehensive NZEB solutions database.

LITERATURE REVIEW / THEORETICAL BACKGROUND

Existing literature confirms the critical role of NZEBs in achieving climate targets (IEA, 2023) while highlighting persistent barriers: high innovation costs, fragmented technology transfer, and limited knowledge exchange between patent holders and the construction sector. Studies on patent-driven innovation (Chesbrough, 2003; WIPO, 2022) show that systematic patent analysis can significantly accelerate technology adoption. Research on building energy

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performance (Attia et al., 2020) identifies passive design, renewable energy integration, and smart systems as key NZEB enablers, reflected in the patent literature through envelope, renewable-energy, and building-automation patent classes respectively. Recent advances in AI-driven patent analytics, including NLP-based classification (Krestel et al., 2021), deep learning-based forecasting (Zhou et al., 2020), and language models for semantic search, demonstrate potential to transform manual patent review into scalable, automated processes. This research builds on these findings to establish a replicable, AI-enhanced patent-to-building knowledge transfer framework.

METHODOLOGY

This work develops a four-phase, patent-driven innovation methodology. Phase 1: AI-Assisted Patent Mapping and Screening- systematic identification of transferable technologies using keyword-based, bibliographic, abstract-based, and IPC queries across Espacenet, PATENTSCOPE, and national databases, augmented by NLP-driven semantic clustering and machine-learning classifiers to automatically categorize patents by NZEB technology domain (insulation, HVAC, renewables, smart systems) and filter legally free patents (expired, without a granted decision, or with unpaid maintenance fees in Serbia). Phase 2: AI-Enhanced Technology Adaptation- feasibility assessment and optimization of selected patents for housing applications, supported by AI-based similarity matching to identify complementary patent families and predictive modelling to estimate integration costs and energy performance gains. Phase 3: System Integration- embedding solutions into modular NZEB prototypes. Phase 4: Validation- simulation-based energy performance testing and scalability assessment. The interdisciplinary research methodology combines architecture, engineering, and IPR management.

RESULTS

As this paper presents the methodology and expected (anticipated) results of an ongoing research project rather than finalized empirical findings, the outcomes outlined below should be interpreted as projected outputs to be validated through subsequent implementation and testing phases. Expected results include: (1) a comprehensive, open-access, AI-structured database of patent-derived solutions for energy-efficient housing, categorized by technology type using automated NLP classification and featuring semantic search, recommendation, and technology-gap analysis capabilities; (2) adapted and optimized technology integration models for modular NZEB prototypes, advancing from TRL 3–4 to TRL

7–8; (3) pilot housing unit simulations demonstrating estimated 40–60% reductions in annual energy consumption, based on preliminary modelling scenarios; (4) projected CO_2 reductions of approximately 3–5 tons per household per year, subject to validation through pilot testing; and (5) a replicable methodology for patent-driven innovation in sustainable construction, applicable beyond the project's scope and supporting the development of new patentable solutions globally.

DISCUSSION / POLICY IMPLICATIONS

Patent documentation is expected to serve as a valuable innovation resource for sustainable architecture, offering a potentially low-cost, legally robust pathway to accelerate NZEB development; the extent of this contribution, however, remains to be confirmed through the project's pilot and validation phases. Rather than yielding conclusive normative guidance at this stage, project findings are anticipated to inform building regulations and energy-efficiency standards, supporting alignment with the European Green Deal and UN SDG 11 (Sustainable Cities and Communities). On this basis, several policy implications can be tentatively outlined, pending empirical validation: integrating AI-assisted patent analysis into national building-innovation strategies, promoting open AI tools for knowledge transfer in sustainable construction, and creating incentive frameworks for developers adopting patent-derived solutions. Potential barriers- regulatory heterogeneity, market adoption inertia, and scaling constraints- are anticipated to be addressed through proactive stakeholder engagement, pilot demonstrations, and an adaptive project management structure, though the effectiveness of these mitigation strategies will itself require empirical assessment during project implementation.

CONCLUSION

This project presents a novel, replicable methodology for sustainable housing innovation by converting publicly available patent documentation into practical building solutions. The project's structured methodology, interdisciplinary consortium, and clear TRL progression from analysis to market-ready prototype position it as a high-impact contribution to sustainable construction. By bridging the gap between patent knowledge and building practice through AI-driven analytics and automated knowledge extraction, patent documentation accelerates the transition to nearly zero energy housing in a cost-effective, legally accessible, and globally scalable way, with direct relevance for researchers, practitioners, policymakers, and communities.

KEYWORDS

Nearly zero energy buildings, patent documentation, sustainable housing, energy efficiency, artificial intelligence

REFERENCES

1. Attia, S., Eleftheriou, P., Xeni, F., Morlot, R., Ménézo, C., Kostopoulos, V., & Maier, M. (2020). Overview and future challenges of nearly zero energy buildings (nZEB) design in Southern Europe. *Energy and Buildings*, 155, 439–458.
2. Chesbrough, H. W. (2003). Open Innovation: The New Imperative for Creating and Profiting from Technology. Harvard Business School Press.
3. European Commission. (2022). Horizon Europe Programme Guide. European Commission.
4. European Patent Office. (2023). Espacenet Patent Search. https://worldwide.espacenet.com
5. International Energy Agency. (2023). Buildings. IEA. https://www.iea.org/energy-system/buildings
6. Krestel, R., Chikkamath, R., Hewel, C., & Risch, J. (2021). A survey on deep learning for patent analysis. *World Patent Information*, 65, 102035.
7. Republika Srbija. (2011). Zakon o patentima. Sl. glasnik RS, br. 99/2011.
8. United Nations. (2015). Transforming our world: The 2030 Agenda for Sustainable Development. UN General Assembly.
9. World Intellectual Property Organization. (2022). World Intellectual Property Indicators 2022. WIPO.
10. World Intellectual Property Organization. (2023). PATENTSCOPE. https://patentscope.wipo.int
11. Zhou, Y., Dong, F., Liu, Y., Li, Z., Du, J., & Zhang, L. (2020). Forecasting emerging technologies using data augmentation and deep learning. *Scientometrics*, 123(1), 1–29.

THE SOVEREIGN GREENIUM IN CENTRAL AND EASTERN EUROPE

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INTRODUCTION

Sovereign green bonds have emerged as an important instrument for financing climate and sustainability objectives. While a growing literature examines green bond pricing in corporate markets, evidence regarding sovereign issuers remains limited, particularly in emerging European economies. This study investigates whether sovereign green bond issuance reduces long-term government borrowing costs in Central and Eastern Europe (CEE) and whether such effects persist over time.

LITERATURE REVIEW / THEORETICAL BACKGROUND

The concept of a greenium suggests that investors may accept lower yields on environ-mentally sustainable securities due to sustainability preferences and growing ESG mandates. Existing studies report mixed evidence regarding sovereign green bond pricing, with outcomes varying across institutional settings and market structures. The present study contributes to this literature by providing causal evidence from CEE sovereign debt markets, where empirical research remains scarce. To the best of our knowledge, this is among the first studies to examine the sovereign greenium in a multi-country CEE setting using modern staggered Difference-in-Differences estimators.

METHODOLOGY

The analysis uses a balanced monthly panel of twelve CEE countries covering January 2018 to December 2025 (N = 12, T = 96). Four countries issued sovereign green bonds during the sample period (Poland, Hungary, Serbia and Romania), while eight countries serve as a control group. To strengthen causal identification,

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propensity-score diagnostics are combined with a staggered Difference-in-Differences framework. Dynamic treatment effects are estimated using the interaction-weighted event-study approaches proposed by Sun and Abraham (2021) and Callaway and Sant'Anna (2021).

RESULTS

The results indicate that sovereign green bond issuance is associated with a statistically and economically significant reduction in benchmark 10-year government bond yields. Across specifications, the estimated average treatment effect corresponds to a decline of approximately 55 basis points in long-term borrowing costs. Dynamic event-study estimates reveal no systematic pre-treatment effects and suggest that the yield-compression effect emerges gradually after issuance. The strongest effects are observed approximately one year following market entry.

DISCUSSION / POLICY IMPLICATIONS

The findings suggest that sovereign green bonds may provide measurable financing benefits for governments pursuing green-transition objectives. Lower borrowing costs can facilitate climate-related public investment while supporting the development of sustainable capital markets. The results are particularly relevant for emerging European economies seeking cost-effective financing mechanisms for environmental and energy-transition projects.

CONCLUSION

This study provides evidence of a sovereign greenium in Central and Eastern Europe. Using a quasi-experimental framework, the analysis shows that sovereign green bond issuance is associated with lower long-term government bond yields. The findings contribute to the growing sustainable finance literature and suggest that sovereign green bonds may represent a viable policy instrument for financing climate-transition objectives at lower borrowing costs.

KEYWORDS

Sovereign green bonds, greenium, sustainable finance, difference-in-differences, Central and Eastern Europe

REFERENCES

1. Callaway, B., & Sant'Anna, P. H. C. (2021). Difference-in-differences with multiple time periods. *Journal of Econometrics*, 225(2), 200–230.
2. Dell'Atti, S., Di Tommaso, C., & Pacelli, V. (2022). Sovereign green bond and coun-try value and risk: Evidence from European Union countries. *Journal of International Financial Management & Accounting*, 33(3), 505–521.
3. Lewandowski, W., & Smoleńska, A. (2023). Member states sovereign green bond issuance and the development of local green bond markets in the EU. In: *Greening the Bond Market: A European Perspective* (pp. 51–77). Springer.
4. Sun, L., & Abraham, S. (2021). Estimating dynamic treatment effects in event studies with heterogeneous treatment effects. *Journal of Econometrics*, 225(2), 175–199.
5. Yadav, A., Manda, V. K., Sangwan, V., & Vambol, S. (2024). Sovereign green bonds as an unconventional tool to address climate change. *Ecological Questions*, 35(3), 1–26.
6. Zerbib, O. D. (2019). The effect of pro-environmental preferences on bond prices: Evidence from green bonds. *Journal of Banking & Finance*, 98, 39–60.

THE ROLE OF FINTECH IN DEMOCRATIZING SUSTAINABLE INVESTMENT IN EMERGING ECONOMIES

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INTRODUCTION

Sustainable investment (SI) has grown rapidly but unevenly, with emerging economies attracting less than 15% of flows due to barriers like lack of transparency and weak regulation (Narayan et al., 2025; Gutsche & Zwergel, 2020; Hafner, James, & Jones, 2019; Paetzold & Busch, 2014). While FinTech is seen as a facilitator, how it democratises sustainable investment is less understood. This study proposes a framework for how FinTech expands access in emerging economies.

LITERATURE REVIEW / THEORETICAL BACKGROUND

The intersection of Fintech and SI has gained attention, mainly focusing on Fintech and firm-level sustainability outcomes. The impact of Fintech on investor SI adoption and its mechanisms remains underexplored. The following gap still remains unanswered in Fintech and SI literature:

1. How FinTech reduce barriers to sustainable investment in emerging economies?
2. What are the mechanisms behind FinTech democratising sustainable finance?
3. What are the factors strengthening or weakening this democratization process?

METHODOLOGY

To address the research gap, the study conducts a systematic literature review. Using keywords, 945 studies were retrieved from SCOPUS and Web of Science.

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After applying inclusion and exclusion criteria, 48 studies were selected. These were analysed with Theoretical Concept Synthesis (TCS), a qualitative method that integrates, refines, and develops theories by identifying recurring concepts and frameworks across studies into a cohesive framework (Okoli, 2022).

RESULTS

The literature suggests that FinTech reduces barriers to sustainable investment in emerging economies by increasing inclusion and transparency and lowering costs. Mobile banking, digital payments, crowdfunding, and P2P lending give unbanked and small investors access to green finance. Blockchain, tokenisation, and smart contracts build trust, while AI and big data enhance ESG risk assessment. Challenges like the digital divide, regulatory issues, cybersecurity, and greenwashing limit effectiveness. Strong infrastructure, regulation, and financial literacy are vital to maximize FinTech's role in democratising sustainable finance.

DISCUSSION / POLICY IMPLICATIONS

To democratise sustainable finance, regulators should align FinTech and ESG regulations, expand digital infrastructure, improve financial literacy, and strengthen cybersecurity. FinTech firms should develop inclusive products, integrate transparent ESG reporting, and collaborate with policymakers and financial institutions. (Habib, 2025; Bayram, Talay, & Feridun, 2022)

CONCLUSION

This study combines the fragmented literature review to provide a comprehensive explanation of the mechanism through which Fintech enables SI. The framework argues that FinTech-enabled innovations broaden participation in sustainable investment through interconnected mechanisms, but these effects are contingent upon institutional factors such as digital infrastructure, regulation, literacy, and trust. Future research can empirically validate the framework and examine its applicability across different institutional contexts.

KEYWORDS

Fintech, sustainable investment, emerging markets, individual investors

REFERENCES

1. Bayram, O., Talay, I., & Feridun, M. (2022). Can FinTech promote sustainable finance? Policy lessons from the case of Turkey. *Sustainability*, 14(19), 12414.

2. Gutsche, G., & Zwergel, B. (2020). Investment barriers and labeling schemes for socially responsible investments. *Schmalenbach Business Review*, 72(2), 111-157.
3. Habib, A. M. (2025). Fintech and Sustainability: Perspectives from Emerging Markets. In: *Trends and Challenges of Electronic Finance: Perspectives from Emerging Markets* (pp. 103-118). Singapore: Springer Nature Singapore.
4. Hafner, S., James, O., & Jones, A. (2019). A scoping review of barriers to investment in climate change solutions. *Sustainability*, 11(11), 3201.
5. Narayan, M., Kumar, N., Parida, V. K., & Kumari, P. (2025). Sustainable finance in emerging markets: Adaptive governance and environmental, social, and governance innovation for equitable climate resilience. Development and Sustainability in Economics and Finance, 100101.
6. Okoli, C. (2022). Developing theory from literature reviews with theoretical concept synthesis: Topical, propositional and confirmatory approaches. *Propositional and Confirmatory* Approaches (February 10, 2022).
7. Paetzold, F., & Busch, T. (2014). Unleashing the powerful few: Sustainable investing behaviour of wealthy private investors. *Organization & Environment*, 27(4), 347-367.

