

VILNIUS UNIVERSITY BUSINESS SCHOOL

DEEPTECH ENTREPRENEURSHIP [6211LX013]

VIDMANTAS MARKEVIČIUS

THE FINAL MASTER'S THESIS:

SMALL AND MEDIUM ENTERPRISES	MAŽŲJŲ IR VIDUTINIŲ ĮMONIŲ (MVĮ)
(SMEs) GROWTH: THE ROLE OF DIGITAL	AUGIMAS: SKAITMENINĖS
TRANSFORMATION AND OPEN	TRANSFORMACIJOS IR ATVIRŲJŲ
INNOVATION	INOVACIJŲ VAIDMUO

Supervisor:

Prof. Dr. Saulė Mačiukaitė-Žvinienė

SUMMARY

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SMALL AND MEDIUM ENTERPRISES (SMES) GROWTH: THE ROLE OF DIGITAL TRANSFORMATION AND OPEN INNOVATION

Supervisor - Prof. Dr. Saulė Mačiukaitė-Žvinienė

Master's thesis was prepared in Vilnius, in 2025

Scope of master's thesis – 84 pages.

Number of tables used in the FMT - 10 pcs.

Number of figures used in the FMT - 11 pcs.

Number of bibliography and references – 32 pcs.

The FMT described in brief: This master's thesis investigates the impact of Digital Transformation and Open Innovation on the growth of small and medium-sized enterprises (SMEs). After analysing different views in the academic literature on digital transformation and open innovation, we developed a conceptual framework that links digital skills, digital transformation, and open innovation with business model innovation to SME performance. Based on Eurostat data, we review general trends highlighting the importance of digital skills, collaboration, and technology adoption in driving SME growth. Based on this, future directions for possible research were defined. Finally, actionable insights and recommendations for SME growth were defined despite data limitations.

Problem of the FMT: SMEs face significant challenges to growth and survival in a rapidly evolving technological landscape. Digital transformation is vital for survival, and open innovation could be a tool for transforming the business more easily.

Object of the Paper: The object of this paper is the analysis of how Digital Transformation and Open Innovation influence the growth of SMEs.

Objectives of the Study:

- Examine the theoretical background and existing research on Digital Transformation and Open Innovation in SME.
- 2. Develop a conceptual framework linking Digital Transformation, Open Innovation, and SME growth by testing key hypotheses.

- 3. Conduct research to evaluate the relationships between digital skills, open innovation activities, digitally enabled business models, and SME performance.
- 4. Identify future research possibilities and propose practical recommendations for SME leaders and policymakers to foster growth through Digital Transformation and Open Innovation.

Research Methods: The study started with a review of literature, scientific research and data interpretation by creating a framework. This was followed by a quantitative research approach using descriptive and correlational analysis of publicly available Eurostat indicators to assess relationships between variables.

Research and results obtained: During our research, we confirmed our conceptual framework through three hypotheses raised. By demonstrating the relationship between digital skills, digital transformation, open innovation, and SME growth, we established this connection using data from Eurostat. This allowed us to define future research possibilities and develop actionable recommendations for policymakers and business leaders.

Conclusions of FMT: The research concluded with findings corresponding to the key tasks of the master thesis.

SANTRAUKA

VILNIAUS UNIVERSITETO VERSLO MOKYKLA

AUKŠTŲJŲ TECHNOLOGIJŲ VERSLAS [6211LX013]

VIDMANTAS MARKEVIČIUS

MAŽŲJŲ IR VIDUTINIŲ ĮMONIŲ (MVĮ) AUGIMAS: SKAITMENINĖS TRANSFORMACIJOS IR ATVIRŲJŲ INOVACIJŲ VAIDMUO

Darbo vadovas - Prof. Dr. Saulė Mačiukaitė-Žvinienė

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Trumpas Magistro darbo aprašymas: Šiame magistro darbe nagrinėjamas skaitmeninės transformacijos ir atvirųjų inovacijų poveikis mažųjų ir vidutinių įmonių (MVĮ) augimui. Išanalizavus skirtingus požiūrius į skaitmeninę transformaciją ir atvirąsias inovacijas mokslinėje literatūroje, sukūrėme konceptų modelį, kuris susieja skaitmeninius įgūdžius, skaitmeninę transformaciją ir atvirąsias inovacijas su verslo modelio inovacijomis ir MVĮ veiklos rezultatais. Remdamiesi Eurostat duomenimis, apžvelgiame bendrąsias tendencijas, išryškinančias skaitmeninių įgūdžių, partnerysčių ir technologijų diegimo svarbą skatinant MVĮ augimą. Tuo remiantis buvo apibrėžtos galimų tyrimų ateities kryptys. Galiausiai, suformuluotos įžvalgos ir rekomendacijos MVĮ augimui skatinti.

Magistro darbo problema: Skaitmeninė transformacija yra gyvybiškai svarbi smulkių ir vidutinių imonių išlikimui, tuo tarpu atvirosios inovacijos galėtų būti verslo transformacijos įrankis.

Magistro darbo tikslas - išanalizuoti skaitmeninės transformacijos ir atvirųjų inovacijų poveikį MVĮ augimui.

Tyrimo uždaviniai:

- 1. Išnagrinėti teorinį pagrindą ir esamus tyrimus apie skaitmeninę transformaciją ir atvirą inovaciją MVĮ.
- 2. Sukurti konceptualų modelį, siejantį skaitmeninę transformaciją, atvirą inovaciją ir MVĮ augimą, išbandant pagrindines hipotezes.

- 3. Atlikti tyrimą, siekiant įvertinti ryšius tarp skaitmeninių įgūdžių, atviros inovacijos veiklų, skaitmeniniu būdu įgalintų verslo modelių ir MVĮ veiklos rezultatų.
- Nustatyti galimas ateities tyrimų kryptis ir pateikti praktines rekomendacijas MVĮ vadovams bei politikos formuotojams, siekiant skatinti augimą per skaitmeninę transformaciją ir atvirą inovaciją.

Tyrimo metodai: Tyrimas pradėtas literatūros ir mokslinių darbų apžvalga bei duomenų interpretacija, kuriant modelį. Po to buvo taikytas kiekybinis tyrimo metodas, naudojant aprašomąją ir koreliacinę analizę, remiantis viešai prieinamais "Eurostat" rodikliais, siekiant įvertinti kintamųjų tarpusavio ryšius.

Tyrimai ir gauti rezultatai: Tyrimo metu patvirtinome savo konceptualią modelį, iškėlę tris hipotezes. Nustatėme ryšį tarp skaitmeninių įgūdžių, skaitmeninės transformacijos, atvirųjų inovacijų ir MVĮ augimo, šį ryšį nustatėme remdamiesi Eurostato duomenimis. Tai leido mums apibrėžti būsimų tyrimų galimybes ir parengti veiksmingas rekomendacijas politikos formuotojams ir įmonių vadovams. **Išvados:** darbo pabaigoje buvo suformuluotos išvados atliepiančios darbo metu iškeltus darbo tikslus.

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LIST OF ABBREVIATIONS

- 1. AI Artificial Intelligence
- 2. BI Business Intelligence
- 3. CRM Customer Relationship Management
- 4. CZ Czechia
- 5. EE Estonia
- 6. ERP Enterprise Resource Planning
- 7. EU European Union
- 8. EU-27 European Union (27 countries, post-2020)
- 9. FI Finland
- 10. ICT Information and Communication Technology
- 11. IoT Internet of Things
- 12. LT Lithuania
- 13. NL Netherlands
- 14. OI Open Innovation
- 15. R&D Research and Development
- 16. SCM Supply Chain Management
- 17. SME Small and Medium-Sized Enterprise

INTRODUCTION

Small and medium enterprises (SMEs) are critical global and local ecosystem components. SMEs employ a significant share of the workforce and contribute to GDP. All large enterprises started as small companies, and it doesn't matter if those companies were once traditional businesses or if today's big companies began as start-ups in someone's garage. In the modern digital age, SMEs face increasing pressure to adopt new digital-first technologies and remain relevant in a rapidly changing technological and social landscape. Because they often lack the resources to innovate, these enterprises must embrace openness and seek collaborative approaches to stay competitive.

Relevance: This thesis explores the critical connection between Digital Transformation and Open Innovation as essential processes for SME growth. The study aims to deepen and expand existing theories on how these factors impact SME performance while testing hypotheses that should prove the link between digital transformation and SME growth.

Object of the Paper: This paper aims to analyze how digital transformation and open innovation influence the growth of SMEs.

Aim of the Study: The aim of the study is to develop and empirically validate a framework explaining how Digital Transformation and Open Innovation drive SME growth.

