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Small and Medium-sized Enterprises (SMEs) are pivotal to both economic resilience and innovation across the European Union. Despite representing 99.7% of all enterprises in Romania and employing over 65% of the workforce, Romanian SMEs remain significantly underrepresented in applied research initiatives compared to their Western European counterparts. This paper explores the structural and strategic challenges that hinder research integration within Romanian SMEs, including limited access to funding, weak innovation ecosystems, and insufficient collaboration with academic and technological institutions. Drawing on official data from Eurostat, the European Commission, and the National Institute of Statistics, the study highlights the discrepancy between Romania and the EU average in terms of research participation—particularly within Horizon Europe programs—and proposes actionable strategies to enhance technology transfer and policy alignment. Emphasis is placed on regional disparities, Smart Specialisation Strategies (RIS3), and the role of digitalisation in strengthening SME innovation capacity. The findings underline the urgent need for coherent policy instruments and targeted support to bridge the innovation divide between Romania and the rest of the EU.

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Abstract

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Keywords

Small and Medium-sized; Applied Research; Innovation Gap; EU Funding; Romania vs EU Comparison.

I. Introduction

Small and Medium-sized Enterprises (SMEs) are the cornerstone of economic growth, innovation, and employment in the European Union. Accounting for over

99% of all businesses and generating more than half of the value added in the EU economy, SMEs play a central role in fostering competitiveness and technological progress. Their flexibility, adaptability, and proximity to market needs make them ideal vectors for applying research and development (R&D) outcomes.

In Romania, SMEs mirror the European structural composition, representing 99.7% of all active firms and contributing approximately 49–50% to the national GDP. However, their involvement in applied research remains limited and fragmented. Recent data from the European Commission shows that only 0.7% of Romanian SMEs have participated in Horizon Europe programs, far below the EU average of 3.5%. This discrepancy reveals not only a research gap but also an innovation divide that risks deepening socio-economic disparities between Romania and more research-intensive EU member states.

Several factors contribute to this divergence. Romanian SMEs often face systemic barriers such as inadequate access to funding, a lack of skilled personnel, limited digital infrastructure, and insufficient collaboration with research institutions and innovation clusters. Moreover, the fragmentation of regional innovation ecosystems and the absence of long-term innovation strategies at the firm level further hinder the integration of R&D into business models.

The aim of this paper is to provide a comparative analysis of applied research participation among SMEs in Romania and the broader EU context. We explore the institutional, financial, and structural constraints specific to the Romanian environment, while highlighting successful policy frameworks and strategic partnerships implemented elsewhere in Europe. Special attention is given to the role of Smart Specialisation Strategies (RIS3), digitalisation trends, and technology transfer mechanisms as enablers of SME-driven innovation.

By investigating both challenges and opportunities, this study contributes to a more nuanced understanding of the research-to-innovation continuum in SMEs and offers evidence-based recommendations for policymakers, innovation intermediaries, and business leaders.

II. Methodology

This study employs a mixed-methods research design, integrating both quantitative and qualitative approaches to explore the extent to which Romanian SMEs engage in applied research and how this compares with EU-level performance.

A. Data Sources and Collection

Quantitative data were collected from several authoritative sources, including:

- Eurostat – Structural Business Statistics, which provides key SME indicators on employment, value added, and innovation output [1];

- European Commission – Annual Report on European SMEs 2022/2023, offering insights on SME participation in research, access to funding, and innovation intensity [2];
- Romanian National Institute of Statistics (INS), for updated figures regarding the number, size, and economic contribution of SMEs across sectors [3];
- Digital Economy and Society Index (DESI), used to assess digital capabilities of SMEs across EU countries [4];
- Public datasets from Horizon Europe and COSME programme dashboards, indicating Romania's participation rate in EU-funded research projects [5].

In addition, qualitative data were sourced from Romanian and European policy documents, including regional innovation strategies (RIS3), national research frameworks, and strategic development plans [6].

B. Analytical Framework

The research follows a comparative-descriptive approach based on two analytical axes:

- Participation Metrics – Assessing SMEs' engagement in research projects, collaboration with universities, involvement in clusters, and application to EU or national funding schemes [7].
- Enabling Conditions and Barriers – Evaluating structural factors such as financial access, digitalisation, human capital, and regional support ecosystems [8].

Benchmarking was conducted using KPIs such as:

- SME R&D expenditure as % of turnover [9].
- Participation in Horizon Europe and COSME (% of total SMEs) [5].
- Level of cooperation with academia and innovation clusters [10].
- DESI digitalisation scores for SMEs [4].
- Share of innovative products or services introduced in the last 3 years [2].

The analysis compared Romania's position relative to the EU average and selected high-performing countries (e.g., Germany, Finland, Netherlands) [1][2].