ESG VERSUS TRADITIONAL PORTFOLIOS: A COMPARATIVE ANALYSIS OF PERFORMANCE IN GLOBAL EQUITY MARKETS

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INTRODUCTION

Environmental, social, and governance (ESG) investing has undergone a significant transformation over the last decade, from a minor concern about ethics to a substantial financial and risk management strategy. The world's ESG assets under management are expected to rise, representing more than one-third of the total global assets under management. Such a staggering growth is a reflection of a profound change in investors' mindset about what value means, risks are, and fiduciary responsibility entails in the context of modern capital markets. Today, there is considerable debate regarding whether incorporating ESG criteria into portfolio construction enhances or reduces financial performance. The paper aims to shed light on these issues, analyse the risk level of ESG portfolios, and explore whether portfolios incorporating ESG criteria achieve significant financial performance compared to traditional investment portfolios. To explore whether the returns of ESG portfolios are higher or lower than those of traditional equity portfolios, and whether they will produce better risk-adjusted performance.

LITERATURE REVIEW / THEORETICAL BACKGROUND

The modern portfolio theory (MPT) established by Markowitz (1952) claims that investors aim to achieve the highest expected return for a given risk level. Through diversification, investors can reduce portfolio risk and achieve the best risk-return combinations on the efficient frontier. Sharpe (1964), Lintner (1965), and Mossin (1966) framed the Capital Asset Pricing Model (CAPM), which implies that any limitation on the investment universe, like those resulting from ESG screening, theoretically ought to lead to less efficient portfolios and lower returns since full diversification cannot be attained. An argument used to criticize ESG

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screening. Later expansions of portfolio theory, such as Arbitrage Pricing Theory (Ross, 1976) and Fama-French multi-factor models (1993,2015), pointed out that other risk factors (size, value, profitability, and investment intensity) guide the variation of equity returns. Proponents contend that ESG screening identifies firms with stronger governance, superior risk management, and greater long-term resilience, ultimately leading to improved risk-adjusted returns.

METHODOLOGY

The research goal is to understand and provide insights into the influence of ESG investment on sustainable finance and its significance compared to traditional portfolios, measuring the MSCI World Index and the MSCI World ESG Leaders Index. A multifaceted approach is used to examine whether the inclusion of ESG factors in building investment portfolios, compared with traditional equity portfolios, differentiates financial results. Primarily qualitative (descriptive, comparative, and analytical) methods of analysis are exploited to answer research questions. Additionally, the analysis is based on quantitative secondary financial data and performance measures (returns, volatility, Sharpe ratio, and maximum drawdown). The research uses historical price data sourced from MSCI, Yahoo Finance, and Morningstar. Ten years of index performance data collected (Jan.2014 - Dec.2023) include various market scenarios: bull markets (2014-2019), the COVID-19 crash and recovery of 2020, and the high-inflation, rising-rate environment of 2022.

RESULTS

The MSCI World ESG Leaders Index has a slightly higher average monthly return, combined with a lower monthly volatility when compared to the conventional MSCI World Index. Both series of data showed a negative skewness, which is typical for stocks. However, the ESG index shows less extreme negative and smaller excess kurtosis, indicating that the return distribution of the index is less prone to extreme events than the traditional benchmark. Annualizing risk and return performance metrics for both MSCI indices over the entire sample period clearly demonstrates that the MSCI World ESG Leaders Index is a step ahead (outperformance of 84 basis points per year) of the standard MSCI World Index during the entire sample period. At the same time, the ESG index showed a lower level of annualized volatility, leading to a considerably better Sharpe ratio. To assess how durable the differences in performance are through different market conditions, the annualized returns and Sharpe ratios are measured. The results in

all three sub-periods indicate that the ESG index consistently beats the traditional benchmark, although the size of the superior performance differs.

DISCUSSION / POLICY IMPLICATIONS

Based on the data analysis, the study confirms that the ESG portfolio slightly outperformed the traditional one in several aspects, including total return, risk-adjusted return, and the ability to manage downside risks. These outcomes are in line with most of the latest research (Friede et al., 2015; Henke, 2016). Increased volume of ESG-oriented capital flows also opens the door to a debate about the endurance of ESG performance advantages, especially when ESG stocks are fully priced at a premium, as has been hypothesized by Pastor et al. (2022). The results offer a variety of useful, direct applications for investors and portfolio managers. From the investor perspective, confirmed data that ESG integration does not consistently damage returns and can lead to even better risk-adjusted returns is an incredibly significant argument for adding ESG elements into investment mandates. Regarding portfolio managers, the findings indicate that ESG integration may be a particularly useful risk management tool.

CONCLUSION

Analysing whether incorporating ESG criteria into portfolios leads to better or worse financial results, as compared with traditional equity portfolios, the data empirically showed that ESG integration does not come at the expense of financial performance. The ESG portfolio slightly outperformed the traditional portfolio on various performance measures (total return, Sharpe ratio, and maximum drawdown) over the examined period. Results add to the accumulating evidence that ESG investing can align with financial performance goals without compromising them and, independently, offer risk management benefits, especially during market downturn periods. Generally, the research data confirm that integrating ESG considerations into portfolio building could also be a way of adding value in equity investment management, perfectly aligning with the long-term goals of responsible and sustainable finance. A limitation of the study (mainly based on the MSCI ESG rating methodology) can be overcome by evaluating and comparing the influence of different ESG data vendors and assessment frameworks on performance results.

KEYWORDS

ESG investing, portfolio performance, risk-adjusted returns, MSCI indices, equity markets

REFERENCES

1. Albuquerque, R., Koskinen, Y., Yang, S., & Zhang, C. (2020). Resiliency of environmental and social stocks: An analysis of the exogenous COVID-19 market crash. *The Review of Corporate Finance Studies*, 9(3), 593-621.
2. Berg, F., Koelbel, J. F., & Rigobon, R. (2022). Aggregate confusion: The divergence of ESG ratings. *Review of Finance*, 26(6), 1315-1344.
3. El Ghoul, S., Guedhami, O., Kwok, C. C., & Mishra, D. R. (2011). Does corporate social responsibility affect the cost of capital? *Journal of Banking & Finance*, 35(9), 2388-2406.
4. Fama, E. F., & French, K. R. (1993). Common risk factors in the returns on stocks and bonds. *Journal of Financial Economics*, 33(1), 3-56.
5. Fama, E. F., & French, K. R. (2015). A five-factor asset pricing model. *Journal of Financial Economics*, 116(1), 1-22.
6. Friede, G., Busch, T., & Bassen, A. (2015). ESG and financial performance: Aggregated evidence from more than 2000 empirical studies. *Journal of Sustainable Finance & Investment*, 5(4), 210-233.
7. Henke, H. M. (2016). The effect of social screening on bond mutual fund performance. *Journal of Banking & Finance*, 67, 69-84.
8. Lintner, J. (1965). The valuation of risk assets and the selection of risky investments in stock portfolios and capital budgets. *The Review of Economics and Statistics*, 47(1), 13-37.
9. Markowitz, H. (1952). Portfolio selection. *The Journal of Finance*, 7(1), 77-91.
10. Mossin, J. (1966). Equilibrium in a capital asset market. *Econometrica*, 34(4), 768–783. https://doi.org/10.2307/1910098
11. MSCI. (2024). MSCI World ESG Leaders Index fact sheet. Retrieved from https://www.msci.com
12. Pastor, L., Stambaugh, R. F., & Taylor, L. A. (2022). Dissecting green returns. *Journal of Financial Economics*, 146(2), 403-424.
13. Ross, S. A. (1976). The arbitrage theory of capital asset pricing. *Journal of Economic Theory*, 13(3), 341-360.
14. Sharpe, W. F. (1964). Capital asset prices: A theory of market equilibrium under conditions of risk. *The Journal of Finance*, 19(3), 425-442.

BETWEEN THE SECOND AND THE THIRD UNBUNDLING: DIGITALISATION AND GVC POSITIONING IN CESEE AND THE BALTIC STATES

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INTRODUCTION

Global value chains account for almost half of world trade (World Bank, 2020). CESEE and Baltic economies are deeply yet asymmetrically integrated: downstream positioning exceeds upstream positioning, reflecting their role as assembly platforms within "Factory Europe" (Baldwin & Lopez-Gonzalez, 2015; Stöllinger, 2021). As de-risking and nearshoring reconfigure European production networks, the paper examines how digitalisation is associated with the position these economies occupy within European production networks.

LITERATURE REVIEW / THEORETICAL BACKGROUND

The analysis builds on Baldwin's (2022) unbundling framework: after separating production from consumption and fragmenting manufacturing stages, a "third unbundling" enables trade in tasks in intermediate services. Digitalisation acts as a coordination technology lowering discovery, compliance and communication costs; by widening firms' access to foreign intermediates, it shifts economies toward later production stages (Antràs, 2020; Ha, 2024; Gopalan et al., 2022). Firm-level evidence points in the same direction. The adoption of digital technologies raises both the likelihood and the depth of participation in value chains (Añón Higón et al., 2026), and digital platforms lower the fixed costs that keep smaller firms out of supply chains (Ganne & Lundquist, 2019; Lundquist & Kang, 2021). What makes the third unbundling operative is the falling cost of trading intermediate services across borders, even though distance continues to constrain such trade more than it constrains trade in final services (Grewal, 2023).

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METHODOLOGY

A fixed-effects panel model is estimated for 13 CESEE and Baltic economies over 2010–2022. Downstream GVC positioning—an index of the production stages embodied in output, capturing proximity to final demand (Mancini et al., 2024), built on trade-in-value-added accounting whose construction and limitations are set out in Aslam et al. (2017) —is regressed on lagged linear and quadratic terms of enterprise e-commerce turnover, with controls for broadband penetration, secondary school enrolment, regulatory quality and FDI inflows. Enterprise e-commerce turnover and broadband penetration are taken from Eurostat, secondary school enrolment and FDI inflows from the World Bank's World Development Indicators, and regulatory quality from the Worldwide Governance Indicators. Standard errors are clustered by country, while one-year lags mitigate simultaneity.

RESULTS

The estimates are indicative of a U-shaped relationship between digitalisation and downstream GVC positioning: the linear e-commerce term is negative and the quadratic term positive, both statistically significant. The implied turning point lies at around one-tenth of enterprise turnover in e-commerce, broadly consistent with Ha (2024), although that study measures participation in value chains rather than position within them. Regulatory quality is negatively associated with downstreamness, while broadband, secondary school enrolment and FDI inflows show no robust short-run effects.

DISCUSSION / POLICY IMPLICATIONS

The link between digitalisation and value-chain positioning has two phases. Where e-commerce use remains low, wider adoption is associated with fewer production stages embodied in output. This is consistent with firms using digital channels to source directly and bypass intermediaries. Beyond a certain point the association becomes positive, which is what would be expected if digital tools are used to coordinate with partners rather than only to trade. The reversal occurs at around one-tenth of enterprise turnover generated through e-commerce. Four qualifications apply. First, the threshold is estimated for economies rather than for firms. It marks the level at which digital use becomes widespread enough to shift the country indicator, and it is not a benchmark for any individual firm. Second, the index measures position in the chain, not value captured. Whether a shift constitutes upgrading depends on which activities accompany it (Stöllinger, 2021). Third, broadband shows no robust effect, but this is not evidence that

connectivity is unimportant. Penetration is close to saturation across the sample, leaving little variation from which an effect could be identified. Fourth, the negative sign on regulatory quality is more plausibly a composition effect than a cost of regulation, since the better-regulated economies in the sample are also those specialised in earlier production stages. The findings also permit a cautious reading at the firm level, though the model is estimated on country averages. Weak returns during the early stage of adoption are consistent with the estimated pattern and need not indicate failure. The positive association emerges where digital tools are applied jointly with suppliers and buyers, not only to sales. For policy, the operative margin over this horizon appears to be the intensity of enterprise use rather than access alone. Evaluation horizons should be set accordingly, since programmes assessed too early are observed in the phase where the association remains negative.

CONCLUSION

The evidence points to a non-monotonic association between digitalisation and GVC positioning, initially negative and turning positive beyond the estimated threshold. To our knowledge, this is among the first assessments of the digitalisation–GVC nexus for the CESEE and Baltic economies. The results identify the intensity of enterprise digital use rather than access as the relevant margin over this horizon: the shift from digital access to digital capability appears to accompany changes in the region's position within European production networks.

KEYWORDS

Global value chains, digitalisation, downstream positioning, third unbundling, CESEE and Baltics

REFERENCES

1. Añón Higón, D., Máñez, J. A., Sanchis, A., & Sanchis, J. A. (2026). Digitalisation and global value chain participation: Evidence from Spanish manufacturing firms. *Industry and Innovation*, 33(1), 34-69. https://doi.org/10.1080/13662716.2025.2484746
2. Antràs, P. (2020). Conceptual aspects of global value chains. *The World Bank Economic Review*, 34(3), 551–574. https://doi.org/10.1093/wber/lhaa006
3. Aslam, A., Novta, N., & Rodrigues-Bastos, F. (2017). *Calculating trade in value added* (IMF Working Paper No. 17/178). International Monetary Fund.
4. Baldwin, R. (2022). *Globotics and macroeconomics: Globalisation and automation of the service sector* [Paper presentation]. ECB Forum on Central Banking, Sintra, Portugal.

5. Baldwin, R., & Lopez-Gonzalez, J. (2015). Supply-chain trade: A portrait of global patterns and several testable hypotheses. *The World Economy*, 38(11), 1682–1721. https://doi.org/10.1111/twec.12189
6. Ganne, E., & Lundquist, K. (2019). The digital economy, GVCs and SMEs. In *Global value chain development report 2019: Technological innovation, supply chain trade, and workers in a globalized world*. World Trade Organization.
7. Gopalan, S., Reddy, K., & Sasidharan, S. (2022). Does digitalization spur global value chain participation? Firm-level evidence from emerging markets. *Information Economics and Policy*, 59, 100972. https://doi.org/10.1016/j.infoecopol.2022.100972
8. Grewal, A. K. (2023). *Does gravity matter for trade in intermediate services?* [Working paper]. Graduate Institute of International and Development Studies.
9. Ha, L. T. (2024). Impacts of digital business on global value chain participation in European countries. *AI & Society*, 39(3), 1039–1064. https://doi.org/10.1007/s00146-022-01524-w
10. Lundquist, K., & Kang, J. W. (2021). Digital platforms and global value chains. *In Global value chain development report 2021: Beyond production*. Asian Development Bank.
11. Mancini, M., Montalbano, P., Nenci, S., & Vurchio, D. (2024). Positioning in global value chains: World map and indicators, a new dataset available for GVC analyses. *The World Bank Economic Review*, 38(4), 669–690. https://doi.org/10.1093/wber/lhae005
12. Stöllinger, R. (2021). Testing the smile curve: Functional specialisation and value creation in GVCs. *Structural Change and Economic Dynamics*, 56, 93–116.
13. World Bank. (2020). *World development report 2020: Trading for development in the age of global value chains*. https://www.worldbank.org/en/publication/wdr2020

DIGITAL MATURITY OF PUBLIC SERVICES IN SLOVAKIA FROM A EUROPEAN PERSPECTIVE

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INTRODUCTION

Digital transformation has become a strategic priority of the European Union, with digital public services representing a key component of modern public administration. The level of digital maturity reflects the ability of public institutions to provide accessible and user-oriented services. This paper evaluates the current state of digital public services in Slovakia from a European perspective.