Objectives of the Study:

- 1. Examine the theoretical background and existing research on Digital Transformation and Open Innovation in SME.
- 2. Develop a conceptual framework linking Digital Transformation, Open Innovation, and SME growth by testing key hypotheses.
- 3. Research to evaluate the relationships between digital skills, open innovation activities, digitally enabled business models, and SME performance.
- 4. Identify future research possibilities and propose practical recommendations for SME leaders and policymakers on fostering growth through Digital Transformation and Open Innovation.

Research Methods: The study started with a review of literature, scientific research, and data interpretation, creating a framework. This was followed by a quantitative research approach, using descriptive and correlational analysis of publicly available Eurostat indicators to assess relationships between variables.

Structure of the Work: In the first part, we analyzed the theoretical background of digital transformation, open innovation, and SME growth. Based on the findings and their interpretation, we developed a framework for SME growth. To verify the framework's high-level relevance, we

formulated hypotheses and defined research questions. Based on selected data collection, we conducted descriptive and correlational analyses. Based on the findings, we developed practical suggestions for SMEs and policymakers.

Difficulties and Limitations: The research encountered several challenges, with a major issue being the availability and quality of data from Eurostat. Although the metadata for the database indicated comprehensive datasets, there were, in practice, gaps in specific metrics and inconsistencies in reporting.

Declaration due to AI tools: Artificial Intelligence (AI) tools have been used as work tools but in good faith. ChatGPT 40, Gemini, DeepL write AI, and Grammarly were used to brainstorm, summarise the data, calculate correlations, and word the text. AI tools were not used as a source of data or information, nor were they allowed to create content that had not been suggested first and was overseen by the author of the text.

1. OVERVIEW OF SMEs AND GROWTH

The following section presents a literature review and analysis of primary and secondary data sources to explore the significance of Small and Medium Enterprises (SMEs) in today's modern economy.

To ensure the relevance of information, the selected literature primarily focuses on recent studies published within the last 5–7 years, with priority given to more recent publications from the past 1-2 years. Even within this timeframe, there is a substantial selection of articles on SME growth, digital transformation, and open innovation. Therefore, we narrowed down the number of publications, focusing on publications with a notable number of citations given their recency, as a selection of literature was done in the spring-summer of 2024. Additionally, we excluded articles that specifically concentrated on developing regions, countries, or even specific cities within these countries. This selection process ensured that only relevant and impactful studies were included in the final work, even though many other articles were analyzed but ultimately not used.

The selection of sources of literature review includes articles from academic journals that concentrate on enterprise management, industry reports, and statistical publications from reputable organizations such as the European Commission, the World Economic Forum, and OECD. These sources were chosen based on their author's or represented organizations' credibility, novelty, alignment with the research topic, and coverage of SMEs' contributions to employment, GDP, and innovation. The decision to use these sources of information was driven by their focus on the broad economic impact of SMEs, their neutrality, and their broad view of the context of emerging trends like digital transformation. This methodological approach supports a broad perspective and up-to-date understanding of SMEs' importance in today's economy but also shows SME growth challenges.

1.1. The importance of SMEs in today's economy

It is commonly agreed that Small and Medium Enterprises (SMEs) are the cornerstone of most economies worldwide. SME generates a significant share of economic value-added and growth while creating jobs. To begin with, by discussing SMEs, it's essential to define and classify them.

Internationally, the definition of an SME may vary, but standard criteria include the number of employees and annual revenue or balance sheet totals. In the European Union (EU), SME companies are defined as Micro, Small, and Medium enterprises, while the World Economic Forum defines them as Small, medium, and Mid-sized Enterprises. However, Lithuania follows the EU classification, with minor adjustments described in the Company classification law. A comparison is provided in Table 1.

However, it is essential to mention that at least two metrics classify SMEs. In many cases, the data available in different databases will be structured according to the SME's performance under one of the metrics. For example, in the Eurostat database, the metric used will be the number of employees.

True o	World Economic Forum	EU	IT
Туре	definition	EU	1.1
Solo	1 person	1 person	1 person
enterprise			
Micro	≤ 10 employees and 1m	≤ 10 employees	2 criteria should be below:
enterprises	USD annual revenues	and	Employees – up to 10
		Annual revenues $\leq 2m$	Annual revenue - 0.9m EUR
		EUR or Balance sheet total	Balance sheet total - 0.45m EUR
		\leq 2m EUR	
Small	\leq 49 employees and/or	\leq 50 employees	2 criteria should be below:
enterprise	annual revenues below	and	Employees – up to 50
	5m USD	Annual revenues $\leq 10m$	Annual revenue – 15m EUR
		EUR or Balance sheet $\leq 4m$	Balance sheet total – 7.5m EUR
		EUR	
Medium	50-250 employees and/or	51-250 employees	2 criteria should be below:
enterprise	have annual revenue	and	Employees – up to 250
	bellow 50m USD	Annual revenues ≤ 50 m	Annual revenue - 50m EUR
		EUR or Balance sheet \leq	Balance sheet total - 25m EUR
		43m EUR	
Mid-sized	250-4 999 employees	Not defined.	Not defined.
enterprises	and/or an annual turnover		
	below 1.75b USD		
Large	More than 5 000	More than 250	More than 250 employees
enterprises	employees and/or 1.75b	employees and 60m EUR	and 40m EUR annual
	USD annual revenues.	annual revenues.	revenues.

Table 1: Company size classification differences, source World Economic Forum and EU and LT.

Source: Developed by the author

On a global scale, SMEs represent approximately 90% of all businesses and are responsible for around 70% of private-sector employment. Also, they contribute a similar amount of GDP. Also, it plays a crucial role in international trade and will contribute significantly to exports. For comparison, based on the European Commission Annual Report on European SME (2024) European Union, SME share in enterprises is even higher - up 99,8 % of all enterprises and employs around 67% of the private-sector workforce. The contribution of the EU's GDP via Value added is 53,1% of the EU's GDP. If we go closer to the author's home market - Lithuania, the situation is very similar to the EU level. SMEs are responsible for around 99.9% of all enterprises. 72,9% of the private-sector workforce and 64%

contribution of the country's GDP (Table 2). What is more, data shows that SMEs in Lithuania also play a crucial role in exports, contributing to about 50% of the total export value.

Class size	Number	of enterpri	ises	Number employed	of persons l		Value ad	ded	
	Lithuania		EU	Lithuania		EU	Lithuania		EU
	Number	Share	Share	Number	Share	Share	Billion €	Share	Share
Micro	260 932	94,8 %	93,6 %	371 258	32,1 %	30,0 %	7,2	19,0 %	19,8 %
Small	11 481	4,2 %	5,4 %	235 050	20,3 %	19,7 %	7,7	20,4 %	16,8 %
Medium- sized	2 286	0,8 %	0,8 %	237 204	20,5 %	15,5 %	9,4	24,7 %	16,6 %
SME	274 699	99,9 %	99,8 %	843 512	72,9 %	65,2 %	24,3	64,2 %	53,1 %
Large	406	0,1 %	0,2 %	313 003	27,1 %	34,8 %	13,6	35,8 %	46,9 %
Total	275 105	100,0 %	100,0 %	1 156 515	100,0 %	100,0 %	37,8	100,0 %	100,0 %

Table 2: Economy structure of enterprises per size class, in EU-27 and LT for 2023

Source: European Commission, 2024

As SMEs account for such a large share of enterprises, they naturally boost competition in markets, which in turn boosts the development of new products or services and, of course, fuels innovation. The importance of SMEs extends beyond just economic benefits. SME growth contributes to broader social well-being across all segments—from local communities to national and global economies—via job creation and other added values.

The growth of SMEs is crucial not only for the companies themselves but also for the overall health and dynamics of global and national economies. As SMEs are the backbone of the economy, stagnation in this sector would lead to stagnation across the entire economy, directly impacting job creation and unemployment, particularly in regions where large corporations lack a significant presence. While large corporations typically establish substantial business units, such as factories or offices, SMEs require fewer resources, allowing them to expand more easily. Consequently, SMEs play a significant role in regional and rural development. They help to balance economic activity across regions, reducing disparities and fostering inclusive growth. Naturally, at the regional level, we anticipate that SMEs will continue to grow, leading to even greater outcomes value.

While growth is a universal goal for businesses (Kindström et al., 2024), finding a way to grow can be a significant challenge task for business owners. Establishing a large enterprise from a microenterprise involves overcoming significant efforts from business leaders and requires overcoming challenges, which often increase the risk of business failure compared to achieving substantial and sustainable growth. The journey from the Microenterprise to the large enterprise is complicated with many challenges, making the likelihood of going out of business significantly higher than achieving substantial and sustainable growth.

