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The Impact of Digitalization on the Economic Performance of SMEs in the European Union: A 2022 Analysis

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Abstract. *This study embarks on an empirical examination of the relationship between digitalization intensity and economic performance among Small and Medium-sized Enterprises (SMEs) within the European Union (EU) in 2022. Utilizing data from European Commission, the research specifically compares the "SMEs with at least a basic level of digital intensity" and the "Proportion of total SME value added for all industries". The aim is to unravel the potential correlation between digital integration in SMEs and their contribution to the economy, measured in terms of value added. The methodology encompasses a quantitative approach, involving the collection of relevant data across EU member states. The study first applies descriptive statistics to summarize the data and then conducts a correlation analysis. In preparing the data for analysis, we adjusted the value-added figures by the number of SMEs to derive a value-added per SME metric, facilitating a more accurate and comparable evaluation across countries with varying numbers of SMEs.Our preliminary analysis reveals significant variations in digital intensity among SMEs across different EU countries. The core of the analysis investigates whether higher levels of digital adoption correlate with an increased economic output per SME. This study is particularly relevant in the context of the EU's digital single market strategy and the increasing emphasis on digital transformation in the business sector. The findings of this study are expected to contribute to the understanding of the digital economy's impact on SMEs, providing valuable insights for policymakers and business leaders.*

Keywords: European Union, Digitalization, SMEs, Value Added

Introduction

In the digital era, the implementation of digital technologies significantly contributes to enhancing innovation and development within enterprises, with a notable impact on small and medium-sized enterprises (SMEs), offering significant advantages in terms of efficiency, competitive ability, and market expansion (Dallocchio et al., 2024).

Particularly, Small and Medium-sized Enterprises (SMEs) represent a vital sector of the European economy, contributing significantly to innovation, employment, and economic growth (European Commission, n.d.). Although small and medium-sized enterprises (SMEs) play a crucial role in the economy, they are often the most exposed to risks generated by rapid technological changes. The accelerated advancement of technology, especially in the field of information and communication technologies (ICT), which has intensified in the last three decades, has created both

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opportunities and challenges for SMEs. (Kahouli et al., 2023). In the context of the European Union (EU), the importance of digitalization for SMEs has been emphasized in numerous policies and strategies (European Commission, n.d.).

This research aims to investigate the correlation between the degree of digitalization within SMEs and their economic success, expressed in terms of added value, in the member states of the European Union in 2022. Consequently, the study seeks to address this gap by providing a comparative analysis of the effects of digitalization on SMEs across the EU.

Literature review

Today's contemporary society considers information and communication technologies - ICT to be fundamental components of everyday life (Bacca-Acosta et al, 2023) and it is undeniable that digitalization has a significant impact on business sectors (Blanka et al, 2022). Ates et al, (2022) categorize the three stages of digital transformation as digitization, digitalization, and digital transformation. Digitalization applied on operational process of the organizations can determine interconnected and resilient value chains (Otoum et al, 2023). Usually, digitalization put emphasis on technology integration, innovation fostering, novel value generating and agile capacity building as noted by Skare et al (2023) in their paper. The adoption of digital technologies is a transformative force for small and medium-sized enterprises (SMEs) to improve business outcomes, stimulate innovation, reach new markets, and boost employee productivity. Cennamo (2021) observes that the modality of companies participation in the market is reshaped by digitalization, altering the fundamentals of competition and introducing both risks and competitive advantages. Risks associated with the rise of technology include a scarcity of trained labour and knowledgeable management (Skare et al, 2023), as well as a loss of fundamental productivity. Human-centric aspects are not prioritized in the ongoing technological advancement (Mourtzis et al, 2022), which is predominantly oriented towards machines and systems digitalization.

Digital technology impacts the global market on different levels. As states in the paper of Bacca-Acosta et al (2023) it has the potential to enhance productivity, foster innovation, and confer a competitive advantage to the company, contributing in the democratization of businesses (Lamine et al, 2023), creating new opportunities. It plays a pivotal role in advancing sustainable green economic development (Zhao and Qian, 2023), prompting a redefinition of designs and regulations. The repercussions extended to workforce (Parteka et al, 2024), client behavior, process effectiveness and product development (Ardito et al, 2021), reshaping several markets and placing burdens on traditional firms. Digitalization has altered resource distribution (Peukert et al, 2022), consumption patterns (Ahmad et al, 2021) and demonstrates a positive impact on the sales performance (Moschko et al, 2023).