LITERATURE REVIEW / THEORETICAL BACKGROUND

Digital public services represent an important dimension of digital transformation and are closely associated with the concepts of e-government and digital maturity. Contemporary literature emphasizes that the successful digitalization of public services depends on technological infrastructure, institutional capacity, digital skills, and user adoption. The level of digital maturity is commonly assessed through composite indicators that enable comparisons between countries and support the evaluation of progress in public sector digitalization.

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METHODOLOGY

The study applies a quantitative comparative analysis based on secondary data obtained from European digitalization indicators. The analysis focuses on the level of digital maturity of public services in Slovakia and its comparison with other European Union Member States. Descriptive statistical methods and comparative evaluation are used to identify development trends and Slovakia's relative position within the European context.

RESULTS

The analysis indicates that Slovakia has achieved gradual progress in the digitalization of public services; however, its level of digital maturity remains below the European Union average. The strongest performance was observed in the availability of selected online public services, while weaknesses persist in service integration and user adoption. Significant disparities continue to exist between Slovakia and the most digitally advanced European countries.

DISCUSSION / POLICY IMPLICATIONS

The findings suggest that improving digital public services requires not only technological investments but also stronger institutional capacity and greater user engagement. Particular attention should be devoted to enhancing service interoperability, accessibility, and user experience. Policymakers should support the further modernization of public administration to reduce the gap between Slovakia and the most digitally advanced European countries.

CONCLUSION

Digital public services have become an essential component of public sector modernization and overall digital development. Although Slovakia has made progress in recent years, differences compared with digitally advanced European countries remain evident. Continued efforts to improve service quality, accessibility, and user adoption are necessary to strengthen the digital maturity of public services and support long-term public sector efficiency.

KEYWORDS

Digital Maturity, digital public services, e-government, public administration, Slovakia

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REFERENCES

1. Aslanova, I. V., & Kulichkina, A. I. (2020). Digital maturity: Definition and model. *Advances in Economics, Business and Management Research*, 138, 443–449. https://doi.org/10.2991/AEBMR.K.200502.073
2. Bánhidi, Z., Dobos, I., & Nemeslaki, A. (2019). Comparative analysis of the development of the digital economy in Russia and EU measured with DEA and using dimensions of DESI. Vestnik of Saint Petersburg University. *Economics*, 35(4), 588–606. https://doi.org/10.21638/spbu05.2019.405
3. Borowiecki, R., Siuta-Tokarska, B., Maroń, J., Suder, M., Thier, A., & Żmija, K. (2021). Developing digital economy and society in the light of the issue of digital convergence of the markets in the European Union countries. *Energies*, 14(9), 2717. https://doi.org/10.3390/en14092717
4. Bruno, G., Diglio, A., Piccolo, C., & Pipicelli, E. (2023). A reduced composite indicator for digital divide measurement at the regional level: An application to the Digital Economy and Society Index (DESI). *Technological Forecasting and Social Change*, 190, 122461. https://doi.org/10.1016/j.techfore.2023.122461
5. European Commission. (2024). DESI dashboard for the Digital Decade (2023 onwards). https://digital-decade-desi.digital-strategy.ec.europa.eu
6. European Commission. (2024). Report on the State of the Digital Decade 2024: Country report – Slovakia. https://ec.europa.eu
7. European Commission. (2025). Digital Decade 2025 country report – Slovakia. European Commission.
8. Gong, C., & Ribiere, V. (2021). Developing a unified definition of digital transformation. *Technovation*, 102, 102217. https://doi.org/10.1016/j.technovation.2020.102217
9. Grabowska, M. (2025). Sweden in the light of the European Union's "Path to the Digital Decade" policy programme 2030. *Studia Europejskie – Studies in European Affairs*, 29(2), 171–189. https://doi.org/10.33067/SE.2.2025.9
10. Hunady, J., Pisár, P., Vugec, D. S., & Bach, M. P. (2022). Digital transformation in the European Union: North is leading, and South is lagging behind. *International Journal of Information Systems and Project Management*, 10(4), 58–81.
11. Jenčová, S., Vašaničová, P., & Miškufová, M. (2023). Multidimensional evaluation of EU and Slovakia in the context of digital transformation. *Central European Business Review*, 12(1), 65–95. https://doi.org/10.18267/j.cebr.313
12. Kiseľáková, D., Šofranková, B., Širá, E., & Fedorčíková, R. (2022). Assessment of the digital economy's level among the EU countries: An empirical study. *Polish Journal of Management Studies*, 26(1), 107–124. https://doi.org/10.17512/PJMS.2022.26.1.07

13. Minović, J., & Jednak, S. (2023). Sustainable economic development and digital progress of EU countries. In: *Lecture Notes in Networks and Systems* (pp. 360–371). Springer. https://doi.org/10.1007/978-3-031-18645-5_22
14. Misuraca, G., Broster, D., & Centeno, C. (2012). Digital Europe 2030: Designing scenarios for ICT in future governance and policy making. *Government Information Quarterly*, 29(1), 121–131. https://doi.org/10.1016/j.giq.2011.08.006
15. Olczyk, M., & Kuc-Czarnecka, M. (2022). Digital transformation and economic growth – DESI improvement and implementation. *Technological and Economic Development of Economy*, 28(3), 775–803. https://doi.org/10.3846/tede.2022.16766

FROM INFORMAL USE TO RESPONSIBLE INNOVATION: A PROPORTIONATE GENERATIVE-AI GOVERNANCE FRAMEWORK FOR SMES

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INTRODUCTION

Generative artificial intelligence (GenAI) enables small and medium-sized enterprises (SMEs) to use AI at low cost and with limited technical prerequisites. Still, use can precede internal guidance, staff training and legal review. In an OECD survey, 31% of SMEs reported GenAI use, whereas no more than one-third of users had adopted training, internal guidelines or structured legal review (OECD, 2025). This paper addresses the resulting gap between rapid uptake and responsible innovation.

LITERATURE REVIEW / THEORETICAL BACKGROUND

Generative-AI governance requires operational mechanisms, not high-level principles alone (Mittelstadt, 2019). GenAI creates privacy, intellectual-property, sensitive-information and validation challenges (Taeihagh, 2025; Dwivedi et al., 2023). The EU's risk-based framework and NIST's AI Risk Management Framework point to proportionate governance, risk management and accountability (European Commission, 2026; Tabassi, 2023).

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METHODOLOGY

The study applies an integrative literature review and documentary analysis. Sources were selected for peer-review status or institutional authority, direct relevance to GenAI governance in SMEs, and publication currency; they include OECD evidence and EU/NIST documents. RQ1 examines risks and capability gaps; RQ2 identifies responsible-use practices and public support; RQ3 develops a proportionate SME governance framework. The selected material was thematically coded.

RESULTS

The synthesis identifies five interdependent gaps: unclear use-case boundaries; data confidentiality and intellectual-property exposure; insufficient AI literacy; weak human review of outputs; and limited documentation, monitoring and escalation procedures. Evidence suggests that the constraints are practical rather than merely attitudinal: among non-adopting SMEs, 54% cite legal/copyright concerns, 52% concerns about information entered into models and 50% skill deficits (OECD, 2025).

DISCUSSION / POLICY IMPLICATIONS

The framework operationalizes generic AI risk-management approaches for SMEs through: (1) risk-based use-case classification; (2) data and confidentiality safeguards; (3) AI literacy and acceptable-use guidance; (4) human validation of consequential outputs; and (5) documentation, monitoring and escalation. Proportionate governance scales controls to use-case risk and SMEs' limited expertise, time and resources, avoiding enterprise-grade compliance burdens.

CONCLUSION

The paper argues that responsible GenAI governance should be treated as an enabling innovation capability rather than a compliance burden. The framework responds to RQ1 by identifying operational, data and skills gaps; to RQ2 by specifying organizational practices and public support; and to RQ3 by integrating innovation with proportionate safeguards. It offers SMEs and innovation-policy actors a practical route from informal experimentation to accountable, scalable GenAI use.

KEYWORDS

Generative AI, SMEs, responsible innovation, AI governance, digital transformation

REFERENCES

1. Dwivedi, Y. K., Kshetri, N., Hughes, L., Slade, E. L., Jeyaraj, A., Kar, A. K., Baabdullah, A. M., Koohang, A., Raghavan, V., Ahuja, M., Albashrawi, M. A., Al-Busaidi, A. S., Balakrishnan, J., Barlette, Y., Basu, S., Bose, I., Brooks, L., Buhalis, D., Carter, L., … Wright, R. (2023). "So what if ChatGPT wrote it?" Multidisciplinary perspectives on opportunities, challenges and implications of generative conversational AI for research, practice and policy. *International Journal of Information Management,* 71, 102642. https://doi.org/10.1016/j.ijinfomgt.2023.102642
2. European Commission. (2026). AI Act. Shaping Europe's digital future. https://digital-strategy.ec.europa.eu/en/policies/regulatory-framework-ai
3. Mittelstadt, B. (2019). Principles alone cannot guarantee ethical AI. *Nature Machine Intelligence,* 1, 501–507. https://doi.org/10.1038/s42256-019-0114-4
4. OECD. (2025). Generative AI and the SME workforce: New survey evidence. OECD Publishing. https://doi.org/10.1787/2d08b99d-en
5. Tabassi, E. (2023). Artificial intelligence risk management framework (AI RMF 1.0) (NIST AI 100-1). National Institute of Standards and Technology. https://doi.org/10.6028/NIST.AI.100-1
6. Taeihagh, A. (2025). Governance of generative AI. *Policy and Society*, 44(1), 1–22. https://doi.org/10.1093/polsoc/puaf001

THE MACRO-FISCAL TRANSMISSION CHANNELS OF ALGORITHMIC TAX ENFORCEMENT: EVIDENCE FROM NORTH MACEDONIA E-INVOICE INFRASTRUCTURE

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INTRODUCTION

The intersection of digital public governance-GovTech and public financial management (PFM) represents a vital structural shift for post-socialist transition economies. For Western Balkan states like North Macedonia, modernizing revenue administration is a foundational requirement for domestic resource mobilization, macroeconomic resilience, and EU accession. This extensive informality erodes the domestic tax base, distorts forecasting, and constrains public infrastructure investments. While policy reports focus on micro-level compliance, a distinct gap persists in empirical literature regarding how standardized, machine-readable data streams enable automated machine learning workflows and transmit into macro-fiscal variables. We analyze the e-Faktura architecture as a foundational data lake for AI, define the econometric transmission channels through which automated fraud detection expands public capital expenditures, and evaluate the structural impact on Macedonian national output.

LITERATURE REVIEW / THEORETICAL BACKGROUND

Integrating AI and ML into tax administration marks a shift from reactive auditing to proactive Compliance Risk Management (CRM), encapsulating the OECD's Tax Administration 3.0 vision (2026). In transition economies, deploying advanced analytics focuses on compressing tax gaps caused by the shadow economy and complex (VAT) evasion schemes (2025). Predictive accuracy in ML is fundamentally bound to data standardization (Alnowiser, 2026). Traditional fiscal

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oversight was constrained by unstructured reporting formats like physical ledgers or PDFs, which introduced processing latency and data fragmentation (2026). Mandatory electronic invoicing under CTC models addresses this by converting B2B transaction flows into uniform XML schemas using standardized Universal Business Language (UBL) syntax (EDICOM, 2026). This transition yields homogeneous datasets that can be immediately processed by ML algorithms without text-preprocessing distortion. However, the literature cautions that realizing these gains depends on institutional execution, mitigating algorithmic biases embedded in legacy datasets, and public sector human capital retention to limit external vendor dependencies (Peixoto et al., 2024; 2024).

METHODOLOGY

This study utilizes a two-stage structural methodology calibrated to the institutional parameters of North Macedonia during its e-Faktura implementation framework. First, the algorithmic ingestion layer is modeled. Real-time transaction records from the e-Faktura platform are treated as structured XML inputs. Through API linkages, these inputs are cross-referenced with customs databases, corporate registries, and banking transaction streams to generate multi-dimensional feature sets for automated anomaly detection. Second, the structural macro-fiscal reallocation channel is defined. The revenue recaptured from the informal sector via machine learning intervention is transferred directly into the national budget's capital expenditure account. This reallocates funds from the informal "leakage" sector into public investment without increasing statutory tax rates or expanding the fiscal deficit.

RESULTS

The empirical analysis estimates the long-run and short-run dynamics linking algorithmic tax enforcement e-Faktura mechanisms to real output expansion in NMK. Estimations are performed using quarterly time-series data spanning from 2018: Q1 to 2025: Q4. Before implementing the (ARDL) estimation, we verify the integration properties of the variables using the (ADF) and (PP) tests. The results confirm that the variables exhibit a mixture of I(0) and I(1) properties, with no variable integrated of order I(2) or higher, justifying the application of the ARDL bounds testing approach. Because the computed F-statistic (5.42) strictly exceeds the upper critical bound at the 1% significance level, we reject the null hypothesis of no cointegration. This confirms a stable, long-run equilibrium relationship among real GDP, capital expenditure, the size of the shadow economy, and the tax-to-GDP ratio. The optimal lag structure is selected as ARDL (1, 2, 0, 1) based on

the minimum Akaike Information Criterion (AIC). Conversely, the shadow economy exerts a highly restrictive effect on real GDP (β= -0.312, p = 0.002), proving that informal economic leakages persistently suppress NMK productive capacity.