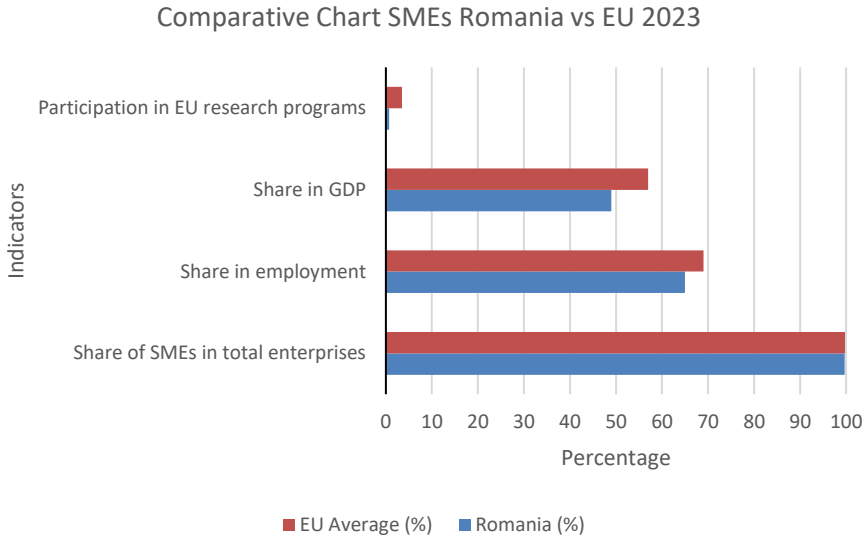


Figure 1. Comparative Chart SMEs Romania vs EU 2023

Table 1. The table below presents a comparative overview of key performance indicators for small and medium-sized enterprises (SMEs) in Romania and the European Union average in 2023.

Indicator	Romania (2023)	EU Average (2023)
SMEs as % of total enterprises	99.7%	99.8%
SMEs employment contribution	65–67%	67–70%
SMEs GDP contribution	49%	56–58%

C. Regional Case Analysis

To capture the intra-national dimension, a regional comparative lens was applied by examining three development regions in Romania with distinct RIS3 priorities:

- North-East: Focused on bioeconomy and agro-innovation [6];
- South-East: Prioritising blue economy and renewable energy [6];
- Centre Region: Targeting mechatronics and creative industries [6].

These cases highlight how localized policies shape SME participation in research and access to funds and help identify both success factors and systemic bottlenecks.

D. Regional Case Analysis

This study uses the most up-to-date available data (2022–2023), but several limitations apply. First, data comparability between EU member states can be affected by differences in reporting cycles or indicators [1][5]. Second, SME involvement in applied research may be underrepresented in national statistics due to delayed or underreported figures [3].

Despite these, the use of triangulation across multiple sources strengthens the reliability of the results, while the combination of macro- and micro-level analyses ensures a robust understanding of SME research engagement.

E. Research Objective and Scope

The primary objective of this research is to investigate the current state, challenges, and opportunities related to the implementation of applied research projects within small and medium-sized enterprises (SMEs), with a particular focus on Romania, while maintaining a broader comparative perspective with the European Union. This study aims to identify structural barriers, assess the effectiveness of public policies and funding instruments, and evaluate the role of SMEs in fostering innovation ecosystems at both national and regional levels.

Specifically, the research seeks to:

- Analyse the economic and strategic relevance of SMEs in Romania and the EU.
- Assess the degree of integration of applied research in Romanian SMEs.
- Identify funding mechanisms (EU and national) that support research-driven innovation in SMEs.
- Evaluate the impact of digitalization and technological readiness on SME research capacity.
- Examine the collaboration frameworks between SMEs, universities, and innovation clusters.
- Propose recommendations for improving the absorption and efficiency of research initiatives in SMEs.

The scope of this research covers:

- SMEs as defined by EU Recommendation 2003/361/EC, focusing on enterprises with fewer than 250 employees and an annual turnover of less than €50 million.
- The period between 2015 and 2024, corresponding to relevant EU funding cycles and digital transformation trends.
- Quantitative indicators (e.g., SME share of GDP, employment, participation in Horizon Europe) and qualitative aspects (e.g., innovation culture, strategic planning for R&D).
- Comparative regional analysis across Romanian development regions and selected EU countries with similar economic profiles.

By delineating these objectives and boundaries, the research aims to contribute both theoretically and practically to understanding how SMEs can better engage in applied research, leveraging innovation as a competitive advantage.

