# ASSESSING THE IMPACT OF DIGITALIZATION ON SMEs IN ROMANIA. BRAŞOV SMEs STUDY CASE

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***Abstract:*** *Digitalization is a crucial advancement of recent decades, progressing swiftly and substantially altering the modern economy. The economic crisis induced by the epidemic has underscored the significance of technology, particularly digital technologies, in both the economy and society. In 2024, the European Commission prioritizes digitalization, aspiring to establish a sophisticated digital ecosystem by 2030, with the objective that 90% of European SMEs implement essential digital solutions, including cloud computing, artificial intelligence, and big data.*

*In Romania, small and medium-sized enterprises (SMEs) comprise 99.7% of all active firms and employ 66% of the labour force, playing a crucial role in the national economy. Despite the significance of digitalization for enhancing the competitiveness and performance of SMEs, Romania's degree of digitization remains comparatively low relative to other European nations, as shown by the 2024 Digital Economy and Society Index (DESI). Nonetheless, SMEs in Romania are afforded an increasing ecosystem to promote digitization, including Digital Innovation Centers and governmental programs like the StartUp Nation program and the Authority for the digitization of Romania (ADR).*

*This research examines the use of digital technologies by SMEs in Romania, contrasting it with the usage by SMEs in other European Union member states. The study aims to assess the impact of digitalization on SMEs in Romania, highlighting that the challenges to digitalization differ based on the level of digitalization and the size of the businesses. Digitalization engenders novel tactics and alters society and the workforce, significantly affecting the manner in which technology impacts professional*

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*life (Deaconu, Igreț, 2019). This research used the DESI index and the χ2 test to examine the impact of digitalization on SMEs in Brașov, highlighting the significance of digital technology and the assistance offered by European and national efforts to enhance their performance.*

***Keywords:*** *digital transformation; digital innovation; digital competitiveness; innovation performance*

***JEL Classification:*** *M15, O12*

## 1. Introduction

Historically, enterprises produced goods and provided services in tangible markets, facilitating face-to-face interactions between sellers and buyers. However, contemporary digital technologies have revolutionized the traditional commercial economy into a digital economy, characterized by online markets where consumers engage virtually, and transactions for products and services occur online.

The COVID-19 pandemic, from which we have only just emerged, has shown the extent of human society's reliance on technology, solutions, and information systems to address the issues of the 21st century (Khrais, Alghamdi, 2022; Foris et al, 2022; Nichifor et al, 2022; Mamatzhonovich et al, 2022).

Small and medium firms in Romania constitute 99.7% of all Romanian companies and employ 65.8% of the active workforce in Romania. The durability and resilience of these SMEs signify their capacity to maintain a competitive profile and adapt their business operations over time, while safeguarding the environment and managing resources effectively (Maniu et al, 2021, Journeault et al, 2021).

The current operational environment for Romanian SMEs is characterized by a high degree of digitalization. Digitalization affords Romanian SMEs more agility in decision-making, communication, and the execution of business activities. The process is complex and requires

resources (Yu et al, 2023); hence, SMEs may also seek non-reimbursable funding for digitization.

A competent human resource pool and an adaptable, creative management framework are necessary. Operating as a sustainable SME entails the use of digital technology, the digitization of processes and operations, and the employment of digital tools for communication, collaboration, promotion, management, and leadership. Organizations and individuals have recognized the need to transition operations and activities online, understanding the influence that digitalization has on productivity and development (Luca, 2020).

While studies highlight the significance of digitalization for the competitiveness of SMEs and note the low degree of digitalization in Romania, there is a lack of local research that specifically examines the impact of digitalization on SMEs in particular localities, such as Braşov. It is essential to comprehensively analyse the influence of digitalization on management choices and the performance of SMEs, including the significance of financing and support activities.

## 2. Literature review

While SMEs are a vital component of the economy, their sustainability largely relies on the precision of the data and information used. Their performance, as shown by the greater or lower levels recorded in the recent time, both internationally and in terms of resource utilization, has facilitated the identification of the actual requirements for enhancing management (Demyen, Ciurea, 2013).