DISCUSSION / POLICY IMPLICATIONS

The econometric results and structural simulations yield targeted, actionable policy implications for the MF and economic planners in the WB, rather than treating digitalization as a passive administrative upgrade, these insights form a strategic blueprint for maximizing the macroeconomic returns on GovTech investments: Institutionalizing a Dedicated Fiscal Reallocation Rule,the empirical model demonstrates that the macroeconomic output dividend is entirely dependent on the structural reallocation parameter α= 1. If recovered revenue is absorbed by current public consumption, the fiscal spending multiplier drops close to 0, neutralizing the growth effect. The MF should establish a formal/GovTech Fiscal Dividend Rule and targeted Allocation. These funds should be automatically directed into (CAPEX) projects possessing high localized multipliers, such as regional transport infrastructure, digital connectivity grids, and green energy transitions mitigating public sector BrainDrain via Hybrid Human in theLoop Structures.

CONCLUSION

The integration of AI into public sector fiscal policy in NMK is transitioning from a conceptual framework into an operational reality. As demonstrated by our structural macro-fiscal analysis, the rollout of the mandatory e-Faktura platform provides the essential data foundation for advanced data science. By standardizing non-cash B2B and B2G transactions into structured, real-time machine-readable XML feeds, the platform constructs the comprehensive data lakes required to run unsupervised anomaly detection and graph-based network analysis. Our simulations confirm that when advanced compliance technologies successfully target systemic structural challenges like theShadow economy, the macroeconomic dividends extend far beyond administrative optimization. By capturing informal leakages and formalizing transactions, the state expands its fiscal space without increasing baseline statutory tax rates.

KEYWORDS

Algorithmic Tax Enforcement, Continuous Transaction Controls (CTC), macro-fiscal transmission channels, shadow economy, North Macedonia

REFERENCES

1. Alnowiser, A. (2026). Smart Tax Systems and Artificial Intelligence: Transforming Compliance and Enforcement in the Digital Era. *Munich Personal RePEc Archive (MPRA),* Paper No. 127541. https://mpra.ub.uni-muenchen.de/127541/
2. Artificial Intelligence for Financial Accountability and Governance in the Public Sector: Strategic Opportunities and Challenges. (2025). *Administrative Sciences*, 15(2), 58. https://www.mdpi.com/2076-3387/15/2/58
3. Artificial Intelligence in tax administration: From early innovation to modern transformation. (2026, April 29). OECD. https://www.oecd.org/en/blogs/2026/04/artificial-intelligence-in-tax-administration-from-early-innovation-to-modern-transformation.html
4. EDICOM. (2026, February 10). North Macedonia to implement mandatory electronic invoicing with the e-Faktura project by 2026. Edicom Global Blog. https://edicomgroup.com/blog/einvoicing-north-macedonia-efaktura
5. Korinek, A., & Lockwood, L. M. (2026). Public Finance in the Age of AI: A Primer. National Bureau of Economic Research (NBER), Working Paper No. 31412. https://www.nber.org/system/files/chapters/c15323/c15323.pdf
6. Methuku, S. (2025). The Use of Artificial Intelligence in Detecting Cross-Border Tax Evasion: Regulatory Gaps and Case-Based Evidence. *International Public Law Review*, 44(5), 4029–4044.
7. Ministry of Finance. (2026). Macroeconomic Indicators and Budgetary Outlook: January 2026 Economic Bulletin. Skopje: Ministry of Finance of the Republic of North Macedonia.
8. OECD. (2023). Tax Administration 3.0 and Electronic Invoicing: Measuring the Impact on the Shadow Economy in Emerging Markets. Paris: OECD Publishing.
9. Peixoto, C., Canuto, O., & Jordan, L. (2024). AI and the Future of Government: Unexpected Effects and Critical Challenges. Policy Center for the New South, Policy Brief No. 104.
10. State Audit Office (DZR). (2026). IT Performance Audit Report: Potential Use of Artificial Intelligence in the Public Sector (Fiscal Years 2019–2024). Skopje: Republic of North Macedonia.
11. Tax Fraud Detection Using Artificial Intelligence-Based Technologies: Trends and Implications. (2025). *Journal of Risk and Financial Management*, 18(9), 502. https://www.mdpi.com/1911-8074/18/9/502
12. The future of tax policy: A public finance framework for the age of AI. (2026, January 8). Brookings Institution. https://www.brookings.edu/articles/future-tax-policy-a-public-finance-framework-for-the-age-of-ai/
13. Understanding Artificial Intelligence in Tax and Customs Administration. (2024). International Monetary Fund (IMF) Technical Notes and Manuals, No. 2024/006.

INNOVATION, DIGITALIZATION, AND COMPETITIVENESS: A CAPABILITY-BASED PERSPECTIVE FROM HUNGARIAN FIRMS

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INTRODUCTION

Firms invest heavily in digital transformation, yet performance effects are heterogeneous (Verhoef et al., 2021). Digitalization translates into competitiveness mainly when firms convert digital maturity into innovation capability, while innovation is enabled by digital solutions (Ferreira et al., 2024). EU rankings show a persistent innovation-digitalization gap between north-central and south-eastern Europe (Tutak & Brodny, 2024; Marti & Puertas, 2023), making Eastern Europe well suited for examining how digital and innovation capabilities co-evolve and shape firm competitiveness.

LITERATURE REVIEW / THEORETICAL BACKGROUND

The study builds on dynamic capabilities theory (Teece et al., 1997), integrated with the Technology-Organization-Environment (TOE) framework (Tornatzky et al., 1990). Digital organizational capabilities and innovation capabilities are theorized as mutually reinforcing antecedents of competitiveness, while innovation ecosystem embeddedness represents the environmental dimension through which firms sense, seize, and reconfigure resources for digitalization and innovation.

METHODOLOGY

Data were collected via the corporate questionnaire survey of the Competitiveness Research Centre at Corvinus University of Budapest, covering 335 Hungarian medium- and large-sized firms across manufacturing, construction, trade and transportation (Chikán et al., 2025). Constructs were derived from the Firm Competitiveness Index (Chikán et al., 2022) via exploratory factor analysis;

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hypothesized relationships were tested using PLS-SEM (SmartPLS 4) with bootstrapping (10,000 subsamples).

RESULTS

Results show that the Level of digitalization ($\beta = 0.381$, $p < 0.001$) and Innovation capabilities ($\beta = 0.396$, $p < 0.001$) both have a significant, direct positive effect on Firm competitiveness. Innovation ecosystem embeddedness and Digital organizational capabilities show no significant direct effect on competitiveness ($\beta = 0.044$, $p = 0.421$; $\beta = 0.010$, $p = 0.857$, respectively); instead, their influence is fully mediated through Innovation capabilities and the Level of digitalization. The total indirect effect of Innovation ecosystem embeddedness on Firm competitiveness is substantial (0.396, $p < 0.001$), yielding the largest total effect in the model (0.441, $p < 0.001$), while the effect of Digital organizational capabilities is likewise fully mediated (indirect effect = 0.144, $p < 0.001$; total effect = 0.153, $p < 0.01$). The model explains a substantial share of variance in the Level of digitalization ($R^2 = 0.633$), Firm competitiveness ($R^2 = 0.543$) and Innovation capabilities ($R^2 = 0.292$). These findings highlight the mediating role of innovation capabilities and the interdependent nature of digitalization and innovation in driving firm performance.

DISCUSSION / POLICY IMPLICATIONS

The results show that digitalization and innovation capabilities mutually reinforce each other, while ecosystem embeddedness acts as a catalyst that is converted into competitiveness only through internal innovation capabilities and digitalization (cf. Kraus et al., 2023). Results may inform policymakers on designing support instruments that jointly target digital and innovation capability-building — for instance by strengthening digital leadership (Dióssy et al., 2025) — particularly for firms in south-eastern Europe facing persistent competitiveness gaps.

CONCLUSION

This study contributes to the literature by jointly examining digitalization, innovation, and ecosystem embeddedness as interrelated drivers of firm competitiveness in an Eastern European context. By integrating dynamic capabilities theory with the TOE framework, it offers a more holistic understanding of how capability co-evolution translates into sustained competitive advantage for catching-up economies.

KEYWORDS

Digitalization, innovation capabilities, firm competitiveness, dynamic capabilities, innovation ecosystem embeddedness

REFERENCES

1. Chikán, A., Czakó, E., Kiss-Dobronyi, B., & Losonci, D. (2022). Firm competitiveness: A general model and a manufacturing application. *International Journal of Production Economics*, 243, 108316. https://doi.org/10.1016/j.ijpe.2021.108316
2. Chikán, A., et al. (2025). Gyorsjelentés a magyar vállalatok versenyképességéről. Corvinus University of Budapest. https://doi.org/10.14267/978-963-503-971-5
3. Dióssy, K., Losonci, D., Aranyossy, M., & Demeter, K. (2025). The role of leadership in digital transformation–a paradox way to improve operational performance. *Journal of Manufacturing Technology Management*, 36(9), 88-113. https://doi.org/10.1108/JMTM- 07-2024-0386
4. Ferreira, J., Fernandes, C., & Veiga, P. (2024). The effects of knowledge spillovers, digital capabilities, and innovation on firm performance: A moderated mediation model. *Technological Forecasting and Social Change.* https://doi.org/10.1016/j.techfore.2023.123086
5. Kraus, S., Vonmetz, K., Orlandi, L., Zardini, A., & Rossignoli, C. (2023). Digital entrepreneurship: The role of entrepreneurial orientation and digitalization for disruptive innovation. *Technological Forecasting and Social Change*. https://doi.org/10.1016/j.techfore.2023.122638
6. Marti, L., & Puertas, R. (2023). Analysis of European competitiveness based on its innovative capacity and digitalization level. *Technology in Society*, 72, 102206. https://doi.org/10.1016/j.techsoc.2023.102206
7. Teece, D. J., Pisano, G., & Shuen, A. (1997). Dynamic capabilities and strategic management. *Strategic Management Journal*, 18(7), 509–533.
8. Tornatzky, L. G., Fleischer, M., & Chakrabarti, A. K. (1990). *The processes of technological innovation*. Lexington Books.
9. Tutak, M., & Brodny, J. (2024). Technological progress in central and eastern Europe: Digitalization and business innovation leaders and outsiders. *Journal of Open Innovation: Technology, Market, and Complexity*, 10(4), 100404. https://doi.org/10.1016/j.joitmc.2024.100404
10. Verhoef, P., Broekhuizen, T., Bart, Y., Bhattacharya, A., Dong, J., Fabian, N., & Haenlein, M. (2021). Digital transformation: A multidisciplinary reflection and research agenda. *Journal of Business Research*. https://doi.org/10.1016/j.jbusres.2019.09.022

DIGITAL AND AI-POWERED MANAGEMENT ACCOUNTING FOR SUSTAINABLE AGRIBUSINESS

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INTRODUCTION

Digitalization within the agricultural sector fundamentally alters the accounting function. The integration of Artificial Intelligence (AI) and the Internet of Things (IoT) enables accountants to transition from retrospective recording to proactive management (Korobeynikova et al., 2021; Odonkor et al., 2024). These technologies successfully overcome the information asymmetry existing between the field and the office. The objective of this study is to examine how precision agriculture and digital reporting support strategic decision-making aimed at sustainable growth.

LITERATURE REVIEW / THEORETICAL BACKGROUND

AI automates routine tasks and enhances financial forecasting accuracy (Odonkor et al., 2024). Business Intelligence (BI) tools, such as OLAP, facilitate multidimensional cost analysis (Namdarian, 2013). Furthermore, integrating Financial Accounting (FFA) with Farm Management Information Systems (FMIS) is critical for environmental reporting (Poppe et al., 2023; Tingey-Holyoak et al., 2021). Precision agriculture optimizes farm productivity through site-specific data (Budzko & Medennikov, 2021; Mukhamedova et al., 2022; Schimmelpfennig, 2018).

METHODOLOGY

This study employs a design science research methodology to develop automated data streams. A systems approach evaluates data integration via a novel conceptual model proposed in this study, "Agro-EMA-AI+". It integrates three main components: IoT field sensors, an AI module for multidimensional cost analysis, and an accounting interface for ESG reporting. Grounded in ISO 14051

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standards for EMA and MFCA (ISO, 2011), the model structures environmental reporting. Empirical data from agricultural enterprises in the EU and Bulgaria (2021–2025) sourced from FADN, Eurostat, and NSI were analyzed using comparative and statistical methods (Eurostat, 2025; FADN, 2025; NSI, 2025).

RESULTS

Empirical analysis of FADN and Eurostat data reveals that AI reduces operating expenses by 18.2% through optimized fertilizer and fuel allocation. Implementing IoT moisture-tracking software enhances water productivity by 42%, directly lowering unit production costs. VRT and GPS technologies enable precise cost allocation down to the field level. Furthermore, automated reporting reduces audit lead times nearly fourfold and elevates green subsidy approval rates to 87.5% (Eurostat, 2024).

DISCUSSION / POLICY IMPLICATIONS

The deployment of these technologies transforms the role of the accountant into a business consultant capable of identifying "hidden" environmental liabilities (Odonkor et al., 2024; Tingey-Holyoak et al., 2021). Digital EMA has become a prerequisite for compliance with the EU's ESG reporting mandates. Policymakers must incentivize invoice digitalization (UBL format) to enable "robotic accounting." This intervention will mitigate administrative burdens and ensure transparency in sustainable resource management (Poppe et al., 2023).

CONCLUSION

Digitalized management accounting, empowered by AI, serves as a pivotal driver of sustainability. It successfully eliminates information asymmetry and provides a reliable foundation for managerial decisions. The future of the agricultural sector hinges on the symbiosis of technological innovation and traditional accounting methods. Integrating sensor data into accounting frameworks constitutes a fundamental pillar in the transition toward a circular economy and the effective management of natural capital.