Zooming away from more global to individual business level, most of today's global corporations began their journey as micro or solo enterprises. Driven by the vision and determination of their founders. For example, Apple Inc., one of the most valuable companies in the world, started in 1976 in a garage in Cupertino, California, with just Steve Jobs and Steve Wozniak working on their first personal computer. Similarly, SAP SE, a European software giant, was founded in 1972 in Germany by five former IBM engineers who saw an opportunity to develop standard application software for real-time data processing. Closer to home, in Lithuania, the internationally recognized technology company Vinted started as a small side project in 2008 when Milda Mitkute and Justas Janauskas created a website called manodrabuziai.lt to exchange pre-loved clothes. These examples illustrate that even the largest enterprises usually start as solo or micro businesses and companies' journeys grow to become great examples for others.

So, the importance of SMEs is evident from both perspectives – first, diver of economic value and second, as an essential path of every businessman's growth journey. SME growth contributes to sustainable economic development at the national or local level, increases employment opportunities, and ensures a balanced distribution of resources. However, data (Figure 1) indicates that SME performance, at least in Lithuania, is growing slower than large enterprises and micro-enterprises. A similar trend is observed in Lithuania and across the EU (Figure 2), where SMEs are also lagging behind large enterprises in growth.

Investing in SME growth should be a strategic direction for any thriving and forward-looking economy. And still, based on data from the Eurostat, (2024) indicates that a significant percentage of businesses fail every year. For the European Union, in 2022, 8.7% of enterprises went out of business. Lithuania is one of the leading countries with a 13,3% mortality rate, with the majority of companies closing in the early stage of their life. It illustrates that young and small companies face growth challenges.





Source: European Commission, 2024



Figure 2: Value added growth by enterprise size in EU, Eurostat 2024

Source: European Commission, 2024

To sum up the first part, SMEs play a pivotal role in national and global economies by generating a substantial share of value-added, driving innovation, and creating a majority of privatesector jobs. Despite variations in definitions across regions, in general, it's the same or very similar. Data shows that SMEs account for nearly all enterprises, and employees make up a big part of the workforce. Although SMEs greatly contribute to growth and job creation, their performance often lags behind that of larger enterprises, underscoring the need for focused strategies that support sustainable growth in addition to lower productivity. Nevertheless, high mortality rates among SMEs underscore the fragility of this segment and show the urgent need for targeted solutions to not only grow but also survive.

1.2. The key challenges of SMEs

In the following section, we examine the challenges faced by SMEs, like limited access to financial resources, low or insufficient digital skills, and resistance to adopting new technologies. These challenges are significant in today's fast-paced economic environment. Understanding key SME challenges is essential for framing the solution that can help to stay in line with larger competitors.

As it was already slightly covered, survival, especially in the early stage of the company, comes first and is the most difficult challenge. As enterprises start their journey, they should have a vision, strategy, and business plan. But a phraseology often used in strategy and plan development that is often attributed to Prussian military leader Helmuth von Moltke, the Elder: "No plan survives first contact with the enemy.". At the beginning of your company life, you must constantly update your business plan (if lucky and have it) vs. reality, find first customers, and keep them. Why do young businesses in some countries survive? It's worth separate research as it might be caused by multiple reasons like better education, too big ambitions, and expectations, or a smaller share of new companies opened.

To continue this idea about survival as a key challenge, survival, and expansion are highlighted as key challenges in Future Readiness of SME and Mid-Sized Companies: A Year On World Economic Forum, (2022) report. Even 67% of SME managers claim a challenge they must overcome. Among other key challenges, Top executives of SMEs mention 48% - Talen acquisition and retention, 34% - Maintaining a strong culture and clear company purpose, 25% - Having product and innovation that keep up with current technological demands from the market, 24% - Funding and accessing to capital and 22% - Policy and regulation environment.

For those businesses that do survive the critical early years, the challenges evolve but remain significant. Research conducted in Sweden's by Kindström, Carlborg, and Nord, (2024) analysed SME' growth problems from a management perspective. They defined quite a big list of different challenges, and based on it, they proposed a conceptualization of growth management focused on three themes: business model, leadership, and people. Within each theme, various lower-level challenges arise, and firms seeking sustained growth must manage all three areas in a balanced manner (Kindström et al., 2024). In this study, research focused on companies with notable growth, survival, financing, and regulatory challenges were less prominent, but the remaining issues closely mirrored those identified in the Future Readiness Report, although it was framed a bit differently.

Various measures are being taken to overcome or mitigate these challenges, and one of the most significant and common approaches is directly or indirectly linked to digitalization. Digital transformation has become critical for the survival and growth of firms, particularly for small and medium-sized enterprises (SMEs). Despite the widespread recognition of digital transformation as essential for business success, SMEs are often slower than larger firms in adopting digital technologies (Clemente-Almendros et al., 2024; Skare et al., 2023; Vrečko et al., 2023) and this being slower adoption in many cases means that enterprises are losing competitiveness vs. larger rivals. Of course, the COVID-19 pandemic has forced companies to rethink their strategies and use digital tools to stay competitive.

Despite the wide acknowledgment of SMEs challenges, current literature rarely explores how SMEs can systematically integrate digital tools with external support via using partnershim mechanisms to minimise failure rates. This gap suggests that additional attention is needed to investigate such strategies and analyze open innovation and capacity-building collaborations that can actively support SMEs beyond their early survival phase.

This section highlights that SMEs face significant challenges such as resource constraints, lack of skilled personnel, and technological adoption. These issues show the importance of adopting digital strategies by SMEs to overcome growth barriers and drive competitiveness.

1.3. SMEs Digital Transformation

Digital transformation is a complex process that requires technology integration into all aspects of business operations, fundamentally altering how SMEs deliver value to customers. This section explores the concept of digital transformation, emphasizing its potential to enhance productivity, innovation, and market access for SMEs. The definition and contextualization of digital transformation will lay the groundwork for understanding digitalisation's role in SMEs growth.

In today's rapidly changing digital landscape, large corporations and small and medium-sized enterprises (SMEs) are forts to turn into digital technologies and knowledge-based capital to enhance productivity and drive growth. While larger companies often lead the way in adopting Industry 4.0 technologies, SMEs face significant challenges in keeping pace with these advancements. SMEs lag behind larger firms in the uptake of digital tools (OECD, 2024). This highlights the urgent need for SMEs to identify strategic enablers for faster adoption of digital tools to remain competitive. The specific types of technologies that SMEs struggle with vary widely. Figure 3 provides an overview from the OECD (2024), where they give a visual illustration of how different digital tools are adopted by firms based on their size. The gap between technologies and services varies from very small to very large.

As it is defined by, the gap is relatively small in the case of digital interaction with governments, providing options of online ordering, reservation or booking for customers, and for the use of electronic invoicing and tools for production and logistics management (RFID). The gap in the adoption of digital technologies in SMEs increases when technologies become more sophisticated or when mass matters arise. The largest gap is observed in the integration of business processes (ERP, CRM, SCM), tools for strategic planning like big data analytics, and purchasing of cloud computing services (OECD 2024). This highlights the critical need for SMEs to embrace digital transformation, not only to remain competitive but to thrive in the digital age.

Like large companies, small and medium-sized companies (SMEs) are using new digital technologies with main targets to boost their productivity and growth. Similarly Erjavec et al., (2023) confirms "that smaller companies lag significantly in implementing new Industry 4.0 technologies and in the intensity of their use". Given in mind that as claimed by Omrani et al., (2024) the decision to adopt digital technologies is strategic to the growth and survival of SMEs, slow adoption or uncorrected decisions can deepen the gap vs. large companies for losing competencies.



Figure 3: The smaller the firm, the higher the barriers to digital transformation

--- Small --- Medium --- Large

The adoption of digital tools is critical to companies, and it can improve their performance. However, the integration of digital tools in companies' daily operations does not bring immediate performance improvement. Digitalization is not just adding new IT tools. In general, for small and

Source: OECD, 2024

medium enterprises (SMEs), "digitalization involves the reinforcement, modification, and renewal of business models with the help of digital technologies." As Etienne Fabian et al. (2024) analyzed, SMEs often encounter significant hurdles when adopting digital technologies. Advanced digital technologies like big data analytics, artificial intelligence (AI), cloud computing (CC), Enterprise resource planning (ERP), blockchain, and other advanced digital technologies have become widespread and accessible, enabling SMEs to streamline processes, enhance their value propositions, and improve customer experiences. However, due to their limited resources and competencies, along with the inherent risks of digital transformation, SMEs may experience inertia that impedes the successful implementation of digitalization initiatives. In his research, the author provided evidence that SME digitalization is beneficial for SME firms and, while risky, is well worth the effort. SMEs should also aim to transform digitally, as such transformation increases SMEs' business performance. As the article claims, "In an increasingly digital world, abstaining from investments in digital technologies and the transformation of business processes is not a wise strategy for SMEs (Etienne Fabian et al., 2024)."