In the realm of corporate organization management, digitalization is seen as an essential prerequisite for competitiveness, irrespective of size and industry. Consequently, digitalization in company management and marketing has lately emerged as a subject of scholarly investigation (Gerasimenko, Razumova, 2020).

In an age of globalization and modernization across all sectors, characterized by the rapid dissemination of information, firms endeavour

to conform to globally established standards. No organization can endure in isolation, using primitive operational procedures, without adjusting to emerging trends (Demyen, Ciurea, 2013).

Studies in sustainable development emphasize the significance of innovative technology, novel methods, and behaviours (Al-Emran et al, 2023; Jiménez et al, 2023, Krajˇco et al, 2019, Bhutani et al, 2007). A portion of the necessary knowledge to address the issues of the 21st century is already prevalent in society, necessitating enhanced collaboration between enterprises and civil society, as they serve as vital partners for future sustainable development.

The fourth industrial revolution is advancing via the use of technology-driven processes. To provide optimal solutions for governance and society, continuous communication with the private, academic, and corporate sectors is essential. The digitization of organizations and the adoption of Industry 4.0 will expedite the allocation of computing resources in industry, driven by the growing use of robots, artificial intelligence, and digital technologies.

The worldwide rating of digital competitiveness for 2022 has United States in top place, the Netherlands in second, and Singapore in third. This score indicates a nation's capacity to embrace and execute digital technologies inside businesses and governmental organizations. This rating puts Romania at the limit of the lowest quartile (the 48th position of 64) (World Digital Competitiveness Ranking. 2023).

The Digital Economy and Society Index (DESI) reflects Europe's digital performance and the digital advancements of European Union nations. Beginning in 2014, DESI established a digital profile for every nation. The goals and critical domains of digital development are thereby delineated. According to the latest at this time Digital Economy and Society Index of 2022, Finland is the most digitally advanced nation (Report on the state of the Digital Decade 2024).

Romania is the least digitally advanced according to Report on the state of the Digital Decade 2024 (Figure 1).

| Digital Decade KPI [1] | Romania | | | EU | | Digital Decade target by 2030 | |
|---|---|---|---|---|---|---|---|
| | DESI 2023 | DESI 2024 | Annual progress | DESI 2024 (year 2023) | Annual progress | RO | EU |
| Fixed Very High-Capacity Network (VHCN) | 95.6% | 95.0% | -0.6% | 78.8% | 7.4% | 99% | 100% |
| Fibre to the Premises (FTTP) coverage | 95.6% | 95.0% | -0.6% | 64.0% | 13.5% | 99% | - |
| Overall 5G coverage | 26.8% | 32.8% | 22.4% | 89.3% | 9.8% | 62% | 100% |
| Semiconductors | | NA | | | | | |
| Edge Nodes | | 5 | | 1 186 | | 113 | 10 000 |
| SMEs with at least a basic level of digital intensity | 22.2% | 26.8% | 9.9% | 57.7% | 2.6% | 75% | 90% |
| Cloud | 11.3% | 15.5% | 17.1% | 38.9% | 7.0% | 40% | 75% |
| Artificial Intelligence | 1.4% | 1.5% | 3.5% | 8.0% | 2.6% | 10% | 75% |
| Data analytics | NA | 21.9% | NA | 33.2% | NA | 15% | 75% |
| AI or Cloud or Data analytics | NA | 28.7% | NA | 54.6% | NA | | 75% |
| Unicorns | | 0 | | 263 | | x | 500 |
| At least basic digital skills | 27.8% | 27.7% | -0.2% | 55.6% | 1.5% | 50% | 80% |
| ICT specialists | 2.8% | 2.6% | -7.1% | 4.8% | 4.3% | 4% | ~10% |
| e ID scheme notification | | No | | | | | |
| Digital public services for citizens | 47.6 | 52.2 | 9.7% | 79.4 | 3.1% | 100 | 100 |
| Digital public services for businesses | 44.6 | 50.0 | 12.1% | 85.4 | 2.0% | 100 | 100 |
| Access to e-Health records | 57.1 | 58.6 | 2.7% | 79.1 | 10.6% | x | 100 |

[1] See the methodological note for the description of the indicators and other descriptive metrics
[2] Last measure used is for 2021