KEYWORDS

Artificial intelligence (AI), precision agriculture, management accounting, digitalization, sustainability

REFERENCES

1. Budzko, V., & Medennikov, V. (2021). Mathematical modeling of evaluating the effectiveness of using RSD data in precision farming. Procedia Computer Science, 190, 122-129.
2. Korobeynikova, O. M., Korobeynikov, D. A., Popova, L. V., Chekrygina, T. A., & Shemet, E. S. (2021). Artificial intelligence for digitalization of management accounting of agricultural organizations. In: IOP conference series: earth and environmental science (Vol. 699, No. 1, p. 012049). IOP Publishing.
3. Mukhamedova, K. R., Cherepkova, N. P., Korotkov, A. V., Dagasheva, Z. B., & Tvaronavičienė, M. (2022). Digitalisation of agricultural production for precision farming: A case study. Sustainability, 14(22), 14802.
4. Namdarian, I. (2013). The Use of Business Intelligence Components as a proficient tool in Monitoring the Operations and Cost Management in Agricultural Business Sector. Agriculture Informatics, 47.
5. Odonkor, B., Kaggwa, S., Uwaoma, P. U., Hassan, A. O., & Farayola, O. A. (2024). The impact of AI on accounting practices: A review: Exploring how artificial intelligence is transforming traditional accounting methods and financial reporting. World Journal of Advanced Research and Reviews, 21(1), 172-188.
6. Poppe, K., Vrolijk, H., & Bosloper, I. (2023). Integration of farm financial accounting and farm management information systems for better sustainability reporting. Electronics, 12(6), 1485.
7. Schimmelpfennig, D. (2018). Crop production costs, profits, and ecosystem stewardship with precision agriculture. Journal of Agricultural and Applied Economics, 50(1), 81-103.
8. Tingey-Holyoak, J., Pisaniello, J., Buss, P., & Mayer, W. (2021). The importance of accounting-integrated information systems for realising productivity and sustainability in the agricultural sector. International Journal of Accounting Information Systems, 41, 100512.
9. https://agridata.ec.europa.eu/extensions/FarmEconomyFocus/FarmEconomyFocus.html
10. https://ec.europa.eu/eurostat/web/agriculture/database
11. https://www.iso.org/standard/50986.html
12. https://www.nsi.bg/pages/is-infostat-926

DIGITAL TECHNOLOGIES AS ENABLERS OF GREEN MARKETING: A PRISMA-GUIDED SYSTEMATIC REVIEW OF SUSTAINABILITY COMMUNICATION, CONSUMER TRUST AND GREENWASHING RISKS

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INTRODUCTION

Digital and green transformation has altered the way firms make environmental value visible. Green marketing now unfolds through websites, social media, e-commerce and automated content, where consumers meet claims before products. This review examines whether digital technologies strengthen sustainability communication or simply make greenwashing travel faster. The aim is to clarify the trust conditions under which digital green marketing becomes persuasive, credible and useful.

LITERATURE REVIEW / THEORETICAL BACKGROUND

The framework combines green marketing strategy, digital and social media marketing, green trust and greenwashing. Green marketing is approached as a strategic system for sustainable value communication, not only promotion (Dangelico & Vocalelli, 2017). Digital channels shape attention and response (Dwivedi et al., 2021). Trust is fragile when claims create confusion, perceived risk or scepticism, as shown by Chen and Chang (2013) and Leonidou and Skarmeas (2017).

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METHODOLOGY

A PRISMA-guided systematic review used a Web of Science (WoS) export covering 2020 to 2026 and PRISMA logic for record selection (Page et al., 2021). The query combined green marketing, green advertising, sustainability communication, digital marketing, social media, e-commerce, artificial intelligence, consumer trust and greenwashing. The exports contained 50 records. After 4 exclusions, 46 studies remained, with 38 core consumer studies and 8 contextual transparency studies.

RESULTS

Preliminary synthesis of the 46 retained WoS records indicates that digital green marketing is mainly discussed through social media and digital platforms, followed by sustainability communication, green advertising and purchase intention. Keyword coding also shows a strong focus on trust, credibility and transparency, while greenwashing, skepticism and confusion appear as central barriers. AI and blockchain are emerging but remain less frequent.

DISCUSSION / POLICY IMPLICATIONS

The synthesis indicates that digital technologies are conditional enablers of green marketing. They enhance reach and interaction, yet their value depends on verifiable proof and credible disclosure. Misleading claims can erode consumer confidence and market legitimacy, as argued by Delmas and Burbano (2011) and Schmuck et al. (2018). Interactive websites may also increase perceived greenwashing when evidence is weak (Szabo & Webster, 2021). Verification should become visible to users.

CONCLUSION

The review positions digital green marketing as a trust-sensitive process. Digital tools can improve sustainability communication when they reduce information asymmetry and make claims verifiable. When communication remains vague, the same tools can intensify scepticism and weaken purchase intention. The study contributes a concise framework linking digital channels, transparency, green trust and greenwashing risk, while identifying AI and blockchain as emerging research directions.

KEYWORDS

Green marketing, digital transformation, sustainability communication, consumer trust, greenwashing

REFERENCES

1. Chen, Y.-S., & Chang, C.-H. (2013). Greenwash and green trust: The mediation effects of green consumer confusion and green perceived risk. *Journal of Business Ethics*, 114(3), 489-500. https://doi.org/10.1007/s10551-012-1360-0

2. Dangelico, R. M., & Vocalelli, D. (2017). "Green Marketing": An analysis of definitions, strategy steps, and tools through a systematic review of the literature. *Journal of Cleaner Production*, 165, 1263-1279. https://doi.org/10.1016/j.jclepro.2017.07.184
3. Delmas, M. A., & Burbano, V. C. (2011). The drivers of greenwashing. *California Management Review*, 54(1), 64-87. https://doi.org/10.1525/cmr.2011.54.1.64
4. Dwivedi, Y. K., Ismagilova, E., Hughes, D. L., Carlson, J., Filieri, R., Jacobson, J., Jain, V., Karjaluoto, H., Kefi, H., Krishen, A. S., Kumar, V., Rahman, M. M., Raman, R., Rauschnabel, P. A., Rowley, J., Salo, J., Tran, G. A., & Wang, Y. (2021). Setting the future of digital and social media marketing research: Perspectives and research propositions. International *Journal of Information Management*, 59, 102168. https://doi.org/10.1016/j.ijinfomgt.2020.102168
5. Leonidou, C. N., & Skarmeas, D. (2017). Gray shades of green: Causes and consequences of green skepticism. *Journal of Business Ethics*, 144(2), 401-415. https://doi.org/10.1007/s10551-015-2829-4
6. Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., Shamseer, L., Tetzlaff, J. M., Akl, E. A., Brennan, S. E., Chou, R., Glanville, J., Grimshaw, J. M., Hrobjartsson, A., Lalu, M. M., Li, T., Loder, E. W., Mayo-Wilson, E., McDonald, S., McGuinness, L. A., Stewart, L. A., Thomas, J., Tricco, A. C., Welch, V. A., Whiting, P., & Moher, D. (2021). The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. BMJ, 372, n71. https://doi.org/10.1136/bmj.n71
7. Schmuck, D., Matthes, J., & Naderer, B. (2018). Misleading consumers with green advertising? An affect-reason-involvement account of greenwashing effects in environmental advertising. *Journal of Advertising*, 47(2), 127-145. https://doi.org/10.1080/00913367.2018.1452652
8. Szabo, S., & Webster, J. (2021). Perceived greenwashing: The effects of green marketing on environmental and product perceptions. *Journal of Business Ethics*, 171(4), 719-739. https://doi.org/10.1007/s10551-020-04461-0

BEYOND DIGITALIZATION: PRIORITY EROSION AND THE TRANSITION FROM WAITING LISTS TO ACTIVE HEALTHCARE ACCESS MANAGEMENT

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INTRODUCTION

Healthcare waiting lists have traditionally served as administrative tools for recording patient demand and monitoring access to healthcare services. Although healthcare systems have invested heavily in digitalization, these efforts have primarily improved data collection rather than transforming healthcare access management. This paper argues that digital transformation should be viewed as a progression from passive record-keeping towards active, data-driven governance of healthcare access.

LITERATURE REVIEW / THEORETICAL BACKGROUND

Previous studies have focused on patient prioritization methods (Déry et al., 2020; Rathnayake et al., 2021), reducing waiting times through organizational redesign (Lewis et al., 2018), advanced access models (Murray & Berwick, 2003; Rose et al., 2011), digital transformation (Hameed et al., 2024; Schiffelers et al., 2025; Stoumpos et al., 2023), and digital prioritization and scheduling tools (Lopes Pécora et al., 2025; Vromans et al., 2026). However, little attention has been devoted to how centralized digital infrastructures can support continuous monitoring of healthcare access or identify emerging systemic failures such as priority erosion.

METHODOLOGY

The study combines a longitudinal descriptive analysis of Slovenia's national waiting-list data (2020–2025) with the development of a conceptual digital maturity framework for healthcare access management. The framework

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integrates evidence from patient prioritization, digital transformation, healthcare operations, and scheduling optimization literature to explain how analytical capabilities evolve alongside digital maturity.

RESULTS

The analysis identifies a substantial increase in the proportion of patients assigned to the highest priority category, providing empirical evidence of priority erosion as an emerging systemic phenomenon. The findings show that traditional indicators, including average waiting time and waiting-list size, fail to detect this deterioration. In contrast, centralized digital data enable continuous monitoring of prioritization behaviour, patient flows, scheduling performance, and access dynamics.

DISCUSSION / POLICY IMPLICATIONS

The proposed framework conceptualizes healthcare access management as a progression from administrative waiting lists towards intelligent decision-support systems and digital twins. It argues that digital maturity should be accompanied by analytical and governance maturity, enabling healthcare systems not only to describe access problems but also to detect emerging risks, evaluate policy interventions, and support proactive management of demand and capacity.

CONCLUSION

This paper introduces priority erosion as a measurable indicator of declining prioritization performance and positions it within a broader digital maturity framework for healthcare access management. By shifting the focus from waiting-list administration to active system governance, the study extends existing literature on healthcare digital transformation and provides a conceptual foundation for future digital twin applications in health-system management.

KEYWORDS

Healthcare waiting lists, digital transformation, Healthcare access, priority erosion, digital twin

REFERENCES

1. Déry, J., Ruiz, A., Routhier, F., Bélanger, V., Côté, A., Ait-Kadi, D., ... & Lamontagne, M. E. (2020). A systematic review of patient prioritization tools in non-emergency healthcare services. *Systematic reviews, 9*(1), 227.

2. Hameed, K., Naha, R., & Hameed, F. (2024). Digital transformation for sustainable health and well-being: a review and future research directions. *Discover Sustainability, 5*(1), 104.
3. Lewis, A. K., Harding, K. E., Snowdon, D. A., & Taylor, N. F. (2018). Reducing wait time from referral to first visit for community outpatient services may contribute to better health outcomes: a systematic review. *BMC health services research, 18*(1), 869.
4. Lopes Pécora, A. T., Lamontagne, M. E., Ruiz, A., Frega, J. R., Déry, J., Pécora Junior, J. E., & de Fraga, R. (2025). Validation of a Patient Prioritization Tool: Addressing Decision-Support Tools' Development in Complex Systems. *Systems, 13*(12), 1109.
5. Murray, M., & Berwick, D. M. (2003). Advanced access: reducing waiting and delays in primary care. *Jama, 289*(8), 1035-1040.
6. Rathnayake, D., Clarke, M., & Jayasinghe, V. (2021). Patient prioritisation methods to shorten waiting times for elective surgery: a systematic review of how to improve access to surgery. *PLoS One, 16*(8), e0256578.
7. Rose, K. D., Ross, J. S., & Horwitz, L. I. (2011). Advanced access scheduling outcomes: a systematic review. *Archives of internal medicine, 171*(13), 1150-1159.
8. Schiffelers, T., Kapteijns, K., Hochstenbach, L., Kietselaer, B., Talboom-Kamp, E., & Spreeuwenberg, M. (2025). Best practices in organizing digital transformation: qualitative case study in Dutch hospital care. *Journal of Medical Internet Research, 27*, e63576.
9. Stoumpos, A. I., Kitsios, F., & Talias, M. A. (2023). Digital transformation in healthcare: technology acceptance and its applications. *International journal of environmental research and public health, 20*(4), 3407.
10. Vromans, R. F. M., van Essen, J. T., van der Vlugt, Y. M., & Carlier, M. (2026). Timeslot allocation for waiting list control. *OR Spectrum*, 1-39.

AGENTIC AI IN HUMAN RESOURCE MANAGEMENT: ENTREPRENEURIAL OPPORTUNITIES AND ORGANIZATIONAL TRANSFORMATION IN THE ERA OF INDUSTRY 5.0

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INTRODUCTION

Industry 5.0 explains a new development paradigm emphasizing the synergy between advanced technologies and people, placing human needs, sustainability, and resilience of organizations at the center of business development (Breque et al., 2021; Ilić et al., 2026). Agentic Artificial Intelligence (Agentic AI) is the next stage of artificial intelligence development, enabling autonomous planning, decision-making, and continuous learning with active collaboration with humans (Kaplan & Haenlein, 2025). Unlike generative artificial intelligence, Agentic AI is not only a decision support tool, but an intelligent agent capable of managing processes independently. The pronounced application of intelligent technologies is changing the role of human resources management (HRM), becoming a strategic driver of innovation, human capital development, and organizational competitiveness in the era of Industry 5.0 (Ilić, 2023). The paper aims to present a conceptual framework explaining how Agentic AI transforms HRM into a strategic function for entrepreneurial innovation and human capital development.

LITERATURE REVIEW / THEORETICAL BACKGROUND

Contemporary literature indicates that Industry 5.0 presents the evolution of previous industrial revolutions, shifting the focus from full automation to a human-centric approach, sustainability, and resilience of organizations, emphasizing the synergy between people and intelligent technologies (Breque et al., 2021; Nahavandi, 2019). Parallel to the development of generative artificial

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intelligence, the concept of Agentic AI appears, which implies intelligent systems capable of autonomous planning, coordination, task execution, and adaptive decision-making with minimal human intervention (Shneier et al., 2025; LangChain, 2024). In the field of human resources management, Agentic AI opens up new opportunities for improving the process of recruitment, selection, talent development, competence management, career planning and strategic decision-making, whereby the function of human resources grows from an administrative to a strategic organizational function (Minbaeva, 2021; Vrontis et al., 2022). At the same time, entrepreneurial organizations increasingly use intelligent technologies as drivers of innovation (Kraus et al., 2022; Nambisan et al., 2019). Although the number of studies on the application of artificial intelligence in human resource management is rapidly increasing, the existing literature mainly analyzes generative artificial intelligence in HR processes. Integrated conceptual models linking Agentic AI, strategic human resource management, entrepreneurship, and Industry 5.0 principles are still not sufficiently developed, which is a research gap that this paper seeks to fill.

METHODOLOGY

The paper presents a conceptual research based on a systematic review of contemporary scientific literature from the Scopus, Web of Science, ScienceDirect and Google Scholar databases (period 2022-2026) in the field of Agentic AI, human resource management, Industry 5.0 and entrepreneurship. The method of comparative and critical analysis was applied with the aim of identifying key trends, challenges, and possibilities of applying autonomous intelligent systems in human resource management. Based on the knowledge obtained, the original conceptual model Human-Centered Agentic HR Framework (HCAHF) (Figure 1) was developed.