Digital transformation involves the extent of change, offering many possibilities. SME managers can progressively move from being less digital to more digital, tailoring their technology investments to match their current situation. Of course, it should be taken in mind that digital transformation is not necessarily radical transformation. "Not every SME has to become the next Amazon, Uber, or Netflix." (Etienne Fabian et al., 2024). As the article by Etienne Fabian et al. (2024) claims, SMEs can improve performance by moving through a digital transformation process via different degrees of digitalization and not necessarily radically changing their business model or entire industry.

Given digital technologies' significant potential to transform business from its operations to entire business models, it becomes crucial to acknowledge and clearly define digital transformation. Understanding the scope and meaning of digital transformation allows businesses to strategically plan their integration of new technologies, ensuring they align these advancements with their long-term goals.

In general, digital adoption in enterprises' daily operations can be defined as a process that, in many cases, is called Digital transformation. Below are a few different definitions of digital transformation provided by area experts.

First, in an IBM article by Keith O'Brien, Amanda Downie, and Mark Scapicchio (2024), "Digital transformation is a strategic initiative incorporating digital technology across all areas of an organization. It evaluates and modernizes an organization's processes, products, operations, and technology stack to enable continual, rapid, customer-driven innovation." (Keith et al., 2024). In line with this perspective McKinsey, (2024), a consultancy company defines "digital transformation as the rewiring of an organization to create value by continuously deploying tech at scale." A clear digital transformation strategy focused on specific domains and enabled by a set of specific capabilities is critical for organizations to not only compete but also survive. It is defined in the article that digital transformations are not a one-and-done project; most executives will be on this journey for the rest of their careers." (McKinsey, 2024)

Based on an IBM article by experts on digital transformation, experts and organizations see digital transformation as ranging from better supply chain and resource management to significant improvements in overall productivity, profitability, and competitive advantage (Keith et al., 2024).

One more view of digital transformation provided by North et al. (2019), which uses such sources as Bloomberg (2018), Gartner (2019), Brennen and Kreis (2016), and Bounfour (2016): "The digital transformation has been evolving through three interlinked processes. First, analog information is digitized to encode it into zeros and ones so that computers can store, process, and transmit it. Second, digitalization of how people interact through digital technologies (e.g., e-mail, chat, social media, etc.) and the digitalization of business models through digital technologies. Finally, the digital transformation of organizations refers to the cross-cutting organizational change based on the implementation of new digital technologies."

The common across all perspectives is that digital transformation is far more than the adoption of digital tools. Digital transformation requires rethinking all company processes, strategies, and organizational structures. It involves integrating technology across all facets of an enterprise to modernize operations, enhance customer-driven innovation, and maintain competitiveness in the market. What is more, as highlighted by IBM, McKinsey, and North et al. (2019), digital transformation requires not only one-time action but continuous effort and strategic focus for reshaping how businesses create, deliver, and capture value. This underscores that digital transformation is not a one-time action but an ongoing operational process of evolving and adapting, aligning technological capabilities with organizational goals and market demands.

As digital transformation significantly changes how companies operate in daily life, it was mentioned that it changes how businesses create, deliver, and capture value - it also requires companies to rethink, update, and, most importantly, innovate their business models (BMs). However, SMEs have scarce time and limited resources for experimenting with their BMs and implementing new strategies (Bouwman et al., 2019) Digital transformation, defined as the restructuring of economies, institutions, and societies through digital technologies such as social media and big data, requires companies to fundamentally change their BMs. Bouwman et al.'s 2019 paper analyzed the relationship between BMI, resource allocation for experimentation, and firm performance in digitalizing SMEs.

The Bouwman et al., 2019 study finds that SMEs can enhance their performance by dedicating more resources to BMI and embracing strategic implementation practices. Specifically, the research suggests that firms that allocate more resources towards BM experimentation—such as testing new business models through simulations or real-world trials—tend to perform better. The article claims that firms can improve their performance through (a) allocating more resources for BM experimentation and (b) enhancing their capacity to innovate either by increasing the number of innovations or spending more time on innovation (Bouwman et al., 2019). By experimenting with and refining their BMs, SMEs are better equipped to navigate the challenges of digital transformation and capture new value for themselves and their customers.

Next to business model transformation, we should also understand that enterprises going through Digital transformation start from different levels of digital maturity. Some may be in the early stages of digitalization, while others might have already adopted or optimized advanced solutions. Jafari-Sadeghi et al., (2021) Clustered transformation into three different clusters: technology readiness, exploration, and exploitation. The research highlights the dynamic capabilities that enable countries and businesses to leverage digital innovation effectively. The findings suggest that investments in digital readiness, combined with robust exploration and exploitation mechanisms, enhance entrepreneurial activity and expand technological markets across Europe. Given the varying stages of transformation among enterprises, it is crucial to tailor tools and strategies to motivate and guide them effectively through their respective processes.

Given these general insights, the implications for SMEs are particularly significant. These insights Jafari-Sadeghi et al., (2021) underscore the importance of aligning business strategies with national-level digital policies. For instance, ICT investments and education directly influence SMEs' ability to adopt new technologies, while R&D activities encourage innovation and market competitiveness. By integrating these dimensions, SMEs can use different digital tools to overcome traditional growth constraints and achieve scalability.

In this section, we reviewed digital transformation, a strategic process involving integrating digital technologies across all aspects of business operations, enabling SMEs to enhance productivity, streamline processes, and deliver more excellent value to customers. While its potential benefits are vast, including improved competitiveness, market access, and customer engagement, SMEs face unique challenges such as resource limitations, technological inertia, and the complexity of implementing advanced tools like big data analytics, AI, and cloud computing. Addressing these challenges requires a tailored, iterative approach to digital transformation, which includes redefining business models and strategically aligning investments in technology and long-term organizational goals.

1.4. Benefits of Digital Transformation

The following section covers the key benefits of digital transformation for SMEs: operational efficiency, improved customer engagement, cost reduction, and market diversification. These advantages position digital transformation as a critical driver of growth. The benefits of digital transformation help to disclose the study's focus on promoting digital adoption to achieve sustainable SME growth. The section provides supporting ideas for SMEs' need to prioritize digital strategies.

Digital transformation brings many values, and as Appio et al. (2024) who was nicely states, self from Appio et al., (2021), "The adoption of digital technologies not only streamlines operations and enhances efficiency but also fosters innovation, facilitates data-driven decision-making, and engenders new business models, paving the way for sustained competitive advantage in the digital era."

In their research, North et al. (2019) and Appio et al. (2024) cover many benefits brought by digitalization for SMEs. By adopting digital tools and processes, SMEs can achieve operational efficiency and cost reduction and enhance collaboration, ultimately improving their resilience and adaptability in a competitive and rapidly evolving market. Digitalization also pushes innovation processes that enable SMEs to create customer-centric products and services, transform business models via new value creation or transfer methods, and explore new value delivery methods. Additionally, it allows SMEs to expand their market reach, access broader customer bases, and integrate into broader business ecosystems, ensuring their relevance and long-term growth. Furthermore, the use of data-driven insights improves the decision-making process and quality. Adopting open innovation approaches helps SMEs overcome resource limitation constraints by acquiring external expertise. Collectively, these benefits equip SMEs with the tools to thrive in a digital-first economy.

Skare et al., (2023) Identifies and highlights five key benefits of digital transformation for SMEs. First, digital transformation enhances business activity by allowing SMEs to find new customers more easily through, e.g., stronger online presence or improved marketing capabilities. Secondly, it boosts SME competitiveness by enabling them to handle competition more effectively, adapting their business models and operations to be more efficient and customer-centric. Thirdly, digital transformation improves an SME's financial health and market position, making them more attractive to lenders and investors, leading to easier financing access. Additionally, digitalization helps SMEs push cost lines down by optimizing resource allocation, increasing efficiency, and potentially reducing production and labor costs. Last, the research identified the benefit of successful digital transformation initiatives, which enable SMEs to quickly adapt to changing regulatory frameworks by

applying cloud public services and addressing digital security or privacy issues. To sum up, digital transformation offers significant advantages for SMEs, including new customer access, increased competitiveness, improved financial opportunities, cost optimization, and reduced regulatory burdens, supporting SME growth and success.