***Figure 1*** *– Report on the state of the Digital Decade 2024 – Annex 3 Romania Executive Summary*

*Source: https://digital-strategy.ec.europa.eu/en/library/report-state-digital-decade-2024*

In 2022, Romania achieved significant advancements in the digitalization of public services and small and medium-sized enterprises (SMEs), while maintaining exceptional performance in fiber-to-the-premises (FTTP) coverage (figure 2). Nonetheless, despite continuous attempts, significant hurdles remain in enhancing fundamental digital capabilities among the populace and in deploying 5G networks. (Report on the state of the Digital Decade 2024)

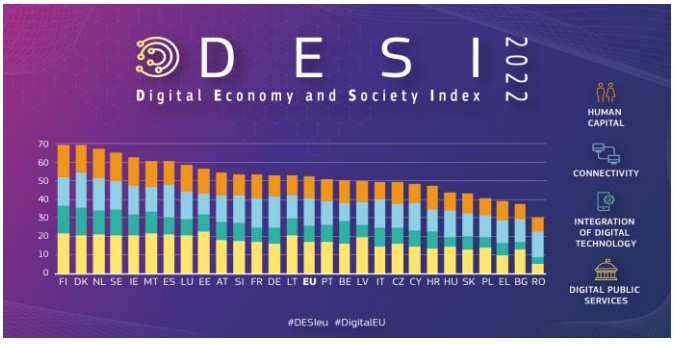


***Figure 2*** *– Digital Economy and Society Index (DESI)*

*Source: https://digital-strategy.ec.europa.eu/en/policies/desi*

Small and medium-sized enterprises (SMEs) comprise 99.7% of all active firms (about 521,000 SMEs), around 66% of total non-financial private sector employment, and roughly 56% of gross value added (GVA). Microenterprises, defined as those with less than 10 workers and an annual sales of less than €2 million, are the predominant section of active firms, accounting for nearly 90% of all SMEs. Notably, although big firms constitute just 0.3% of active enterprises, they provide the most significant portion of employment, accounting for around 34% of total non-financial private sector employment. (figure 3)

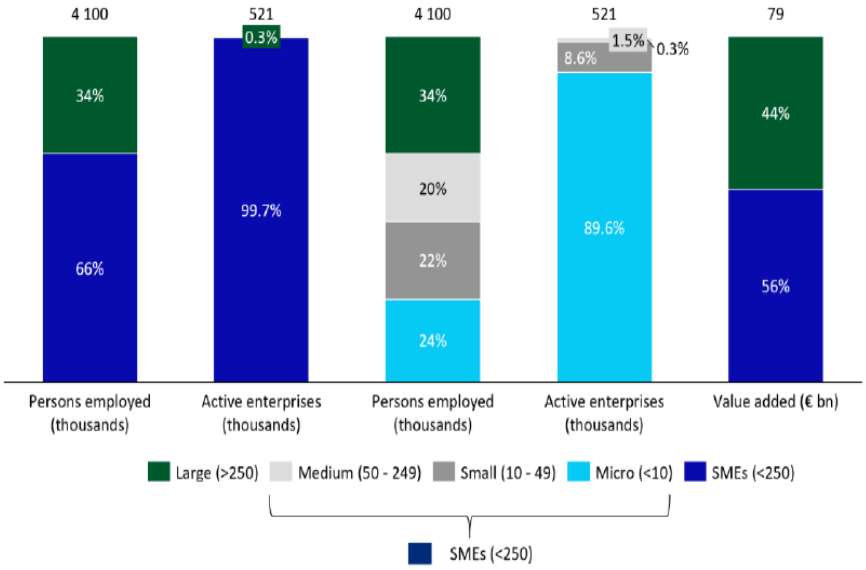


***Figure 3*** – *SMEs contribution to employment*

EU-wide measurements indicate that the digitalization level of Romanian small and medium firms is inferior to that of most other European nations, even their nearest counterparts (The Digital Economy and Society Index). In the 2021 Digital Economy and Society Index, a yearly evaluation of the digitalization of EU nations, Romania was positioned last: 27th out of 27 countries. The index assessed digitalization via four

components: human capital, integration of digital technology in commercial operations, digital public services, and connectivity (The Digital Economy and Society Index).