Unlike existing conceptual approaches that mainly view the application of artificial intelligence through individual human resource management functions (such as recruitment, selection or talent development) the proposed Framework unites the principles of Industry 5.0, the capabilities of Agentic AI, HRM and entrepreneurial innovation into a single conceptual framework. Its originality is reflected in the fact that it places the collaboration between employees and autonomous intelligent agents at the center of the transformation of the HR function, linking the development of human capital, organizational resilience and innovation potential within a single model. Essentially, the most important thing is that human capital is not threatened, but that it is encouraged to develop through practical participation.

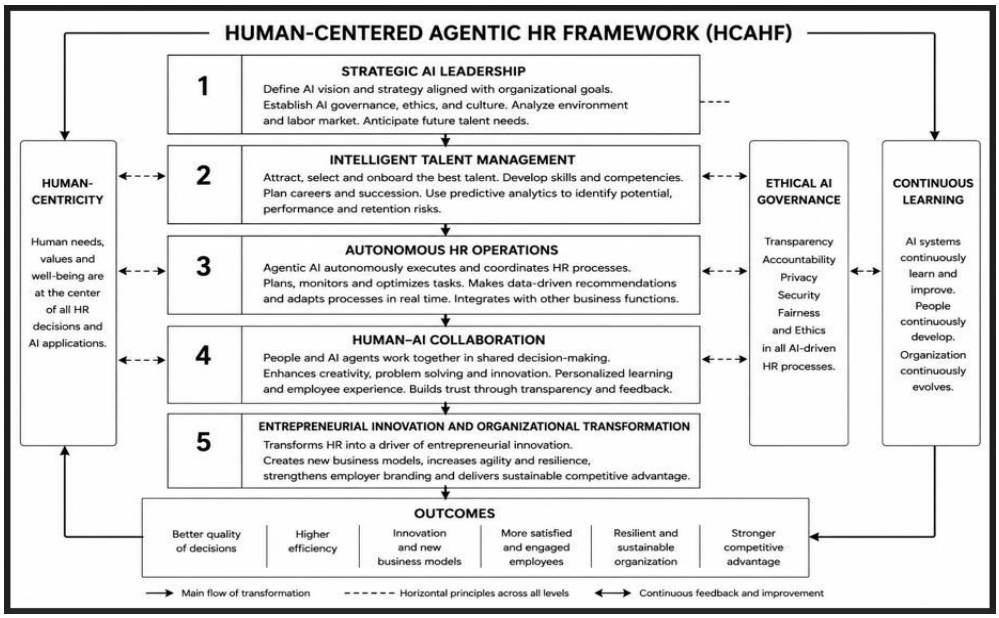


Figure 1. Human-Centered Agentic HR Framework

Source: Authors according to Kraus et al., 2022; Nambisan et al., 2019

CONCEPTUAL SYNTHESIS

A conceptual analysis of the relevant scientific literature indicates that Agentic AI has the potential to transform the human resource management function from a predominantly administrative to a strategic and development function. Based on a systematic review of the literature and identified theoretical knowledge, the Human-Centered Agentic HR Framework was developed, which unites five interrelated dimensions: (1) strategic leadership based on artificial intelligence, (2) intelligent talent management, (3) autonomous HR processes, (4) collaboration between people and intelligent agents, and (5) entrepreneurial innovation. The original contribution of the proposed model is reflected in the integration of the mentioned dimensions within the human-centric philosophy of Industry 5.0. Unlike the existing approaches that mostly consider these elements separately, the proposed framework shows their mutual connections and indicates that it is the synergy of employees and autonomous intelligent agents that is the basis for improving organizational agility, innovation capacity and sustainable competitive advantage. The findings of the paper represent the result of a conceptual synthesis conducted through a systematic literature review and can serve as a theoretical basis for future empirical research.

DISCUSSION / POLICY IMPLICATIONS

The transformation of the human resources function using Agentic AI requires the development of new organizational policies that include the ethical management of autonomous intelligent systems, the development of digital competencies of employees, and the establishment of transparent decision-making models. Of special importance are entrepreneurial organizations that, through the application of Agentic AI, can accelerate innovation, improve knowledge management, and increase resistance to dynamic market changes. At the same time, the development of regulatory frameworks and guidelines for the responsible application of autonomous artificial intelligence is becoming one of the key challenges of future economic development.

CONCLUSION

Industry 5.0 is changing the traditional understanding of HRM, with Agentic AI representing one of the most significant technological innovations of the new generation. Instead of replacing human labor, autonomous intelligent systems become partners in decision-making, talent development, and innovation creation. The proposed Human-Centered Agentic HR Framework represents a conceptual contribution to the understanding of the transformation of human resource management in the era of Industry 5.0 and can serve as a basis for future empirical research and the development of strategies that connect artificial intelligence, entrepreneurship, and sustainable organizational development. A special contribution of the paper is reflected in the development of a unique conceptual framework that connects Agentic AI, strategic human resource management, principles of Industry 5.0 and entrepreneurial innovation. In this way, the Human-Centered Agentic HR Framework represents a theoretical basis for future empirical research, but also a basis for the development of organizational strategies based on the responsible and human-centric application of autonomous intelligent systems.

KEYWORDS

Agentic AI, human resource management, Industry 5.0, entrepreneurship, organizational transformation

REFERENCES

1. Breque, M., De Nul, L., & Petridis, A. (2021). *Industry 5.0: Towards a sustainable, human-centric and resilient European industry*. European Commission, Directorate-General for Research and Innovation.
2. Ilić, B. (2023). *Green Management of Human Resources in the Context of Modern Entrepreneurship and Technologies.* In Reference Module in Social Sciences. Elsevier
3. Ilić, B., Anđelić, S., & Pavićević, N. (2026). Global Experience of Financial Regulations of the Agro-Industrial Complex and Serbian Entrepreneurial Agriculture in Modern Business. *Ekonomika poljoprivrede, 73*(2), 633–647.
4. Kaplan, A., & Haenlein, M. (2025). *Rethinking Artificial Intelligence for Autonomous Organizational Decision-Making.*
5. Kraus, S., Durst, S., Ferreira, J. J., Veiga, P., Kailer, N., & Weinmann, A. (2022). Digital transformation in business and management research: An overview of the current status quo. *International Journal of Information Management, 63*, 102466.
6. LangChain. (2024). *Agentic AI: Building autonomous AI agents*. LangChain Documentation.
7. Minbaeva, D. (2021). Disruptive HRM? Human resource management in the digital age. *Human Resource Management Review, 31*(4), 100820.
8. Nahavandi, S. (2019). Industry 5.0—A human-centric solution. *Sustainability, 11*(16), 4371.
9. Nambisan, S., Wright, M., & Feldman, M. (2019). The digital transformation of innovation and entrepreneurship: Progress, challenges and key themes. *Research Policy, 48*(8), 103773.
10. Vrontis, D., Christofi, M., Pereira, V., Tarba, S., Makrides, A., & Trichina, E. (2022). Artificial intelligence, robotics, advanced technologies and human resource management: A systematic review. *The International Journal of Human Resource Management, 33*(6), 1237–1266.

DETERMINANTS OF EMPLOYMENT DYNAMICS, SKILLS TRANSFORMATION, AND WORKFORCE RESILIENCE

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INTRODUCTION

The twin green and digital transition is inducing structural transformations in European labour markets by reshaping employment patterns, occupational structures, and skill requirements. These changes arise from the interaction of technological innovation, industrial restructuring, environmental regulation, and institutional capacity, increasing demand for digital, green, analytical, and interdisciplinary competencies. Human capital therefore constitutes a central mechanism through which economies adapt to emerging technological and sustainability imperatives. Within this framework, workforce resilience denotes the capacity of workers, organizations, and institutions to anticipate and adapt to structural change while maintaining labour-market functionality. This study examines the relationships between innovation capacity, human capital development, institutional conditions, and labour-market adaptability across the EU-27, integrating employment dynamics, skills transformation, and workforce resilience within a comparative analytical framework.

LITERATURE REVIEW / THEORETICAL BACKGROUND

Employment dynamics increasingly reflect interactions among labour supply and demand, technological progress, productivity, and organizational adaptation (Aji

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& Akbardin, 2024; Lim, 2023). Employment stability and diversification remain important dimensions of organizational and regional resilience (Auer & Cazes, 2000; Bogdański, 2021). Concurrently, digitalisation intensifies demand for reskilling, lifelong learning, digital literacy, critical thinking, and adaptability (Grama & Todericiu, 2025). Workforce resilience consequently emerges from the interaction of employee adaptability, organizational capacity, digital infrastructure, human capital, and institutional conditions (Sony & Mekoth, 2022; Qazi, 2026).

METHODOLOGY

This study employs a quantitative descriptive research design to examine the determinants of employment dynamics, skills transformation, and workforce resilience within the context of the twin transition. Data were collected from Eurostat and the European Innovation Scoreboard. The analysis includes indicators describing employment, lifelong learning, digital skills, and labour productivity. Descriptive statistics and comparative analyses were applied to identify cross-country differences.

RESULTS

The empirical analysis indicates cross-country heterogeneity in workforce resilience across the EU-27. Member States characterized by stronger innovation performance, higher digital-skill levels, and greater R&D intensity generally exhibit higher employment rates and stronger participation in lifelong learning. Pearson correlation coefficients indicate positive associations between innovation performance and employment ($r \approx 0.69$), digital skills and lifelong learning ($r \approx 0.72$), and renewable-energy deployment and workforce adaptability ($r \approx 0.58$). Nordic and Western European economies display comparatively stronger resilience profiles, while several Central and Eastern European countries exhibit greater labour-market vulnerability. Overall, the results suggest that innovation capacity, skills development, digitalisation, and continuous learning are systematically associated with stronger workforce adaptability under the twin transition.

DISCUSSION / POLICY IMPLICATIONS

The findings indicates that workforce resilience depends on the interaction between technological advancement, institutional effectiveness, and sustained investment in human capital. Comparative evidence suggests that countries implementing integrated policies supporting digitalisation, innovation, lifelong

learning, and workforce reskilling achieve greater labour market adaptability and stronger economic competitiveness. European policy should prioritise coordinated investments in education, digital competencies, research capacity, and active labour market measures to reduce structural skills shortages and strengthen resilience. Such an integrated policy framework is essential for ensuring an inclusive, competitive, and sustainable labour market throughout the European twin transition.

CONCLUSION

The twin transition is transforming labour markets by simultaneously accelerating digitalization and the shift toward sustainable economic systems. Countries characterized by stronger innovation performance, greater digitalization, higher investment in research and development, and wider deployment of renewable energy technologies generally exhibit more favourable employment outcomes and enhanced workforce adaptability. Higher educational attainment, participation in lifelong learning, and the development of digital and green competencies significantly strengthen workers' ability to respond to evolving occupational requirements. At the same time, institutional quality, effective governance, and active labour market policies play a critical role in facilitating organizational adaptation and reducing the risks associated with skills mismatches and employment restructuring.

KEYWORDS

Employment, skills, transformation, workforce resilience, twin transition

REFERENCES

1. Aji, A. S. S., & Akbardin, M. (2024). Economic insights into workforce dynamics: Analyzing labor supply, demand, and compensation. *Advances in Human Resource Management Research*, 2(2), 113-126.
2. Auer, P., & Cazes, S. (2000). Resilience of the Long-Term Employment Relationship: Evidence from teh Industrialized Countries, the. I*nt'l Lab. Rev.*, 139, 379.
3. Bogdański, M. (2021). Employment diversification as a determinant of economic resilience and sustainability in provincial cities. *Sustainability*, 13(9), 4861.
4. Grama, B., & Todericiu, R. (2025). The Evolution of Skill Dynamics in the Context of the Future of Work. *Studies in Business and Economics*, 20(2), 137-154.
5. Lim, W. M. (2023). The workforce revolution: Reimagining work, workers, and workplaces for the future. *Global Business and Organizational Excellence*, 42(4), 5-10.

6. Qazi, A. (2026). Interdependent drivers of resilience: insights from the future of growth framework. *Competitiveness Review: An International Business Journal*, 36(2), 378-402.
7. Sony, M., & Mekoth, N. (2022). Employee adaptability skills for Industry 4.0 success: a road map. *Production & Manufacturing Research*, 10(1), 24-41.

BEYOND DIGITAL LITERACY: ASSESSING TRANSFORMATION READINESS IN THE TOURISM AND HOSPITALITY WORKFORCE

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INTRODUCTION

Digital transformation is reshaping workforce requirements across industries, increasing the importance of digital capabilities as drivers of innovation, adaptability, and competitiveness (Dredge et al., 2019; OECD, 2021; WTTC, 2025). However, workforce preparedness is often inferred from conventional measures of digital competence, despite limited evidence that digital literacy alone captures the capabilities needed to support organizational transformation. This discrepancy is conceptualized in this study as the transformation readiness gap, defined as the difference between employees' ability to use digital technologies and their ability to apply them strategically in support of organizational transformation.

LITERATURE REVIEW / THEORETICAL BACKGROUND

Existing research has primarily focused on technology adoption, digitalization, employability, and digital skills development (Buhalis & Law, 2008; Chung & D'Annunzio-Green, 2018; Lam & Law, 2019; Busulwa et al., 2022; Carlisle et al., 2023). While competence frameworks such as DigComp and related studies provide valuable insights into digital capabilities (European Commission, 2022; Van Laar et al., 2017), recent research has also highlighted persistent mismatches between educational outcomes and evolving competency requirements of digitally transforming workplaces (Chemli et al., 2024; Stylianou & Pericleous, 2025). Nevertheless, considerably less attention has been given to transformation-oriented competencies. Building on this gap, the study examines

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transformation-oriented competencies as a distinct dimension of workforce preparedness in digitally transforming tourism and hospitality environments.

METHODOLOGY

The study distinguishes between foundational digital competence, understood as the ability to use digital tools, and transformation-oriented competence, understood as the ability to apply digital technologies strategically for innovation, problem-solving, and organizational change. The study draws on primary data collected for the development of the Tourism Development Strategy of the Republic of Serbia 2026-2030. A survey of 194 employees in the tourism and hospitality sector, covering catering, tourism organizations, travel agencies, tourist guiding, tourism inspection, and administrative services, was used to assess workforce digital competencies across two composite dimensions: foundational competence and transformation-oriented competence. The latter was operationalized through the Transformation Readiness Index. Descriptive and comparative statistical analyses were applied.