However, innovation may be one of the biggest and most important benefits of digital transformation for enterprises. Digital transformation is not only a tool for operational improvement but a powerful booster of possibilities and a source of innovation. Digital diffusion does lead to higher innovation performance among SMEs (Hassan et al., 2024). Through digital diffusion, SMEs can reimagine their business models, develop innovative products and services, and enhance their processes to meet evolving market demands. Importantly, this digital evolution empowers SMEs to stay relevant and thrive in an increasingly digital-first economy.

In the research by Hassan et al. (2024), it is covered that the nature of digital technologies as a source of innovation is particularly pronounced in their ability to facilitate dynamic organizational changes. Strategic integration of digital tools—especially those designed for information processing, collaboration, and communication—enhances the capacity of SMEs to drive organizational innovation and business model change. In addition, it is mentioned that manufacturing SMEs benefit significantly from specialized digital technologies vs. counterparts in services when it comes to gaining strategic benefits from digital diffusion and the generation of innovations.

The values brought by digital transformation for SMEs, as summarized in Table 3, showcase a wide range of benefits that collectively enhance competitiveness, resilience, and growth. From operational efficiency to business model innovation, these benefits highlight the transformative impact of adopting digital tools and strategies in SME operations. For example, operational efficiency and cost reduction directly contribute to improved productivity and resource management, enabling SMEs to compete more effectively with larger enterprises. Similarly, market expansion and customer engagement leverage digital platforms to unlock new opportunities for revenue generation and customer satisfaction, which are vital in today's digital-first economy.

Category	Description	Supporting Sources
Operational	Streamlines processes and reduces resource wastage,	Appio et al. (2024); North
Efficiency	improving overall productivity and cost-effectiveness.	et al. (2019)
Market	Enables SME to reach broader markets through enhanced	Skare et al. (2023);
Expansion	digital presence and e-commerce platforms.	Hassan et al. (2024)

Table 3: Benefits of Digital Transformation for SME

Innovation	Facilitates the development of customer-centric products	Hassan et al. (2024);
Enablement	and services using digital tools and insights.	Appio et al. (2024)
Enhanced	Empowers data-driven strategies by utilizing analytics and	Appio et al. (2021);
Decision-	big data to make informed business decisions.	Etienne Fabian et al.
Making		(2024)
Customer	Improves customer experience through personalized	North et al. (2019); Skare
Engagement	services and efficient communication channels, leading to	et al. (2023)
	higher satisfaction and loyalty.	
Cost Reduction	Reduces operational and labour costs by optimizing	Skare et al. (2023);
	resource allocation and automating routine tasks.	Bouwman et al. (2019)
Access to	Enhances financial credibility and market positioning,	Skare et al. (2023);
Financing	making SME more attractive to investors and lenders.	Hassan et al. (2024)
Regulatory	Helps SME quickly adapt to changing regulatory	Skare et al. (2023); Appio
Adaptability	environments using digital solutions for compliance,	et al. (2024)
	security, and privacy management.	
Resilience and	Increases adaptability to market disruptions (e.g., COVID-	Appio et al. (2024); North
Agility	19) and accelerates recovery through remote work	et al. (2019)
	capabilities and digital operations.	
BM Innovation	Enables SME to explore and implement new revenue	Bouwman et al. (2019);
	streams and value delivery mechanisms by leveraging	Hassan et al. (2024)
	digital technologies.	

Source: developed by the author

Adopting advanced technologies also supports innovation enablement and enhanced decisionmaking, fostering customer-centric approaches and data-driven strategies that allow SMEs to better meet market demands. Furthermore, digital transformation creates opportunities for SMEs to adapt to unexpected disruptions, such as economic crises, global pandemics, or energy shortages. Digital adoption also strengthens SMEs' ability to comply with regulatory requirements more efficiently and improves their financial credibility, thereby enhancing access to financing.

These values, derived from various scientific studies and captured in Table 3, underscore the strategic importance of digital transformation for SMEs' sustainable growth and resilience.

It is important to mention the innovation benefits of digitalization are not automatic. As is claimed by the OECD, 2024, limited access to reliable, fast, and affordable digital infrastructure and a lack of digital skills continue to limit the digital transition of SMEs across many OECD countries and regions. Access to a fast broadband connection remains uneven between urban, rural, and remote areas,

which is crucial for firms to fully capitalize on the opportunity of digital transformation and unlock the potential of the most advanced applications. Additionally, skills shortages weigh on SMEs' ability to adapt and transform (OECD, 2024).

Based on North et al. (2019), despite huge digitalization benefits, the digital transition remains a significant challenge for SMEs due to resource limitations and strategic gaps. Most SMEs adopt a cautious approach, implementing small-scale, quick-impact projects without a comprehensive digital transformation strategy. In scientific literature, we can find multiple barriers for SMEs that limit them from adopting digitalization in their enterprises, and some scientific research will already prove these points. First, it goes, the ability of SMEs to innovate depends on employees with appropriate digital capabilities to maximize the use of digital technologies (Scuotto et al., 2021). Secondly, Absorptive capacity—an organization's ability to acquire, assimilate, and exploit new knowledge—plays a crucial role in ensuring that digital diffusion translates into tangible innovation outcomes (Hassan et al., 2024). Another barrier to digital transformation is resource constraints, both financial and human identified by (Costa Melo et al., 2023). Resource limitation is limiting their ability to leverage technologies effectively.

Another limitation/risk is directly caused by digital transformation, which is defined as Skare et al., (2023) an increased demand for skilled labor. As SMEs adopt new technologies and processes, digital transformation may lead to a higher demand for skilled labor. The article claims that "in the short run, digital technology adoption increases SME concerns about attracting high-skilled labor, professionals, and experienced managers necessary for digital transformation." (Skare et al., 2023)

Although all these studies we reviewed underscore the varied benefits of digital transformation, they provide limited insight into the combined effect of internal digital readiness and external partnerships on SMEs' capacity to innovate. By clarifying how collaboration with technology providers, universities, or peer networks can amplify these benefits, our research addresses a gap in understanding how SMEs can effectively harness digital transformation to achieve sustainable growth.

To conclude, digital transformation provides SMEs significant advantages like operational efficiency, market expansion, innovation enablement, enhanced decision-making, and cost reduction. Together, these advantages brought to the enterprise drive its growth and competitiveness. While digital transformation enables SMEs to streamline processes, develop innovative business models, and access broader markets, its success hinges on overcoming barriers like absorptive capacity, strategic gaps, and uneven digital readiness. Additionally, adopting digital technologies is not without challenges, as SMsE often face resource constraints, skills shortages, and limited access to infrastructure.

1.5. Drivers of Digital Transformation in SME

To continue, we will investigate different research and identify the key drivers of digital transformation in SMEs. These include leadership, digital skills, organizational culture, and external factors such as market demand and technological advancements. Understanding these drivers will help us build the framework for SME growth, as it highlights the internal and external forces that influence successful digital change.

To begin with, Omrani et al. (2024) explore the key factors influencing the adoption of digital technologies in SMEs, applying the Technology–Organization–Environment (TOE) framework to identify the primary drivers. This study reveals the internal, external, and technological factors shaping the digital transformation journey of SMEs, focusing on their ability to use new digital tools to improve business performance and remain competitive in a fast-changing environment. Omrani et al. (2024) define key drivers that push for digital transformation. In their study, they look at **Internal factors** (resources, capabilities, IT infrastructure, human skills, financial resources, and the level of innovation within the company), **External factors** (e.g., pressure from partners, government regulations, availability of technology infrastructure. Also, company size and location.

Based on a study by Clemente-Almendros et al. (2024), we can add three main factors that affect digital transformation in SMEs: the managerial education level, the level of internationalization, and firm size. These factors are analyzed not only in isolation but also in terms of how they interact with each other in the digitalization journey of SMEs. Arranz et al., (2023) brings - Innovation Capabilities (internal): The ability of a firm to seek out, acquire, and implement new ideas, Digital Capabilities (internal): The skills and resources needed to adopt and utilize digital technologies and Environmental Support (external): Refers to factors like financial aid, regulations, and access to digital infrastructure provided by the government or other institutions. These factors fit next to Omrani et al. (2024) research as a supplementary study.

Digital capabilities additionally rose in the study of Scuotto et al. (2021). In the study, Digital capabilities and specifically individual employee digital skills in enterprises were analyzed as drivers for Innovation performance and SME growth. Scuotto et al. (2021) suggested that SMEs with a higher degree of individual digital capabilities will experience greater growth, stronger individual digital capabilities will experience, and finally, Innovation performance for a better growth rate. The study shows significant evidence that individual digital skills matter and matter deeply, relating employees' skills and innovation performance to organizational outcomes. <...> Individual digital capabilities can be seen as an important, critical asset to allow companies to exploit

new opportunities, to be more efficient, and to discover new ways to create and manage a business (Scuotto et al., 2021).