The importance of digital transformation for SME can be explained by its role in fostering resilience against volatility. Developing countries risk falling behind more developed digital economies, if ICT adoption is not immediate and extensive (Bacca-Acosta et al, 2023), respectively companies that don't change with trends and fulfil the needs of their customers run the danger of going out of operation. Researchers have identified a connection between a company's performance and digitalization (Malodia et al, 2022), with the process of digital transformation also being influenced by the capabilities of its leadership. Management is in charge of organization and integration of capacities (Matarazzo et al, 2021). The relevance of digital intensity is changing the way that various sectors compete (Palmié et al, 2022), a well-executed digital strategy (Urbano et al, 2023) provides several benefits for businesses of every type. The ongoing digitalization of

management processes involves, among other aspects, a necessity for automating the process of making specific business decisions (Domanski et al, 2023). Analytics and decision-making guided by data-driven insights are growing in significance in all markets (Bar-Gill et al, 2024), but SME find challenges in adopting it. Small and medium enterprises represent over 99% (Trabert et al, 2023) of enterprises in the European Union, having an essential part across multiple economic sectors, especially in the service and industrial sectors, therefore their continuing adaptation to digital technology is vital.

To help the European Union undergo the digital transition, the European Commission is working towards sustainable solutions, identifying "technologies to support the needs of citizens; the development of a fair and competitive economy; the achievement of an open, democratic and sustainable society" (Ionescu et al, 2022, p.62) as the three major objectives for the years 2020–2025. Regulatory authorizations for novel services and goods may be adopted quickly and efficiently (Ahmad et al, 2021), given the rapid improvements in technology, artificial intelligence, and data analytics. This, however, necessitates particular organizational frameworks (Verhoef et al, 2021). Moreover, researchers indicate that digital transition is affecting also the environmental sustainability in EU (Ha et al, 2022), showing a negative impact on short term and positive impact on long term. Bacca-Acosta et al. (2023) identify the use of Information and Communication Technology - ICT as a reliable indicator of economic dynamism in European nations. The variance is noted in various aspects, including ICT with 35.6%, product market with 51.6%, skills with 72.2%, system with 38%, and financial labor market with -81.7%. The importance of the shift to digital businesses and the necessity of supporting small and medium-sized businesses digitalization (Roman et al, 2022) have been underlined by the European Commission on multiple occasions.

Developing a culture of continuous learning is essential (Trabert et al, 2023) for becoming prepared to face new challenges. The conventional business structure of SMEs and the way consumers create value are being altered by digitalization (Matarazzo et al, 2021). The major global changes that caused disturbances forced SMEs to adapt to the digital economy at a fast pace (Skare et al, 2023). Challenges can be sensed in all elements, from workforce, strategies, management to technology development department. Researchers found that firms should focus more on their workforce (Blanka et al, 2022) to have the desired results, because usually the employees are the last part to consider in the process of digitalization and they play a major role for success. Digitalization has the power to immediately turn outdated and destabilize whole industries (Lamperti et al, 2023) by replacing goods, procedures, and business models. SMEs are at risk due to their limited resources (Kääriäinen et al, 2023) and size vulnerability. By embracing the risks associated with digitalization, SMEs are venturing down the path of innovation (Ko et al, 2022) seizing opportunities. To maintain competitiveness, SMEs must allocate resources to data protection, workforce, infrastructure, customer relationship, and digital security (Kuczewska et al, 2023). The main facilitators for the adoption of digital technologies in SMEs are the employees (Blanka et al, 2022), they can facilitate the business growth through their expertise and competencies. The positive impact of small and medium enterprises digitalization on performance improvement is highly contingent on SME characteristics, companies exhibiting greater rigidity are at a disadvantage, experiencing less revenue as noted by Fabian et al, (2023). Roman et al (2022) mention that implementing such technologies, which come with higher initial expenses, may short-term damage the success of enterprises.

Financial success for small and medium enterprises in European Union may be achieved by giving priority to the construction of an ongoing process for adjusting to the changing technological environment (Nasiri et al, 2022). New business prospects for entrepreneurs have been

brought forward by technological advances (Galindo-Martín et al, 2023) and by embracing an organizational culture centered around innovation (Rodrigues et al, 2022). Digital change and innovation go hand in hand (Bacca-Acosta et al, 2023), making it easier to develop novel operational and organizational procedures that add value and improve economic and financial results. The literature review reveals that researchers are deeply engaged in the topic of digitalization, but there was identified a gap related to economic performance in small and medium enterprises sector in European Union which will be analyzed further.