Small and medium firms in Romania have access to an expanding innovation environment to facilitate their digitalization initiatives. This includes business organizations that provide reference points for SMEs and facilitate direct access to centralized information and skills, including themes related to digitalization.

• Digital Innovation centers (DIHs): Romania has a growing network of locally built digital innovation centers as well as those financed by the European Union. These initiatives provide assistance to SMEs seeking digitalization via training, guidance on digital transformation and accessing support, as well as networking opportunities with other SMEs and stakeholders in the innovation ecosystem.

• Other participants: Additional stakeholder groups engage in the digitalization ecosystem in various capacities, such as industrial clusters, big corporations, and universities.

Furthermore, the Romanian government has launched many programs to enhance digitalization across the nation, particularly in small and medium-sized enterprises (SMEs).

The Competitiveness and Human Capital Operational Programmes, the StartUp Nation programme (initiated for the third time in July 2022), and the establishment of the Authority for the Digitalisation of Romania (ADR) in 2020, which is primarily responsible for advancing the digitalisation of government and its services, are included. The budget for digitalisation is €1.8 billion, including digital public services, digital connection, cybersecurity, digital skills, human capital, internet use, and other components. The additional components encompass digitalization initiatives, including the digitalization of education, healthcare, and physical infrastructure, as well as Romania's involvement in the multi-country Important Project of Common European Interest (IPCEI) centred on microelectronics, which has received an allocation of €500

million within the plan.25 The fund, amounting to €300 million, is only aimed at companies (excluding SMEs) and will provide debt financing for digitization, climate change, and other pertinent sectors, with 16% of the resources designated for digitalisation-related investments. Additionally, the Romanian Recovery and Resilience plan includes three financial instruments that will provide loan financing (€500 million via the InvestEU category for Romania) and equity financing (€400 million) to SMEs, specifically for digitalization initiatives. Initiatives are a crucial aspect of the Romanian Recovery and Resilience Plan, particularly under component seven, 'Digital Transformation'.

## 3. Scope and methodology

Utilizing the findings of the DESI index and reviewing relevant literature, we conducted research on a randomly chosen sample of 25 SMEs from Braşov. Respondents were characterized by decision-making characteristics in the analysed SMEs.

The research aimed to determine the need of digitization and its effects on SMEs. We have formulated the hypotheses:

H0: Digitalization does not have a substantial influence on SMEs in Braşov.

H1: Digitalisation significantly affects SMEs in Braşov.

To assess this effect, we used the $\chi 2$ test. Upon establishing the null and alternative hypotheses, the significance level of the test is calculated, often set at $\alpha = 0.05$ (5%) (Şipoş, Preda, 2004). Upon generating the $\chi 2$ test statistic, the computed value is compared to the critical value from the table to determine whether to accept or reject the null hypothesis.

## 4. Results and discussion

Subsequent to data collection from respondents, the findings highlighted the following aspects:

*Question 1. Do you believe that digitalization will enhance the performance of SMEs?*

| Alternatives | Responses (number) | Responses (% from total) |
|---|---|---|
| Agreement | 22 | 88 |
| Disagreement | 2 | 8 |
| Undecided | 1 | 4 |
| Total | 25 | 100 |

*Source:* Made by author

We can see that 22 (88%) respondents believe that digitalisation will enhance the performance of SMEs, while 2 (8%) opposed this view and 1 (4%) is undecided.

*Question 2. Will the application of digitalization in SMEs be a crucial element for the economic growth of Braşov?*

| Alternatives | Responses (number) | Responses (% from total) |
|---|---|---|
| Agreement | 16 | 64 |
| Disagreement | 3 | 12 |
| Undecided | 6 | 24 |
| Total | 25 | 100 |

*Source:* Made by authors

Analysing the results, one can notice that 16 (64%) respondents believe that digitalisation will be a crucial element for economic growth of SMEs from Brasov, while 3 (12%) opposed this view and 6 (24%) are undecided.