Omrani et al. (2024) define digital transformation in SMEs as being driven more by internal organizational factors, like innovation level, skills availability, and financial resources. Companies with high internal readiness - whether in terms of human capital or existing technological infrastructure - are better positioned to adopt and implement new digital technologies. The key finding – is that the main driver of technology adoption is "organization preparedness" for digitalization (Omrani et al., 2024). Similarly, Clemente-Almendros et al. (2024) emphasize that managerial education is crucial, with higher-educated managers being more likely to adopt digital technologies. The importance of education in enabling the successful digital transformation of SMEs. SME managers must proactively acquire new knowledge and capabilities, meaning that business professionalization is paramount for these companies (Clemente-Almendros et al., 2024). Two additional internal drivers for digitalization are proposed Arranz et al., (2023). The study suggests Innovation and Digital capabilities have a greater impact than innovation capabilities in the digital transformation process of SMEs (Arranz et al., 2023).

On the other hand, Omrani et al. (2024) found that environmental factors - including external pressures from competitors, customer demands, and regulatory frameworks - have a weaker influence on digital technology adoption. Rather than adopting mimetic behaviors based on external pressure, SMEs that aim for digitalization should assess their existing technologies and develop a meticulous technological roadmap that includes skills upgrades and investments in upskilling employees' capabilities (Omrani et al., 2024). Arranz et al., (2023) The study finds that environmental support plays a weaker role than internal capabilities, even cautioning that excessive external support can create administrative burdens, and it, in general, goes in hand with Omrani et al. (2024). In contrast, Clemente-Almendros et al. (2024) study claims that companies with higher levels of Internationalization have greater levels of digital transformation. Internationalization could be assumed as an environmental or external factor –enterprises that operate in different countries face diverse regulations, legal frameworks, or cultural differences.

Studies by Omrani et al. (2024) and Clemente-Almendros et al. (2024) highlight firm size as a factor that possibly affects digital technology adoption. This factor is mainly linked to a company's resource availability, enabling digital adoption. Due to greater resource availability, large companies are more capable of implementing digital transformation strategies.

The key drivers highlighted by different research that influence SMEs' digital transformation are summarized in Table 4. They all nicely illustrate what enables successful digital adoption. Internal

drivers, such as digital capabilities, innovation capabilities, organizational preparedness, and managerial education, are critical for readiness and adaptability within SMEs. Factors show the importance of building skills, leadership, and infrastructure to drive transformation from the inside. External drivers, including regulations, market demands, and internationalization, illustrate the role of external pressures and opportunities. Even the impact of these factors often depends on how effectively SMEs leverage them in combination with internal readiness. Finally, technological drivers, such as technology readiness and the balance between exploration and exploitation, show the need for strategic alignment between available technologies and organizational objectives. Together, these drivers provide a comprehensive understanding of the conditions under which SMEs can be influenced and achieve growth through digital transformation.

Most of the research we reviewed acknowledges the significance of internal drivers, such as digital skills and leadership, in shaping technology adoption in enterprises. However, studies do not deeply analyze how these internal drivers intersect with external drivers (e.g., market demands and regulatory support) and how they accelerate digital transformation in SMEs. Our study values both as significant forces and highlights where gaps in capability or infrastructure can be bridged through open innovation initiatives.

Key Drivers	Description	Supporting Sources
Internal Factors		
Digital	Skills, resources, and readiness of employees and	Scuotto et al. (2021);
Capabilities	managers to adopt and utilize digital technologies.	Arranz et al. (2023)
Innovation	The ability of SME to seek, acquire, and implement	Arranz et al. (2023)
Capabilities	innovative ideas and processes.	
Leadership and	Proactive leadership and higher education levels in	Clemente-Almendros et
Managerial	management enhance readiness and willingness to adopt	al. (2024); Omrani et al.
Education	digital solutions.	(2024)
Organizational Availability of IT infrastructure, financial resources, and a		Omrani et al. (2024);
Preparedness culture of innovation within the organization.		Scuotto et al. (2021)
External Factors		•
Market and	Pressure from customers to provide modern, tech-enabled	Omrani et al. (2024)
Customer	solutions and competitive market dynamics driving	
Demands	innovation.	
Regulatory	Government policies and legal requirements that	Omrani et al. (2024);
Framework	incentivize or necessitate the adoption of digital practices.	Arranz et al. (2023)
Technology	The accessibility of digital tools and platforms to enable	Omrani et al. (2024);
Availability	transformation.	Clemente-Almendros et
		al. (2024)

Table 4: Key Dr	ivers of SME	Digital	Transformation
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Internationalizati	SME operating in multiple markets adopt digital	Clemente-Almendros et
on transformation to address diverse regulatory, cultural, and		al. (2024)
	operational challenges.	
Technological Facto	ors	
Technology	The maturity of available technologies and their alignment	Jafari-Sadeghi et al.
Readiness	with SME needs.	(2021); Omrani et al.
		(2024)
Technology	Balancing the acquisition of new technologies with the	Carrasco-Carvajal et al.
Exploration and	efficient utilization of existing ones to maximize business	(2023)
Exploitation	impact.	

Source: developed by the author

So, to sum up, the key drivers influencing SMEs' digital transformation could be categorized into internal, external, and technological factors. Internal drivers, such as digital and innovation capabilities, organizational preparedness, and managerial education, play a critical role, with studies emphasizing that SMEs with higher internal readiness and skilled leadership are better positioned to adopt digital technologies. External factors, including regulatory frameworks, market demands, and internationalization, impact digital transformation, though their influence is generally weaker than internal factors. Technological drivers, such as technology readiness and exploration, further shape SMEs' ability to leverage digital tools effectively. Overall, the findings underscore that successful digital transformation heavily depends on a firm's internal capabilities and strategic preparedness, with external and technological factors as supplementary enablers.

1.6. Roadmap for SMEs Digital Transformation

This section outlines a structure other authors suggested for a roadmap for SMEs to implement digital transformation. The roadmap provides a practical framework for navigating the complexities of digital transformation. This section contributes actionable insights to the study's broader framework by breaking the process into manageable steps.

While market forces, internal drivers, and technological advancements can drive digital transformation in SMEs, a successful journey requires more than just readiness or external pressure. Digital transformation in SMEs isn't merely a matter of technological adoption. It demands a strategic, structured approach. A well-defined strategic plan and effective implementation are crucial to harnessing the full potential of digital technologies. True success leads SMEs to successful digital transformation on a well-defined plan and its effective execution.

Appio et al., (2024) in his research, he proposes a five-stage digital transformation roadmap for SMEs (Figure 4). The framework emphasizes the critical role of open innovation throughout the

process. The roadmap comprises five interconnected phases: scanning, testing, adoption, integration and alignment, and permanent transformation.

The general idea is that SMEs start by observing their external environment to identify relevant digital trends and opportunities, ensuring their strategies remain informed by market demands and technological advancements. Companies can reduce risks and refine solutions before fully integrating them into their operations by adopting a pilot-first approach in the testing phase. During the adoption phase, these validated solutions are rolled out across the organization, ensuring they align with resource availability and operational needs. The integration and alignment phase then embeds these capabilities into the core business model, creating cohesion between new technologies and existing processes. Finally, the permanent transformation phase establishes a culture of ongoing innovation, where agility and collaboration are continuously promoted by leadership, ensuring that digital transformation becomes a sustained effort rather than a one-time event. This holistic progression ensures that SMEs embrace change and thrive in a dynamic and competitive digital economy.

Overall, Appio et al., (2024) the five-stage roadmap provides SMEs with a structured and iterative approach to navigating the complexity of digital transformation. By integrating open innovation, the roadmap addresses the resource limitations often faced by smaller enterprises and unlocks opportunities for growth and competitiveness.

	SCANNING	TESTING	ADOPTION	INTEGRATION & ALIGNMENT	PERMANENT TRANSFORMATION
Task	Scan surrounding environment Perform scouting of new digital business models and solutions Identify relevant use cases and digital solutions	Articulate business problem Validate effectiveness of identified digital solutions Assess potential business impacts (business case) Develop Minimum Viable Product (MVP) Run Proof-of-Concept (PoC) Fine-tune solution	Define scale-up strategy Develop detailed implementation plan Perform assessment of resources Identify funding needs Identify implementation partner Develop solution at scale	Secure leadership commitment Set up centralized governance & control mechanism Refine business & operating model Align internal organization and capabilities Manage change	Nurture an agile organizational culture Set-up permanent mechanisms to secure engagement of internal resources to continuous evolution Foster internal/external collaboration and innovation practices
Output	Long list of most attractive use cases/digital solutions	Business case Minimum Viable Product Digital solution	Implementation Plan Resource Plan including funding sources Implementation partner identified and engaged Solution go-live	Governance & control mechanism Updated business & operating model	Continuous evolution mechanisms in place Open-innovation and collaboration strategy

Figure 4: SMEs digital transformation roadmap

Source: Appio et al., 2024

North et al. (2019) claim that digital transformation is a learning process and offer the DIGROW framework for SMEs, which is based on the design and growth of digital transformation in the organization. The framework offers a structured way to evaluate and enhance an SME's readiness for

digital. It structures all framework in to the "wheel of digitally enabled growth" that can also be used as a self-evaluation tool (Figure 5).