Methodology

This chapter presents the hypothesis that guides the direction of the inquiry and methodological framework used in investigating the relationship between digital intensity and the economic contribution of Small and Medium-sized Enterprises (SMEs) within the European Union. The data sources, data collection and preparation procedures, as well as the analytical techniques used are presented.

Objectives and hypotheses

The primary aim of the research presented in this article is to investigate the impact of digitalization on the economic performance of Small and Medium-sized Enterprises (SMEs) within the European Union in 2022.

In accordance with the main purpose of the research, the following research objectives must be achieved:

- Identification of databases for SMEs with at least a basic level of digital intensity and Value Added per SME (2022);
- Investigation of the relationship between SMEs with at least a basic level of digital intensity and Value Added per SME (2022);
- Highlighting the Importance of Digitalization in SMEs.

Reflecting on the concepts presented earlier, we were particularly keen at this juncture to assess agility and to evaluate a singular, primary hypothesis.

Primary hypothesis: For the year 2022, there is a statistically significant positive correlation between the level of digital intensity in SMEs (SMEs with at least a basic level of digital intensity) and their economic output (Value added per SMEs) within the non-financial business economy of the EU member states.

Data sets

The first data set, "SMEs with at least a basic level of digital intensity," was collected from the European Commission's website and measures the percentage of enterprises. This data is from the year 2022 and is detailed in Table 1. The indicator is constructed based on the prevalence of digital technology usage, specifically counting the number of technologies used from a selected group of twelve. A "basic level" of digital intensity is defined as the use of at least four technologies by an enterprise. This data set excludes the financial sector and includes SMEs with 10-249 employees.

Table 1. SMEs with at least a basic level of digital intensity (2022)

Country	SMEs with at least a basic level of digital intensity (2022)
Austria	67,30%
Belgium	77,10%
Bulgaria	47,20%
Croatia	57,80%
Cyprus	70%
Czechia	68%
Denmark	88,80%
Estonia	66,90%
Finland	89,50%
France	63,50%
Germany	77,30%
Greece	41,20%
Hungary	51,70%
Ireland	84,50%
Italy	69,90%
Latvia	52,30%
Lithuania	63,70%
Luxembourg	66,20%
Malta	77,90%
Netherlands	80,10%
Poland	61%
Portugal	70,30%
Romania	52,50%
Slavakia	60,20%
Slovenia	67,10%
Spain	67,50%
Sweden	86,90%

Source: Created by the author based on data provided by European Commission. (2023a).

Figure 1 illustrates the percentages of SMEs with a basic level of digital intensity in various countries in 2022. It is observed that Finland, Denmark, and Sweden lead in digital adoption, while Hungary, Bulgaria, and Greece are at the bottom of the ranking, highlighting significant regional variations in the digitalization of the business sector.

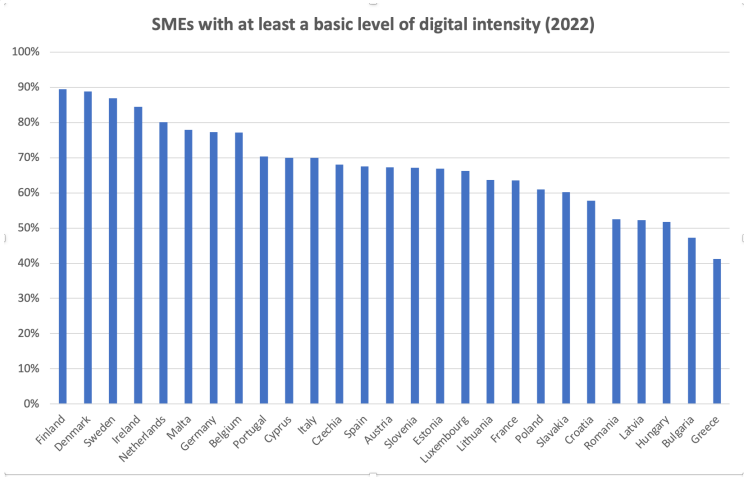

Figure 1. SMEs with at least a basic level of digital intensity (2022)

Source: Created by the author based on data provided by European Commission. (2023a).