*Question 3. Will the use of digitalization in SMEs provide new business prospects in Brasov?*

| Alternatives | Responses (number) | Responses (% from total) |
|---|---|---|
| Agreement | 22 | 88 |
| Disagreement | 3 | 12 |
| Undecided | 0 | 0 |
| Total | 25 | 100 |

*Source:* Made by author

From the responses, we can see that most of the respondents, 22 (88%), think that digitalisation will provide new business prospects for SMEs in Brasov, while 3 (12%) opposed this view.

*Question 4. Will the digitization of SMEs result in the generation of new employment opportunities?*

| Alternatives | Responses (number) | Responses (% from total) |
|---|---|---|
| Agreement | 23 | 92 |
| Disagreement | 2 | 8 |
| Undecided | 0 | 0 |
| Total | 25 | 100 |

*Source:* Made by author

We can see that 23 (92%) respondents think that digitalisation of SMEs results in generation of new employment opportunities in Brasov, while 2 (8%) opposed this view.

For each question, the observed values (O) are the actual responses collected:

| Questions | Agree | Disagree | Undecided | Total |
|---|---|---|---|---|
| Q1: Digitalization will enhance performance | 22 | 2 | 1 | 25 |
| Q2: Digitalization will be crucial for economic growth | 16 | 3 | 6 | 25 |
| Q3: Digitalization will provide new business prospects | 22 | 3 | 0 | 25 |
| Q4: Digitalization will generate new job opportunities | 23 | 2 | 0 | 25 |

The total number of responses for each question is 25. To calculate the expected values, the used formula is:

$$E = \frac{(Row\ total)\ x\ (Column\ total)}{Grand\ Total}$$

Since the Grand Total is 100 responses (25 responses for each of 4 questions), and each question has 3 possible answers (Agree, Disagree, Undecided), the expected value (E) would be:

$$E = \frac{25\ x\ 25}{100} = 6.25$$

The chi-square value for each question is based on the formula:

$$\chi^2 = \sum \frac{(O-E)^2}{E}$$

where O is the observed value and E is the expected value calculated above.

For question 1, the chi-square value is calculated below.

$$Agree: \frac{(22-6.25)^2}{6.25} = \frac{15.75^2}{6.25} = \frac{247.5625}{6.25} = 39.61$$

$$Disagree: \frac{(2-6.25)^2}{6.25} = \frac{-4.25^2}{6.25} = \frac{18.0625}{6.25} = 2.89$$

$$Undecided: \frac{(1-6.25)^2}{6.25} = \frac{-5.25^2}{6.25} = \frac{25.5625}{6.25} = 4.41$$

Total for Question 1: $\chi 2 = 39.61 + 2.89 + 4.41 = 46.91$

For question 2, the chi-square value is calculated below.

$$Agree: \frac{(16-6.25)^2}{6.25} = \frac{9.75^2}{6.25} = \frac{96.0625}{6.25} = 15.21$$

$$Disagree: \frac{(3-6.25)^2}{6.25} = \frac{-3.25^2}{6.25} = \frac{10.5625}{6.25} = 1.69$$

$$Undecided: \frac{(6-6.25)^2}{6.25} = \frac{-0.25^2}{6.25} = \frac{0.0625}{6.25} = 0.01$$

Total for Question 2: $\chi 2 = 15.21 + 1.69 + 0.01 = 16.91$

For question 3, the chi-square value is calculated below.

$$Agree: \frac{(22-6.25)^2}{6.25} = \frac{15.75^2}{6.25} = \frac{247.5625}{6.25} = 39.61$$

$$Disagree: \frac{(3-6.25)^2}{6.25} = \frac{-3.25^2}{6.25} = \frac{10.5625}{6.25} = 1.69$$

$$Undecided: \frac{(0-6.25)^2}{6.25} = \frac{-6.25^2}{6.25} = \frac{39.0625}{6.25} = 6.25$$

Total for Question 3: $\chi 2 = 39.61 + 1.69 + 6.25 = 47.55$

For question 4, the chi-square value is calculated below.

$$Agree: \frac{(23-6.25)^2}{6.25} = \frac{16.75^2}{6.25} = \frac{280.0625}{6.25} = 44.89$$

$$Disagree: \frac{(2-6.25)^2}{6.25} = \frac{-4.25^2}{6.25} = \frac{18.0625}{6.25} = 2.89$$

$$Undecided: \frac{(0-6.25)^2}{6.25} = \frac{-6.25^2}{6.25} = \frac{39.0625}{6.25} = 6.25$$