Figure 5: DIGROW framework by North

Source: North et al., 2019

The DIGROW framework is composed of four stages. In the first stage, Sensing Digitally Enabled Growth Potentials, in this stage enterprises should identify and understand opportunities and threats in the digital landscape. This includes recognition of technologies, market trends, and customer needs. The second stage, Developing a Digitally Enabled Growth Strategy and Mindset, focuses on creating a clear digital strategy aligned with the organization's goals. This involves setting specific objectives, allocating resources, and fostering a culture of innovation and experimentation.

The third stage, Seizing Digitally Enabled Growth Potentials, is taking action. In this stage, SMEs take action to implement their digital strategy. This includes digital initiatives, digital market presence, and changing digital customer experience, leading to new ways of creating value (in general, the development of a digital business model). The final stage, Managing Resources for Digital Transformation, covers different recourses. Apart from financial resources, these assets are knowledge of people and technologies embedded in processes. (North et al., 2019)

Digital transformation offers a pathway to improved performance. Even with strong internal and external drivers propelling change and a framework in hand, the key challenge remains effectively allocating limited resources to digital transformation activities.

Digital transformation in SMEs is a complex process requiring more than just technological adoption. It requires a strategic, structured approach to ensure success. While different frameworks offer distinct methodologies, they generally emphasize the importance of aligning digital strategies with organizational goals, enterprise culture of innovation, and integration of technologies into daily business models. Common things across these approaches include the need for careful planning, iterative execution, and resource optimization. But also - recognition of digital transformation as a learning and adaptive process that is repeating and not ending by adopting some specific technology.

1.7. Open Innovation – as a source of SME Digital Transformation and performance

This section explores open innovation as a strategy for SMEs to overcome resources and knowhow limitations to enhance their digital transformation efforts. Open innovation involves leveraging external partnerships, such as collaborations with technology providers, research institutions, and other enterprises. By linking open innovation to SME performance, this section supports the idea of this work that collaboration is essential for driving digital adoption and growth.

Digital transformation can bring various benefits to SMEs. However, when an SME decides to implement a change, it has insufficient internal resources and is not capable of doing so alone; thus, it is forced to involve external parties (Albats et al., 2023).

For example, while the DIGROW model by North et al. (2019) provides a structured framework and practical recommendations, it also emphasizes that "the owner/manager, supported by a 'growth coach,' defines a strategic growth project (North et al., 2019)." This indicates that the model is not designed for standalone implementation but requires collaboration and partnership for successful execution.

Even more challenges or barriers to Digital technology adoption in SMEs are defined in Appio et al., (2024) Figure 6. His research Appio et al., (2024) analyzed how to overcome different barriers to digital transformations. In the paper, the role of Open Innovation (OI) as a key strategy for SMEs, enabling them to access external resources and incorporate digital technologies into their business processes.

As SMEs might face different challenges in digital transformation and business model transformation - solutions to speed this process faster might be needed to embrace Open innovation (OI) via collaboration with external partners could be the way. OI provides a path for these businesses to access necessary resources and solutions that would not be available in their organization and overcome barriers more easily.



Figure 6: Main SMEs benefits and barriers in digital technologies implementation by Appio

Source: Appio et al., 2024

Open innovation (OI) has emerged as a strategic imperative for small and medium-sized enterprises (SMEs) striving to stay competitive in an increasingly digital world. Adopting an OI could be a life-changing strategy for SMEs as it can help them access needed technology adoption. "Through the lens of OI, SMEs can not only swiftly access the latest technologies but also unlock new market opportunities" (Appio et al., 2024) and create business models.

Open innovation (OI) is defined as a decentralized innovation method that relies on deliberately managing knowledge transfer across organizational borders, utilizing monetary and nonmonetary mechanisms in accordance with the organization's business model (Chesbrough & Bogers, 2014.). Meanwhile – "Open innovation (OI) is a strategy that firms adopt to innovate by incorporating knowledge from both outside and inside their firms, exploiting their knowledge, and exploring the knowledge of their environment (Carrasco-Carvajal et al., 2023)."

In simplified words – Open innovation is a collaborative approach that involves sharing or acquiring knowledge, resources, and ideas both inside and outside the organization with the expectation of receiving valuable insights and improvements in return.

Based on Appio et al. (2024), OI might serve as a solution for SMEs facing various internal limitations. By leveraging external knowledge and resources, SMEs can overcome constraints related to funding, expertise, and technology access. Partnerships with universities, research centers, suppliers,

or other entities allow SMEs to use a broader network and access the latest technologies and market opportunities. OI enables SMEs to adopt the latest digital tools and solutions to remain competitive in a fast-changing market.

Open innovation is important for all SMEs, whether they adopt an incremental or radical business model transformation. As stated, radical business model transformation requires more complex changes in different parts of a business model via changing value creation, value delivery, and value-capturing processes, and, therefore, requires more complicated forms of open innovation (Albats et al., 2023). SME digitalization is also a key component of business model transformation, as it can significantly improve or entirely reshape how a company creates, delivers, and captures value. By digitalizing their processes, SMEs can streamline operations, enhance customer experiences, and introduce new revenue streams. For example, a company that adopts digital tools for task management for field workers may optimize efficiency and discover new ways to collaborate with partners and/or deliver service faster.

Carrasco-Carvajal et al., (2023) classified OI on the following four perspectives:

- External knowledge sources, internal knowledge, and collaboration
- Technology exploitation and technology exploration
- Inbound, outbound, and a couple
- Openness

These four perspectives give a complete picture of OI in enterprise usage.

External Knowledge Sources, Internal Knowledge, and Collaboration

Carrasco-Carvajal et al., (2023) stands out in a systematic literature review that the interaction between external and internal knowledge forms a cornerstone of open innovation (OI) in SMEs. External knowledge sources: customers, competitors, universities, and research institutions. They provide critical inputs for enhancing innovation. These knowledge sources show a variety of actors with which SMEs engage. According to the authors, enterprises that actively engage with diverse and deeply integrated external networks achieve better innovation outcomes. Internal knowledge, encompassing the enterprise expertise, resources, and operational processes, complements external inputs by fostering synergy and leveraging existing capabilities.

Collaboration is identified as a key enabler of these knowledge flows. SMEs benefit from partnerships that span various phases of the innovation lifecycle, including ideation, experimentation, and commercialization. The use of e-collaboration platforms, highlighted by Carrasco-Carvajal et al. (2023), further enhances the efficiency of such interactions by enabling seamless communication with

external partners. This approach mitigates resource limitations and facilitates co-creation, allowing SMEs to access skills, technology, and networks that would otherwise be beyond their reach.

Technology Exploitation and Technology Exploration

Carrasco-Carvajal et al. (2023), in their overview of research, also highlight the importance of balancing technology exploitation and exploration in driving innovation within SMEs. Technology exploration involves acquiring new knowledge and capabilities from external sources to address gaps in the enterprise's technological portfolio. This can include R&D collaborations, customer-driven innovation, outsourcing, and intellectual property acquisition. These activities enable SMEs to remain agile and responsive to technological advancements and market trends, fostering innovation.

On the other hand, technology exploitation focuses on utilizing existing technologies to their full potential. SMEs can monetize their technological assets through licensing, spin-offs, or joint ventures, thereby maximizing the value of their internal knowledge. This dual strategy is particularly critical for SMEs, as overemphasizing exploration or exploitation can limit long-term growth. Carrasco-Carvajal et al. suggest that SMEs that effectively balance these activities can sustain innovation by simultaneously leveraging existing resources and integrating external advancements.

Inbound, Outbound, and Coupled Open Innovation

Carrasco-Carvajal et al. (2023) describe the dynamic flow of knowledge in SMEs through the inbound, outbound, and coupled dimensions. Barrett et al., 2021 in their article, analyze 3 Open innovation mechanisms that were originally proposed by West and Bogers, (2014) and define them as Inside-out (outbound), Outside-in (inbound), and Coupled mode:

• Inside-out – the acquisition, integration, and commercialization of knowledge from suppliers, customers, the "crowd," and other sources.