RESULTS

The findings reveal a substantial disparity between the two dimensions. On a 0–100 scale, respondents achieved a high Foundational Competence Index (91.4), while the Transformation Readiness Index was considerably lower (41.8). The results further suggest that higher educational attainment is not consistently associated with stronger transformation-oriented competencies, indicating that workforce preparedness for digital transformation may be overestimated when assessed through conventional indicators of digital competence.

DISCUSSION / POLICY IMPLICATIONS

The findings indicate that digital competence and transformation readiness are related but distinct constructs. From a policy and organizational perspective, capability-building initiatives should extend beyond digital literacy and place greater emphasis on innovation, adaptability, problem-solving, and the strategic application of digital technologies. These capabilities are increasingly critical for supporting digital transformation in tourism and hospitality organizations.

CONCLUSION

By identifying a substantial transformation readiness gap, the study highlights the limitations of assessing workforce preparedness solely through conventional

indicators of digital competence. The findings suggest that, although employees may demonstrate strong foundational digital skills, these skills do not necessarily translate into the ability to apply digital technologies strategically for innovation, problem-solving, and organizational change. In this sense, the key challenge for tourism and hospitality organizations is no longer only whether employees can use digital technologies, but whether they can leverage them to support digital transformation and long-term competitiveness.

KEYWORDS

Digital transformation, transformation readiness, digital competencies, workforce preparedness, capability-building

REFERENCES

1. Buhalis, D., & Law, R. (2008). Progress in information technology and tourism management: 20 years on and 10 years after the Internet - The state of eTourism research. *Tourism Management*, 29(4), 609-623.
2. Busulwa, R., Pickering, M., & Mao, I. (2022). Digital transformation and hospitality management competencies: Toward an integrative framework. *International Journal of Hospitality Management,* 102, 103132. https://doi.org/10.1016/j.ijhm.2021.103132
3. Carlisle, S., Ivanov, S., & Dijkmans, C. (2023). The digital skills divide: evidence from the European tourism industry. *Journal of Tourism Futures*, 9(2), 240–266. https://doi.org/10.1108/jtf-07-2020-0114
4. Chemli, S., Toanoglou, M., & Del Val Roman, J. L. (2024). Skills mismatch and digital skill shortages in tourism: impact on graduate employment and implications for higher education. *International Journal of Technology Enhanced Learning,* 16(4), 447–465.
5. Chung, K. L., & D'Annunzio-Green, N. (2018). Talent management practices in small- and medium-sized enterprises in the hospitality sector. *Worldwide Hospitality and Tourism Themes*, 10(1), 101–116.
6. Dredge, D., Phi, G., Mahadevan, R., Meehan, E., & Popescu, E. S. (2019). Digitalization in tourism: In-depth analysis of challenges and opportunities. European Parliament, Policy Department for Structural and Cohesion Policies. https://vbn.aau.dk/en/publications/digitalisation-in-tourism-in-depth-analysis-of-challenges-and-opp/
7. European Commission, Joint Research Centre. (2022). The Digital Competence Framework for Citizens (DigComp 2.2): With new examples of knowledge, skills and attitudes (Y. Punie & M. Bacigalupo, Eds.). Publications Office of the European Union. https://doi.org/10.2760/115376

8. Lam, C., & Law, R. (2019). Readiness of upscale and luxury-branded hotels for digital transformation. *International Journal of Hospitality Management*, 79, 60–69. https://doi.org/10.1016/j.ijhm.2018.12.015
9. Organization for Economic Co-operation and Development. (2021). *Preparing the tourism workforce for the digital future*. OECD Publishing. https://doi.org/10.1787/9258d999-en
10. Stylianou, C., & Pericleous, K. (2025). Reviewing the digital skills and readiness of hospitality and tourism graduates: a way of success. *Worldwide Hospitality and Tourism Themes*, 17(1), 11–21.
11. Van Laar, E., Van Deursen, A. J. A. M., Van Dijk, J. A. G. M., & De Haan, J. (2017). The relation between 21st-century skills and digital skills: A systematic literature review. *Computers in Human Behavior,* 72, 577–588. https://doi.org/10.1016/j.chb.2017.03.010
12. World Travel & Tourism Council. (2025). *The future of work in travel and tourism: The key trends shaping workforce strategies*. WTTC Research Hub. https://researchhub.wttc.org/product/the-future-of-work-in-travel-tourism-the-key-trends-shaping-workforce-strategies

DIGITAL LITERACY AS A CATALYST FOR INCLUSIVE DIGITAL TRANSFORMATION: THE ROLE OF ONLINE SECURITY AND PSYCHOLOGICAL WELL-BEING ACROSS AGE GROUPS

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INTRODUCTION

Digital transformation is reshaping economic development, public services, education, healthcare, and everyday life by expanding access to digital technologies and creating new opportunities for innovation and participation. However, unequal digital competencies continue to create disparities in individuals' ability to engage safely and effectively in digital environments. Limited digital literacy increases vulnerability to online fraud, privacy violations, misinformation, and digital exclusion, particularly among older adults. Consequently, digital literacy should be viewed not only as a technological competence but also as a strategic capability supporting digital inclusion, online security, and psychological well-being within increasingly digital societies. This study investigates the role of digital literacy in promoting secure digital participation and inclusive digital transformation across age groups.

LITERATURE REVIEW / THEORETICAL BACKGROUND

Digital literacy is widely recognised as a multidimensional construct comprising information literacy, digital communication, content creation, problem-solving, and online security competencies (List et al., 2022). Recent digital transformation policies identify digital literacy as a critical component of human capital, innovation, and social inclusion (European Commission, 2023; OECD, 2023). Individuals with stronger digital competencies are more likely to participate confidently in digital services, maintain digital trust, and protect themselves

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against online threats. Emerging evidence also indicates that digital literacy contributes to psychological well-being by enhancing confidence, autonomy, and resilience while reducing technology-related anxiety and vulnerability to cyber risks.

METHODOLOGY

A quantitative cross-sectional design was employed involving 332 participants, including 152 younger adults (18–35 years) and 180 older adults (50 years and above). Digital literacy was assessed using the validated Everyday Digital Literacy Questionnaire (EDLQ), measuring seven competency domains: Information Literacy, Communication and Social Interaction, Productivity and Content Creation, Problem-Solving and Self-Efficacy, Ethics and Copyright, Security and Privacy, and Health Awareness. Additional measures included the WHO-5 Well-Being Index, secure digital participation, experiences of online security incidents, and demographic characteristics. Data were analysed using descriptive statistics, independent-samples *t*-tests, Pearson correlation coefficients, and hierarchical multiple regression analyses.

RESULTS

Statistically significant age differences were identified across all seven dimensions of digital literacy. Younger adults demonstrated higher digital competencies than older adults, with the largest differences observed in Security and Privacy and Problem-Solving and Self-Efficacy. These dimensions also exhibited the strongest associations with secure digital participation and psychological well-being. Higher levels of digital literacy were positively associated with confident use of digital services and negatively associated with experiences of phishing, online fraud, and privacy violations. Older adults possessing stronger digital competencies demonstrated substantially lower vulnerability to online risks and higher levels of psychological well-being, highlighting the protective role of digital literacy in digitally transforming societies.

DISCUSSION / POLICY IMPLICATIONS

The findings demonstrate that digital literacy is a strategic human capability underpinning inclusive digital transformation, innovation, and sustainable socio-economic development. Investments in digital infrastructure alone cannot ensure successful digital transformation unless accompanied by initiatives that strengthen citizens' digital competencies. Policymakers should integrate digital literacy into national innovation strategies, lifelong learning systems, digital

inclusion policies, and healthy ageing programmes. Particular emphasis should be placed on strengthening online security competencies and problem-solving skills, as these appear to provide the greatest benefits for secure digital participation and psychological well-being. Such investments can enhance digital trust, reduce cyber risks, and promote equitable participation within the digital economy.

CONCLUSION

Digital literacy functions as a catalyst for inclusive digital transformation by strengthening online security, supporting confident engagement with digital services, and promoting psychological well-being across age groups. The findings emphasise that digital competencies should be recognised as strategic human capital essential for innovation, resilience, and sustainable development. Future digital transformation policies should therefore combine technological innovation with investments in lifelong digital literacy programmes that foster secure digital participation, digital trust, and healthy ageing.

KEYWORDS

Digital literacy, digital transformation, online security, psychological well-being, digital inclusion

REFERENCES

1. European Commission. (2020). New Consumer Agenda: Strengthening consumer resilience for sustainable recovery.
2. List, A., Brante, E. W., & Klee, H. L. (2022). A framework of everyday digital literacy. *Computers in Human Behavior Reports*, 6, Article 100194. https://doi.org/10.1016/j.chbr.2022.100194
3. List, Alexandra & Brante, Eva & Klee, Holly. (2020). A framework of pre-service teachers' conceptions about digital literacy: Comparing the United States and Sweden. *Computers & Education*. 148. 103788. 10.1016/j.compedu.2019.103788.
4. OECD. (2023). *OECD Digital Economy Outlook 2023.*
5. van Deursen, A. J. A. M., Helsper, E. J., & Eynon, R. (2016). Development and validation of the Internet Skills Scale (ISS). *Information, Communication & Society*, 19(6), 804–823. https://doi.org/10.1080/1369118X.2015.1078834
6. World Health Organization. (1998). WHO-5 Well-being Index. WHO Regional Office for Europe. Zuboff, S. (2019). The age of surveillance capitalism: The fight for a human future at the new frontier of power. PublicAffairs.

SOCIO-DEMOGRAPHIC PREDICTORS OF ONLINE PURCHASING IN THE WESTERN BALKANS

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INTRODUCTION

The widespread adoption of the internet and mobile devices has substantially transformed the way businesses interact with consumers. Previous research highlights the role of digital technologies, digital marketing strategies, and digital competencies in improving business performance (Domazet & Lazarević-Moravčević, 2022; Ivanović et al., 2021; Lazić et al., 2022; Noerhartati et al., 2023). Identifying the socio-demographic characteristics associated with online purchasing behavior is important for developing more effective strategies, enabling companies to better understand their customers and reach new market segments (Wu, 2024). Evidence on these determinants can also help policymakers design targeted interventions that contribute to a more inclusive digital society. Despite the growing body of literature on online purchasing, investigation of regional patterns regarding socio-demographic characteristics in the Western Balkans based on harmonized cross-country data remains limited. Addressing this gap, this study aims to investigate the influence of socio-demographic factors on the use of mobile phones or the internet for online purchasing in the Western Balkan region.

LITERATURE REVIEW / THEORETICAL BACKGROUND

Mrdović (2023) highlights that expanding the use of digital services (e.g., online shopping, online ordering, and digital banking) is a key priority for the Western Balkans, with particular emphasis on ensuring equal access for all residents, strengthening trust, and narrowing the digital divide, given that digitalization contributes to overall well-being. Addressing this issue is particularly significant because the Western Balkans still lags behind neighboring European countries and

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has not yet completed its digital transition process. A recent OECD report (2025) also indicates only modest progress, showing that the share of individuals who made online purchases remains relatively low compared with the EU average, suggesting the importance of analyzing the impact of socio-demographic factors and taking appropriate measures to close the gap in the region. Previous studies have investigated the association of socio-demographic factors such as gender, age, education, income, workforce status, and residents' urbanicity with online purchasing engagement (Ivanović & Antonijević, 2025; Tutar et al., 2024; Gracz, 2023; Ismail & Wahid, 2022; Song, 2022; Colaço & Silva, 2022; Dominici et al., 2021; Ivanović & Antonijević, 2020). However, prior publications have predominantly examined individual Western Balkan countries using data collected at different points in time and based on different methodological approaches and study objectives. Moreover, no previous study has examined socio-demographic predictors of online purchasing using harmonized data collected simultaneously across all Western Balkan countries.

METHODOLOGY

The sample consisted of 3,727 respondents from the Western Balkans (Albania, Bosnia and Herzegovina, Montenegro, North Macedonia, and Serbia). Data were obtained from the latest Global Findex Database, with data collection conducted in these countries in 2024. The hypotheses were tested using binary logistic regression, with the dependent variable indicating whether a mobile phone or the internet was used to purchase something online, while the independent variables included socio-demographic characteristics (gender, age, education, income, workforce status, and area of residence).

RESULTS

The results show that gender, age, education, income, workforce status, and urbanicity have a statistically significant impact on online purchasing behavior. The key findings suggest that men, older respondents, individuals with lower levels of education and income, those who are out of the workforce, and residents of rural areas have lower odds of purchasing online.

DISCUSSION / POLICY IMPLICATIONS

The findings indicate that socio-demographic factors drive disparities in participation in online purchases within the Western Balkans. These results are in line with prior studies reporting the critical role of gender (Tutar et al., 2024; Dominici et al., 2021; Bhat et al., 2021), age (Tutar et al., 2024; Bhat et al., 2021;

Akman & Rehan, 2014; Colaço & Silva, 2022; Dominici et al., 2021; Ismail & Wahid, 2022), education (Tutar et al., 2024; Ristevska-Jovanovska, 2026; Akman & Rehan, 2014; Colaço & Silva, 2022; Dominici et al., 2021), income (Tutar et al., 2024; Akman & Rehan, 2014; Colaço & Silva, 2022), workforce status (Colaço & Silva, 2022), and urbanicity (Song, 2022) in shaping online shopping behavior. By providing regional evidence, the study contributes to the literature on consumer behavior and offers practical implications for businesses operating in the Western Balkans and for policymakers seeking to promote digital inclusion. Thus, strategies should be tailored to specific consumer groups who are less likely to engage in online purchasing, such as older individuals, those with lower education and income levels, those out of the workforce, and rural residents. Implementing targeted measures (e.g., enhancing digital skills and digital financial literacy, expanding access to digital infrastructure, and strengthening trust) could help reduce digital inequalities and promote a more inclusive digital society.

CONCLUSION

This study provides new evidence on the determinants of online purchasing in the Western Balkan region. The results suggest that targeted measures should be implemented, particularly for older individuals and those with lower levels of education and income, who are less likely to engage in online purchasing. Such measures could support their digital inclusion and enable them to benefit from the advantages of online shopping.