The second data set, "Added Value per SME (Euro)," was derived through calculations based on data also obtained from the European Commission and is detailed in Table 2. It was calculated by dividing the total added value of each country by the number of SMEs in that country. The raw data for this calculation were derived from estimates produced by the Joint Research Centre (JRC) for the year 2022. These estimates are based on historical figures from the 2008-2020 Structural Business Statistics Database and provisional data for 2021-2022 sourced from the National Accounts database and the Short-Term Business Statistics Database, all maintained by Eurostat. The coverage is comprehensive of the non-financial business economy sectors, including industry, construction, trade, and services (NACE Rev. 2 sections B to J, L, M, and N), explicitly excluding sectors such as agriculture, forestry, fisheries, and non-market services like education and health (European Commission, 2023b). The data set includes the added value for SMEs with 10-249 employees. A limitation is the potential discrepancy between Eurostat data and figures published by national authorities. Additionally, the added value estimates used for analysis are not adjusted for inflation.

Table 2. Value added, number if SMEs & Value added per SMEs (2022)

Country	Value added (Billion Euro)	Number of SMEs	Value added per SMEs (Euro)
Austria	91,4	41.368	2.210.444
Belgium	100,7	30.161	3.338.212
Bulgaria	17,4	26.886	646.496
Croatia	12,3	14.370	858.431
Cyprus	5,6	4.326	1.290.151
Czechia	47,4	41.218	1.148.798
Denmark	85,2	28.529	2.986.982
Estonia	9,2	6.652	1.377.541
Finland	48,9	22.800	2.145.734
France	296,4	155.929	1.900.549
Germany	667,9	377.819	1.767.881
Greece	24,1	40.321	597.959
Hungary	29,2	33.840	862.747
Ireland	54,5	26.032	2.094.792
Italy	298,0	192.411	1.548.561
Latvia	8,3	10.144	813.744
Lithuania	14,9	13.492	1.106.346
Luxembourg	15,3	4.602	3.316.184
Malta	2,5	2.650	941.580
Netherlands	192,1	58.697	3.272.842
Poland	101,1	97.789	1.033.603
Portugal	47,0	43.738	1.075.646
Romania	32,6	51.701	631.126
Slavakia	13,6	12.256	1.108.186
Slovenia	14,7	8.588	1.707.653
Spain	203,8	153.088	1.331.090
Sweden	92,3	37.579	2.457.445

Source: Created by the author based on data provided by European Commission. (2023b).

Statistical analysis

The process began with data quality verification. Once the data were inspected and confirmed to be clean, descriptive statistical analysis followed. This provided an overview of the central

tendencies and variabilities within the data. Key descriptive statistics calculated included the mean, median, and standard deviation for each variable. After establishing the descriptive foundation, we examined the distribution of the data sets. The Shapiro-Wilk and Kolmogorov-Smirnov tests indicated that while the data for "SMEs with at least a basic level of digital intensity" conformed to a normal distribution, the "Added Value per SME" data did not. Therefore, Spearman's rho, a non-parametric test, was used for correlation analysis.

The correlation analysis specifically sought to determine whether there is a statistically significant relationship between the level of digital intensity in SMEs and economic performance as indicated by the added value per SME. Statistical procedures were conducted using SPSS software.

Throughout the research process, ethical considerations were strictly adhered to. The study did not involve the collection of primary data from human participants, thereby mitigating ethical concerns related to consent and confidentiality. The secondary data used were obtained from public domains, ensuring adherence to open data principles and avoiding any infringement of intellectual property rights.

In conclusion, this chapter detailed the methodological approach used in this research, from data collection and preparation to the analytical techniques employed to probe the research questions. The rigorous methodological framework provided a solid foundation for the research, ensuring that the findings were robust, reliable, and relevant to stakeholders at the intersection of digitalization and SME performance.

Results and discussions

Descriptive analysis

In Table 3, we present descriptive statistics for SMEs with at least a basic level of digital intensity and Value added per SMEs (Euro) year 2022, highlighting the central tendency.

Table 3. SMEs with at least a basic level of digital intensity and Value added per SMEs (Euro) year 2022.