III. Results

The results of the research indicate that Romanian small and medium-sized enterprises (SMEs) continue to play a significant structural role in the national economy, yet they encounter considerable obstacles when engaging in research and innovation activities. Empirical data from Eurostat and national statistics show that SMEs account for 99.7% of all active enterprises in Romania, employ over 65% of the national workforce, and contribute approximately 49–50% to the country's gross domestic product (GDP). While these figures reflect a robust presence of SMEs in economic terms, their performance in accessing and leveraging research funding remains substantially limited.

At the European level, the average participation rate of SMEs in Horizon Europe research funding programs reached 3.5% in 2023. By contrast, only 0.7% of Romanian SMEs were involved in such initiatives. This striking gap reveals structural deficiencies in terms of institutional support, digital infrastructure, and research readiness across the Romanian SME landscape. The data suggests that many firms lack the internal capacity and strategic orientation required to access these competitive funding instruments. Despite numerous national programs supporting entrepreneurship and innovation, such as Start-Up Nation and POCU, the absorption rate of research-oriented funding in Romania remains modest and uneven across sectors and regions.

A further examination of sectoral investment patterns reveals that European research and innovation funds allocated to Romanian SMEs between 2014 and 2020 were concentrated predominantly in a few key areas. The most targeted sectors included information and communication technology, agro-food innovation, renewable energy, health sciences, and manufacturing technologies such as mechatronics. Although these investments reflect alignment with EU research priorities, the actual impact on innovation outputs within SMEs appears limited, largely due to insufficient follow-up mechanisms, weak commercialization channels, and low institutional connectivity.

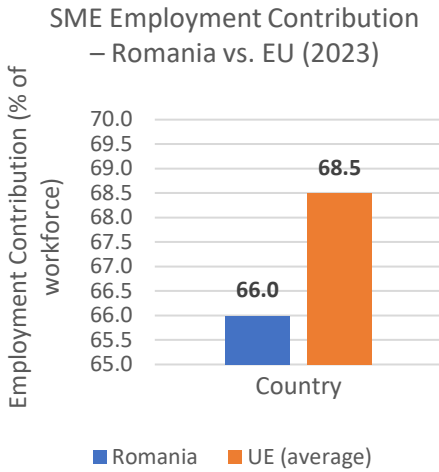


Figure 2. SME Employment Contribution Romania vs. EU (2023)

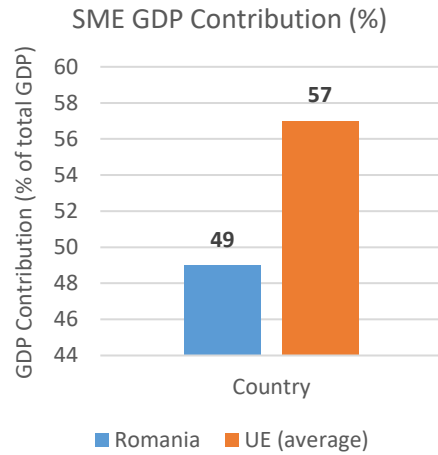


Figure 3. SME GDP Contribution Romania vs. EU (2023)

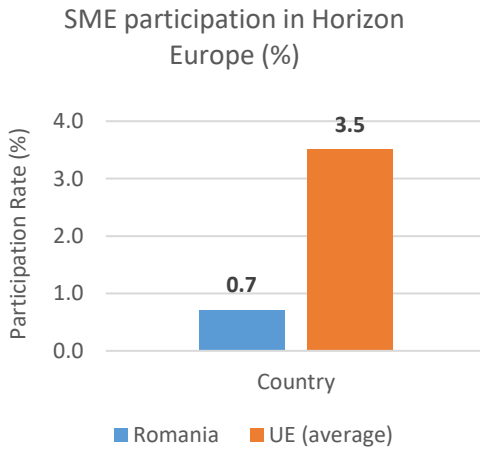


Figure 4. SME Participation in Horizon Europe Romania vs. EU (2023)

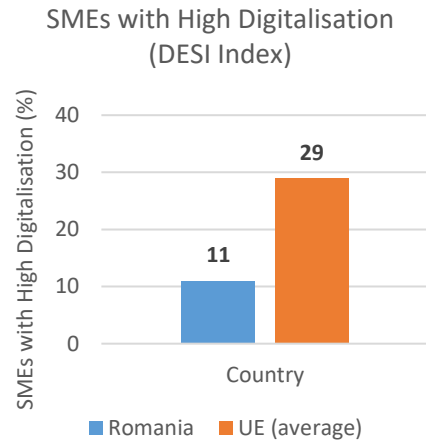


Figure 5. SMEs with High Digitalisation Romania vs. EU (2023)

In terms of digital maturity, Romanian SMEs rank significantly below the European average. According to the Digital Economy and Society Index (DESI), only around 11% of SMEs in Romania had a high level of digitalization between 2015 and 2020, compared to 29% across the EU. This technological lag correlates

strongly with diminished research performance and the adoption of innovation. Digital tools are fundamental enablers of participation in research projects, especially in cross-border collaborations, where interoperability and data access are essential. The limited integration of digital infrastructure within Romanian SMEs thus acts as a barrier to research participation, both in terms of execution and in accessing funding mechanisms that require a minimum level of technological capability.