Total for Question 4: $\chi 2 = 44.89 + 2.89 + 6.25 = 54.03$

The total chi-square value is $\chi 2_{total} = 46.91 + 16.91 + 47.55 + 54.03 = 165.4$

The degrees of freedom (*df*) for each question can be calculated as:

$$df = (r - 1) \times (c - 1) = (3 - 1) \times (4 - 1) = 2 \times 3 = 6$$

From the chi-square distribution table (Watkins, 2024), the critical value for df = 6 at $\alpha = 0.05$, is approximately 12.59

Since the *total chi-square* (165.4) is grater than the critical value of *df* (12.59), the null hypothesis H0 can be rejected and it can be concluded that the digitalization has a significant impact on SMEs in Braşov.

## 5. Conclusion

The swift digital transformation is essential for the competitiveness and sustainability of small and medium-sized firms (SMEs), which are integral to Romania's economy. To leverage the advantages of digitization, Romania must first do a thorough assessment of current support mechanisms for SMEs, pinpoint deficiencies in meeting the requirements for digital transformation, and guarantee the effective operation of European Digital Innovation Hubs (DIHs). By fortifying the support infrastructure for digitalization, Romania will augment the capability of SMEs to embrace and use digital technologies efficiently, consequently promoting development and innovation across diverse industries. Furthermore, Romania must develop a comprehensive strategy to merge digital and green transformations, emphasizing the enhancement of energy and material efficiency in digital infrastructures, such as data centers, while advocating for digital solutions that mitigate carbon emissions in sectors including energy, transportation, agriculture, and construction. These initiatives should focus on promoting the use of sustainable digital solutions by SMEs, enabling them to maintain competitiveness in both local and international markets (Report on the state of the Digital Decade 2024).

The significance of digitization in enhancing the performance of SMEs is paramount. It has become a crucial facilitator for SMEs to provide goods and services more effectively, while attracting and keeping young personnel with sophisticated digital competencies. As the business environment increasingly necessitates technical solutions, SMEs must use digital tools to sustain their market position, promote innovation, and explore new business opportunities, particularly within the digital economy. The use of digital technology will not only enable SMEs to

compete during economic downturns but will also provide long-term development prospects both inside and beyond their local markets. Consequently, it is essential for SMEs to emphasize digital transformation as a fundamental strategy for enduring competitiveness and future prosperity. In this environment, regulations and activities designed to enhance digitalization among SMEs are essential for generating new job possibilities, increasing efficiency, and facilitating innovation in corporate operations.

Digitalization will continue as a stimulus for development, enabling SMEs to react to evolving customer needs for technology solutions and efficient service delivery. In the digital economy, consumer groups will progressively choose firms that demonstrate technical agility and provide creative solutions. Consequently, SMEs must incorporate digital technology into their business strategies to not only survive but also prosper in an increasingly linked and digitalized global market.

To facilitate this digital transition, it is imperative that the Romanian government amplifies initiatives to provide targeted support measures, including grants, financial incentives, and digital literacy programs. Collaboration among SMEs and essential stakeholders, such as technology providers and industry experts, will promote the adoption of digital technologies and the cultivation of a digital culture inside SMEs. Promoting this partnership, in conjunction with the creation of a conducive environment for digitalization, would provide SMEs with the essential resources to navigate the obstacles of digital transformation and attain sustainable success.

Furthermore, digitization offers SMEs a chance to tackle environmental issues. By integrating green technology into their digital strategy, SMEs may improve operational efficiency and support Romania's overarching sustainability objectives. The simultaneous emphasis on digital and green transformation will foster a more resilient and competitive SME sector, therefore enhancing its role in economic growth and environmental sustainability.

In summary, digitization is not just a competitive advantage but a vital avenue for the survival and expansion of SMEs in Romania. The

government and relevant stakeholders must take urgent action to promote digital transformation by implementing appropriate support mechanisms, legislative frameworks, and strategic initiatives, therefore fostering a more digital, sustainable, and creative SME environment.

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