KEYWORDS

Online shopping, e-commerce, binary logistic regression, consumer behavior, digital economy

REFERENCES

1. Akman, I., & Rehan, M. (2014). Online purchase behaviour among professionals: a socio-demographic perspective for Turkey. *Economic research-Ekonomska istraživanja*, *27*(1), 689-699.
2. Bhat, S. A., Islam, S. B., & Sheikh, A. H. (2021). Evaluating the influence of consumer demographics on online purchase intention: An E-Tail Perspective. *Paradigm*, *25*(2), 141-160.
3. Colaço, R., & Silva, J. D. A. (2022). Exploring the e-shopping geography of Lisbon: Assessing online shopping adoption for retail purchases and food deliveries using a 7-day shopping survey. *Journal of Retailing and Consumer Services*, *65*, 102859.

4. Domazet, I. S., & Lazarević-Moravčević, M. (2022). Internet marketing: Factor of improving SME business in Serbia. In *Navigating digital communication and challenges for organizations* (pp. 202-222). IGI Global Scientific Publishing.
5. Dominici, A., Boncinelli, F., Gerini, F., & Marone, E. (2021). Determinants of online food purchasing: The impact of socio-demographic and situational factors. *Journal of Retailing and Consumer Services*, *60*, 102473.
6. Gracz, L. (2023). Differences in online shopping risk perception between urban and rural consumers in Poland. *European Research Studies Journal*, *26*(3), 729-739.
7. Ismail, K. A., & Wahid, A. (2022). The drivers and barriers of online shopping behaviours for older adults: A review. *International Journal of Education, Psychology, and Counselling*, *7*(47), 90-103.
8. Ivanović, Đ., & Antonijević, M. (2020). The role of online shopping in the Republic of Serbia during COVID-19. *Economic Analysis*, *53*(1), 28-41.
9. Ivanović, Đ., & Antonijević, M. (2025). Consumer online shopping behaviour in the Republic of Serbia post-COVID-19. *Teme*, *49*(2), 357-376.
10. Ivanović, Đ., Simović, V., Domazet, I., & Antonijević, M. (2021). Average matching levels for two DigComp competence areas of the female entrepreneurs in Serbia. *Journal of Women's Entrepreneurship and Education*, (3-4), 42-60.
11. Lazić, M., Domazet, I., & Vukmirović, V. (2022). Global pandemic and digital marketing: Trends and perspectives. *Marketing*, *53*(2), 143-152.
12. Mrdović, P. (2023). *The role of digitalisation in transforming Western Balkan societies* (Policy Brief No. 14/2023). Austrian Society for European Politics. https://www.wb2eu.eu/wp-content/uploads/2023/07/PB-142023.pdf
13. Noerhartati, E., Handani, N. D., & Dhaneswara, N. (2023). Exploring the influence of online reviews on Sales: An Empirical Analysis of lady-managed Indonesia Restaurant in East Asia. *Journal of Women's Entrepreneurship and Education*, (3/4), 48-74.
14. OECD. (2025). *Economic Convergence Scoreboard for the Western Balkans 2025*. OECD Publishing.
15. Ristevska-Jovanovska, S. (2026). Determinants of consumer behavior in online shopping: Evidence from North Macedonia. *Mest Journal*, *14*(1), 225-232.
16. Song, Z. (2022). The geography of online shopping in China and its key drivers. *Environment and Planning B: Urban Analytics and City Science*, *49*(1), 259-274.
17. Tutar, G., Küçükoğlu, H., Özdemir, A., Alkan, Ö., & Ipekten, O. B. (2024). An investigation of gender differences in e-commerce shopping frequency during COVID-19: Evidence from Türkiye. *Sage Open*, *14*(4), 21582440241287630.
18. Wu, M. Y. (2024). Profiling consumers' online shopping and following social media influencers behaviors. *Consumer Behavior Review*, *8*(1), e-261052.

FINANCIAL WELL-BEING IN THE DIGITAL AGE: TOWARD A RESEARCH AGENDA INTEGRATING SOCIAL MEDIA INFLUENCE, BEHAVIORAL BIASES, AND MINDFULNESS

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INTRODUCTION

With 63% of the global population active on social media (DataReportal, 2024), these platforms shape financial decisions, amplifying biases like herding and overconfidence (Haddad et al., 2021; Hirshleifer et al., 2024). Yet their consequences for financial well-being (Brüggen et al., 2017) remain unclear, as research examines biases in isolation and overlooks regulatory mechanisms. This review asks how social media shapes financial well-being through biases, and how mindfulness moderates it.

LITERATURE REVIEW / THEORETICAL BACKGROUND

Social media reduces information asymmetries yet amplifies herding (Banerjee, 1992) and overconfidence (Barber & Odean, 2001). Prior work treats these biases in isolation from psychological self-regulation. The review integrates behavioral finance (Barberis & Thaler, 2003; Kahneman & Tversky, 1979), social influence (Kelman, 1958) and dual-process (Kahneman, 2011) theories in a Stimulus–Organism–Response model. Bias is the mechanism; mindfulness (Brown & Ryan, 2003) the moderator.

METHODOLOGY

Following Tranfield et al. (2003), a systematic review was conducted in Scopus under the PRISMA protocol with PICO inclusion criteria. Of 267 identified records, 38 peer-reviewed empirical studies met eligibility. These were examined through two complementary approaches: bibliometric analysis (keyword co-occurrence,

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co-authorship; VOSviewer) and qualitative thematic content analysis (Mayring, 2014).

RESULTS

Publications surged post-2020, with behavioral finance being the most central theme. Four clusters emerged: behavioral bias mechanisms (Odean, 1998); social influence and digital connectivity (Shiller, 2017); psychological effects and financial well-being; and mindfulness and decision-making (Hafenbrack et al., 2014). Synthesis yields an Antecedent–Intervention–Consequence (AIC) framework and four testable propositions awaiting empirical validation.

DISCUSSION / POLICY IMPLICATIONS

Prior work examined social media, biases and mindfulness separately; this review unifies them, extending behavioral finance beyond bias-centric models. Biases are theorised to mediate the exposure–well-being link, and mindfulness to moderate it by supporting reflective choice (Kabat-Zinn, 2003). Implications: educators pair financial literacy (Lusardi & Mitchell, 2014) with mindfulness; platforms curb comparison-driven design; policymakers oversee finfluencers.

CONCLUSION

This review unifies behavioral biases, social media and mindfulness into one framework of financial well-being. Social media amplifies herding, overconfidence and anchoring through rapid diffusion and sentiment contagion, while mindfulness counters these via attentional and emotional regulation, supporting self-control (Strömbäck et al., 2017) and sound financial behavior (Xiao & O'Neill, 2018). The contribution is conceptual; future work should test the AIC model.

KEYWORDS

Behavioral finance, financial well-being, systematic literature review, social media, mindfulness

REFERENCES

1. Banerjee, A. V. (1992). A simple model of herd behavior. *The Quarterly Journal of Economics*, 107(3), 797–817.
2. Barber, B. M., & Odean, T. (2001). Boys will be boys: Gender, overconfidence, and common stock investment. *The Quarterly Journal of Economics*, 116(1), 261–292.

3. Barberis, N., & Thaler, R. (2003). A survey of behavioral finance. In G. M. Constantinides, M. Harris, & R. Stulz (Eds.), Handbook of the economics of finance (Vol. 1B, pp. 1053–1128). Elsevier.
4. Brown, K. W., & Ryan, R. M. (2003). The benefits of being present: Mindfulness and its role in psychological well-being. *Journal of Personality and Social Psychology*, 84(4), 822–848.
5. Brüggen, E. C., Hogreve, J., Holmlund, M., Kabadayi, S., & Löfgren, M. (2017). Financial well-being: A conceptualization and research agenda. *Journal of Business Research*, 79, 228–237.
6. DataReportal. (2024). Digital 2024: Global overview report. https://datareportal.com
7. Haddad, C., Amihud, Y., & Hameed, A. (2021). Social media sentiment and stock market volatility. *Finance Research Letters*, 40, 101752.
8. Hafenbrack, A. C., Kinias, Z., & Barsade, S. G. (2014). Debiasing the mind through meditation: Mindfulness and the sunk-cost bias. *Psychological Science*, 25(2), 369–376.
9. Hirshleifer, D., Teoh, S. H., & Yu, J. (2024). Social transmission bias in financial markets. *The Review of Financial Studies*, 37(1), 55–98.
10. Kabat-Zinn, J. (2003). Mindfulness-based interventions in context: Past, present, and future. *Clinical Psychology: Science and Practice*, 10(2), 144–156.
11. Kahneman, D. (2011). *Thinking, fast and slow*. Farrar, Straus and Giroux.
12. Kahneman, D., & Tversky, A. (1979). Prospect theory: An analysis of decision under risk. *Econometrica*, 47(2), 263–291.
13. Kelman, H. C. (1958). Compliance, identification, and internalization: Three processes of attitude change. *Journal of Conflict Resolution*, 2(1), 51–60.
14. Lusardi, A., & Mitchell, O. S. (2014). The economic importance of financial literacy: Theory and evidence. *Journal of Economic Literature*, 52(1), 5–44.
15. Mayring, P. (2014). Qualitative content analysis: Theoretical foundation, basic procedures and software solution. Klagenfurt: SSOAR.
16. Odean, T. (1998). Are investors reluctant to realize their losses? *The Journal of Finance*, 53(5), 1775–1798.
17. Shiller, R. J. (2017). Narrative economics. *American Economic Review*, 107(4), 967–1004.
18. Strömbäck, C., Lind, T., Skagerlund, K., Västfjäll, D., & Tinghög, G. (2017). Does self-control predict financial behavior and financial well-being? *Journal of Behavioral and Experimental Finance*, 14, 30–38.
19. Tranfield, D., Denyer, D., & Smart, P. (2003). Towards a methodology for developing evidence-informed management knowledge by means of systematic review. *British Journal of Management*, 14(3), 207–222.
20. Xiao, J. J., & O'Neill, B. (2018). Propensity to plan, financial capability, and financial satisfaction. *International Journal of Consumer Studies*, 42(5), 501–512.

ARTIFICIAL INTELLIGENCE, CAPITAL INTENSITY AND DIGITAL TRANSFORMATIO: EVIDENCE FROM EUROPEAN SECTORS

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INTRODUCTION

Digital transformation has become a key factor of business competitiveness. Growing attention is devoted to family businesses, which are often represented within the SME sector, accounting for over 99% of enterprises in Europe. Artificial Intelligence (AI) is increasingly viewed as a driver of productivity and innovation. This paper examines whether the effectiveness of AI depends on complementary capital resources and discusses implications for digital transformation.

LITERATURE REVIEW / THEORETICAL BACKGROUND

Digital transformation and emerging technologies represent critical drivers for enhancing business competitiveness (Vial, 2019). Artificial Intelligence is widely recognized as a transformative force capable of altering labor markets and operations (Acemoglu & Restrepo, 2019). However, the literature highlights a digitalization paradox where technology investments do not always translate into immediate productivity gains (Brynjolfsson et al., 2021). This phenomenon is explained by the Productivity J-Curve which shows that realizing true value requires substantial implementation costs and organizational adaptations

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(Brynjolfsson et al., 2021; Gebauer et al., 2020). Furthermore, research indicates that economic impacts and labor productivity growth are deeply contingent on complementary assets and capital intensity, heavily influenced by underlying technology diffusion and capital structures (Anderton et al., 2023; Calvino & Fontanelli, 2023; Guo et al., 2023).

METHODOLOGY

The study uses a balanced panel dataset covering 29 European countries and nine NACE sectors over the period 2021–2024 (sourced from Eurostat). A fixed-effects regression model examines the direct relationship between AI adoption, capital intensity, and Unit Labour Costs (ULC), alongside their interaction term. The empirical findings provide generalizable insights relevant for catching-up economies and SME-dominated sectors across Europe.

RESULTS

The empirical findings show that AI adoption alone does not automatically generate immediate cost savings, confirming initial implementation lags consistent with the productivity J-curve theory. However, the interaction between AI adoption and capital intensity has a statistically significant negative effect on Unit Labour Costs. Specifically, the interaction between AI adoption and capital intensity is negative and statistically significant ($\beta = -0.022$, $p < 0.05$), confirming that higher capital intensity strengthens the cost-reducing effect of AI. This indicates that sectors with stronger capital foundations are substantially better positioned to convert AI investments into tangible productivity gains and long-term labour cost reductions.

DISCUSSION / POLICY IMPLICATIONS

The results indicate that successful digital transformation requires a holistic approach that goes beyond mere technology adoption, addressing the digitalization paradox and asset complementarity. Capital availability and structural depth act as key moderators determining whether AI investments produce measurable economic benefits. Digitalization policies should strategically combine support for AI technology adoption with targeted incentives for capital investment, infrastructure, and modernization, particularly within the SME and family business sectors.

CONCLUSION

The study confirms that the economic benefits of AI depend fundamentally on sectoral capital intensity and complementary asset accumulation. While implementation may initially generate adjustment costs, capital-intensive structures are more likely to achieve long-term structural efficiency gains. These findings establish a robust empirical foundation for future research on digital transformation, SMEs, and family-business development.

KEYWORDS

Artificial Intelligence, Digital Transformation, Capital Intensity, Smes, Productivity, Digitalization

REFERENCES

1. Acemoglu, D., & Restrepo, P. (2019). Automation and new tasks: How technology displaces and reinstates labor. Journal of Economic Perspectives, 33(2), 3–30.
2. Anderton, R., Reimers, P., & Botelho, V. (2023). Digitalisation and productivity: Gamechanger or sideshow? ECB Working Paper Series.
3. Brynjolfsson, E., Rock, D., & Syverson, C. (2021). The productivity J-curve: How intangibles complement general purpose technologies. American Economic Journal: Macroeconomics, 13(1), 333–372.
4. Calvino, F., & Fontanelli, L. (2023). Artificial intelligence, complementary assets and productivity: Evidence from French firms. LEM Working Paper Series.
5. Gebauer, H., Fleisch, E., Lamprecht, C., & Wortmann, F. (2020). Growth paths for overcoming the digitalization paradox. Business Horizons, 63(3), 313–323.
6. Guo, X., Li, M., Wang, Y., & Mardani, A. (2023). Does digital transformation improve firm performance? From the perspective of digitalization paradox and managerial myopia. Journal of Business Research, 163, 113868.
7. Vial, G. (2019). Understanding digital transformation: A review and a research agenda. The Journal of Strategic Information Systems, 28(2), 118–144.

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