Regional disparities are also evident in the implementation of Smart Specialisation Strategies (RIS3), a key component of EU cohesion policy. Romanian development regions have defined distinct priority sectors based on their local potential and economic fabric. For instance, the North-East region has prioritized bioeconomy and agro-innovation, the South-East has focused on renewable energy and maritime industries, while the Centre region emphasizes creative industries and advanced manufacturing. While RIS3 frameworks are meant to tailor research priorities to regional strengths, the capacity of SMEs to actively participate in these strategies remains limited by a lack of coordination between regional governance bodies, academic institutions, and the business environment.

Ultimately, the evidence points to several persistent bottlenecks that hinder Romanian SMEs' integration of applied research into their business models. These include a shortage of qualified personnel in research and development, limited access to strategic consultancy services, inadequate communication between academia and the private sector, and a general lack of awareness regarding funding instruments and their requirements. Addressing these limitations requires not only increased financial resources but also a shift in institutional design, capacity-building, and improved outreach mechanisms to ensure inclusivity and long-term engagement.

IV. Conclusion

This study sheds light on the critical role of SMEs in shaping Romania's economic resilience and innovation potential, particularly in contrast with broader European Union trends. Although Romanian SMEs constitute the majority of enterprises and serve as key drivers of employment, their contribution to research, innovation, and productivity remains below their potential. The comparative analysis with EU data reveals persistent structural and operational gaps, particularly in digitalization, access to funding, and participation in European research programs.

The findings point to a need for systemic change at multiple levels. First, enhancing SMEs' digital capabilities is essential. Low digital maturity significantly hampers the ability of firms to engage in research collaboration, adopt new technologies, and integrate innovation into business models. Addressing this issue requires not only investment in infrastructure but also in education and digital literacy across the SME workforce.

Second, the integration of SMEs into research ecosystems remains fragmented. Despite initiatives such as Horizon Europe and RIS3 strategies, Romanian SMEs' actual participation in collaborative innovation remains minimal. Strengthening partnerships between universities, research institutes, and the private sector is essential to creating a functional innovation ecosystem. Furthermore, the promotion of intermediary organizations such as innovation clusters and technology transfer centers could significantly ease the transition from academic knowledge to market-ready solutions.

Third, regional disparities must be acknowledged and addressed. While smart specialization strategies reflect regional strengths and priorities, their implementation varies widely across Romanian territories. Ensuring consistency, equity, and effectiveness in the distribution of research and innovation funds is key to fostering balanced regional development and unlocking the untapped potential of SMEs in less-developed areas.

Ultimately, the research highlights both the urgency and the opportunity of strengthening SME participation in applied research. Policymakers, academic institutions, and business leaders must work together to create a more enabling environment for innovation—one where SMEs are not peripheral actors but central drivers of sustainable growth. Supporting their capacity to innovate is not only a matter of economic competitiveness but also a strategic imperative for ensuring Romania's successful integration into a knowledge-based European economy. At the same time, these findings underline the need for further investigation into regional specificities, digitalisation trends, and collaborative mechanisms, aspects which are outlined in the following section on future research directions.

V. Future Research Directions

While the present paper has explored the current state of applied research in Romanian SMEs compared to EU trends, further work is needed to provide a more comprehensive understanding of the phenomenon. Several directions for future research can be outlined:

- **Extend longitudinal analysis (2025–2030):** Future studies should cover longer time horizons, integrating upcoming data from Horizon Europe and Romania's National Recovery and Resilience Plan (PNRR), to capture structural changes in SME research involvement.
- **Regional case studies:** In-depth investigations of SMEs across Romanian regions (e.g., North-East, Centre, South-East) could provide insights into territorial disparities and highlight localized barriers to research participation.
- **Digitalisation and Industry 4.0 adoption:** Further research should explore the extent to which advanced digital tools, artificial intelligence, and Industry 4.0 technologies shape SME innovation capacity and competitiveness.

- Collaborative ecosystems: Future work could examine the impact of clusters, technological transfer centres, and cross-border partnerships on bridging the innovation divide between Romania and the EU average.

- Socio-economic impact assessment: It would also be valuable to assess how increased SME participation in research contributes to Romania's economic growth, resilience, and convergence with EU development standards.

By pursuing these avenues, research can support policymakers and business leaders in designing targeted measures that enhance the role of SMEs in innovation-driven growth.

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