	Indicator	SMEs with at least a basic level of digital intensity	Value added per SMEs (Euro)
1	Median	48.30%	2740253
2	Mean	67.6444%	1613729.93
3	Std. Deviation	12.57208%	854103.543
4	Skewness	-0.70	0.865
5	Std. Error of Skewness	0.448	0.448
6	Kurtosis	-0.373	-0.313
7	Std. Error of Kurtosis	0.872	0.872
8	Kolmogorov-Smirnov p	0.200	0.059
9	Shapiro-Wilk p	0.687	0.008
10	Minimum	41.20%	597959
11	Maximum	89.50%	3338212

Source: Authors' own research with SPSS Statistics 26.

Data analysis from 2022 reveals significant findings regarding the digital intensity and economic output of SMEs in the EU. The average digital intensity is 48.30%, with a significantly higher average of 67.6444%, indicating a distribution skewed towards SMEs with higher digital

adoption. Despite the wide range of digital intensity (from 41.20% to 89.50%), the standard deviation suggests moderate dispersion among SMEs.

The economic output, measured by the value added per SME, shows an average of 1,613,729.93 euro, with a large standard deviation of 854,103.543 euro, indicating a wide variance in SME performance. The data shows a positive skew in value added, indicating that a subset of SMEs disproportionately contributes to economic output.

Normality tests show a p-value greater than 0.05 for digital intensity, suggesting a normal distribution, while the value added per SME has a Shapiro-Wilk value of 0.008, indicating an abnormal distribution.

Hypothesis

In Table 4, we present Nonparametric Correlations (Spearman's rho) for SMEs with at least a basic level of digital intensity and Value added per SMEs (Euro) year 2022.

Table 4. Nonparametric Correlations

			SMEs with at least a basic level of digital intensity	**Value added per SMEs (Euro)**
Spearman's rho	SMEs with at least a basic level of digital intensity	Correlation Coefficient	1.000	0.713'
		Sig. (2-tailed)	.	.000
		N	27	27
	Value added per SMEs (Euro)	Correlation Coefficient	0.713	1.000
		Sig. (2-tailed)	.000	.
		N	27	27

Source: Authors' own research with SPSS Statistics 26.

The nonparametric correlation analysis, using Spearman's rho, has revealed a statistically significant positive relationship between the digital intensity of SMEs and their value added per SME, with a correlation coefficient of 0.713. This significant correlation, with a p-value of less than 0.01, strongly suggests that SMEs with higher levels of digital intensity tend to have higher economic output. The analysis was conducted on a sample size of 27 SMEs, providing robust evidence to support our hypothesis that digitalization plays a critical role in enhancing the economic performance of SMEs within the EU.

Conclusion

Our research on the "Impact of Digitalization on the Economic Performance of SMEs in the European Union: A 2022 analysis" has yielded convincing results. Our endeavor to analyze comprehensive databases led us to the estimates produced by the Joint Research Centre (JRC) for the year 2022, which served as a crucial benchmark for assessing the economic output of SMEs.

The empirical analysis, supported by data derived from JRC and data taken from the European Commission's website, revealed a strong positive correlation between digital intensity and value added per SME, demonstrated by a Spearman's rho correlation coefficient of 0.713 and a very significant P-value. While this correlation is statistically significant and economically

meaningful, it is important to acknowledge certain limitations in our study. The value added per SMEs data utilized were estimated by the JRC and may not entirely align with Eurostat data or figures published by national authorities, presenting a potential discrepancy. Furthermore, the added value estimates employed for our analysis are not adjusted for inflation, which could affect the interpretation of the economic output over time.

In conclusion, despite these limitations, this study has highlighted the transformative importance of digital technologies in the SME sector of the EU economy. Interpretations based on data extracted from the European Commission's website and using JRC estimates have demonstrated that a higher level of digital intensity is associated with an increase in value generation by SMEs. This highlights the need for ongoing digital advancement among SMEs, encouraged by the development of informed policies and strategic investments in digital capabilities. Moving forward, it is essential for the EU's economic strategy to continue promoting an environment where digitalization acts as a stimulant for growth, especially in the SME segment, which is vital for the economic dynamism and resilience of the region.

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period=desi_2022&unit=pc_ent&country=AT,BE,BG,HR,CY,CZ,DK,EE,EU,FI,FR,DE,EL,HU,IE,IT,LV,LT,LU,MT,NL,PL,PT,RO,SK,SI,ES,SE

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