• Outside-in mode – the external exploitation of ideas or innovation processes in different markets with different organizations.

• The coupled mode – linking outside-in and inside-out processes (Barrett et al., 2021)

Openness

The degree of openness in SMEs innovation strategies is a critical focus of Carrasco-Carvajal et al. (2023). The authors, in their review of OI research, define openness as the extent to which firms engage external actors in their innovation processes. This includes working with market-based sources like customers and competitors, as well as research-focused institutions such as universities and R&D
organizations. More openness is associated with greater adaptability and access to diverse perspectives, which are crucial for achieving innovative outcomes. This very match fits the idea of forming partnerships with complementary companies where a give-and-take approach is crucial for achieving positive results. In addition to that, absorptive capacity positively relates to SMEs' innovation performance. Greater absorptive capacity can allow SMEs to assimilate and exploit external knowledge more effectively in the innovation process and achieve better innovation performance. (Son et al., 2023).

Table 5 provides an overview of various open innovation strategies that we looked through, and enterprises can adopt to drive innovation and overcome resource limitations.

The adoption of OI in SMEs has challenges. Different research highlights **different challenges.** The few that would be important to highlight, as it is possibly highly important for SMEs. For example, Barrett et al. (2021) analyze how individuals affect OI acceptance in companies. He highlights several attributes. First, the influence of leadership, especially that of founders and CEOs, individual technical skills, and the maturity stage of the company. Next, external networks, growth stage, and absorptive capacity by Son et al. (2023).

Strategy Type	Description	Examples	Supporting Sources
Inbound Open	Acquiring external knowledge and	Partnering with universities for	Carrasco-
Innovation	ideas from customers, competitors,	R&D, sourcing ideas from	Carvajal et al.
	universities, and other external	customer feedback, and	(2023); Appio et
	sources.	adopting supplier solutions.	al. (2024)
Outbound	Leveraging internal knowledge	Licensing technology to other	Carrasco-
Open	externally through licensing, joint	firms or creating spin-offs for	Carvajal et al.
Innovation	ventures, or selling unused IP.	commercializing internal	(2023); Barrett
		innovations.	et al. (2021)
Coupled Open	Combining inbound and outbound	Joint ventures with competitors	Carrasco-
Innovation	strategies by forming collaborative	to co-develop products or	Carvajal et al.
	partnerships for mutual knowledge	public-private partnerships for	(2023); Barrett
	exchange.	innovation.	et al. (2021)
Collaboration	Using digital tools and platforms	Utilizing e-collaboration tools to	Carrasco-
Platforms	to enhance collaboration with	manage R&D partnerships or	Carvajal et al.
	external partners for innovation.	co-develop products.	(2023)
Technology	Searching for and adopting	Participating in innovation hubs	Carrasco-
Exploration	external technologies to fill	or technology fairs to scout new	Carvajal et al.
	innovation gaps.	technologies.	(2023); Son et
			al. (2023)
Technology	Monetizing and utilizing existing	Offering existing solutions to	Carrasco-
Exploitation	technologies effectively within and	new markets or licensing unused	Carvajal et al.
	outside the firm.	intellectual property (IP).	(2023)

Table 5:	Open	Innovation	Strategies	for	SME
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Knowledge	Establishing long-term	Building relationships with	Appio et al.
Networks	partnerships with research	innovation clusters or	(2024); Son et
	institutions, suppliers, and	technology incubators.	al. (2023)
	customers for ongoing innovation.		
Openness in	Actively engaging a diverse range	Forming ecosystems with	Appio et al.
Innovation	of stakeholders to foster creativity	multiple actors like startups,	(2024);
	and share resources for innovation.	research bodies, and larger	Carrasco-
		corporations.	Carvajal et al.
			(2023)

Source: developed by the author

Founders and CEO influence: Barrett et al. (2021) explore how the founder or CEO's characteristics influence the adoption of Open Innovation (OI) practices in high-tech SMEs. Research highlights the importance of the founder's background and entrepreneurial orientation in shaping the firm's OI trajectory. It examines how these leaders engage in external collaborations, particularly using "outside-in" mechanisms to solve problems and access new technologies. As these SMEs mature in their OI practices, they shift between different modes of innovation based on project needs, gradually adopting more complex collaboration models.

Individual technical skills: Barrett et al. (2021) delve into how the personal attributes of a founder/CEO—such as their technical background and entrepreneurial mindset—affect an SME's open innovation adoption. They reveal that founders with strong technical expertise tend to build trust and partnerships more effectively, while those lacking commercial experience face challenges in managing partnerships.

Maturity stage: Barrett et al. (2021) study analyses how SMEs shift between closed and open innovation ("pivot") based on project needs. As SMEs gained experience with OI, they progressed along an "OI maturity pathway," adopting more complex collaboration modes and appreciating the strategic benefits of OI. As firms progress, their OI practices mature, leading to more sophisticated, coupled innovation models.

Additionally, maturity stages were analyzed by Son et al. (2023). He found out that **external network** activities positively affect SMEs' innovation performance, and the effect of external network activities on innovation performance is stronger for SMEs in the mature stage than for SMEs in the early stages. (Son et al., 2023) This suggests that mature SMEs may benefit more from external collaborations as their processes and structures are more stable, allowing them to leverage external knowledge and resources more effectively. So, SMEs' open innovation activities are generally positively associated with innovation performance and firm performance. However, the effects of open

innovation may differ depending on the type of innovation and the SME's growth stages (Son et al., 2023).

Absorptive capacity. One more important factor for OI, as defined by Son et al. (2023), is how much OI a company can take in-house. The findings indicate that absorptive capacity positively relates to SMEs' innovation performance. Greater absorptive capacity can allow SMEs to assimilate and exploit external knowledge more effectively in the innovation process and achieve better innovation performance (Son et al., 2023).

What is more, even as many companies are already using open innovation, Barrett et al. (2021) observed that while SMEs may not be familiar with the concept of "open innovation," they often utilize it in their daily operations. According to the researchers, evidence of leveraging OI was clear from interviews that respondents were often unfamiliar with the term 'open innovation,' viewed examples of OI practices as 'common sense,' and made decisions pertinent to the specific innovation project (Barrett et al., 2021). So, such activities as encouraging open innovation based on partnership should be encouraged.

As covered by Son et al., 2023, government support and subsidies might play an important role in supporting SME open innovation activities, especially in early-stage firms that lack resources and experience. Government R&D subsidies can help initiate cutting-edge, high-risk R&D projects and overcome a shortage of R&D funds. However, it is well-known that government subsidy programs usually have a high administrative burden (Son et al., 2023). In countries like South Korea, R&D subsidies have been provided to SMEs in innovation clusters, helping them overcome financial barriers and initiate high-risk projects. However, such subsidies are often associated with administrative burdens, which can limit their accessibility for some firms (Son et al., 2023).

But even as Open innovation can help SMEs to digitalize faster, it is still important to understand that new business models are not developed overnight, and the role of Open Innovation activities in crafting new business models can only be analyzed properly when SMEs are observed for a longer time.

In our literature review, we noticed that while studies highlight how open innovation helps SMEs overcome resource and knowledge constraints, few address the specific mechanisms by which such collaborations lead to digital transformation and enterprise growth. This gap points to the need to investigate not only whether external partnerships drive digital adoption but also how they fit with SMEs' internal capabilities to create long-term competitive advantage and growth. By exploring the synergies between these partnerships and internal innovation processes, our research aims to shed light on the conditions under which open innovation can most effectively accelerate SMEs' digital transformation and growth.

In this topic, we reviewed the critical role of open innovation (OI) in pushing SMEs' digital transformation and overcoming its resource limitations. Open innovation enables SMEs to access external knowledge, technologies, and networks, which are often beyond their internal capacity, fostering innovation and enhancing competitiveness. By leveraging OI strategies, such as collaboration with external partners, inbound and outbound innovation, and technology exploration, SMEs can overcome challenges like limited financial resources, lack of technical skills, and restricted infrastructure. The insights reveal that while OI significantly enhances SMEs' ability to adapt to a digital-first economy, its success depends on factors like absorptive capacity, maturity stage, and leadership involvement. Ultimately, OI serves as a powerful enabler for SMEs to develop new business models, improve operational efficiency, and remain resilient in rapidly evolving markets.

The final remarks reveal the significant role of SMEs in modern economies and the transformative potential of digital technologies for their growth and competitiveness. Additionally, we examined the clear benefits of digital transformation, such as operational efficiency, innovation enablement, and market expansion, while also addressing the numerous challenges SMEs face, including resource constraints, skills shortages, and other barriers to technology adoption in their daily operations. Furthermore, we explored the key drivers of digital transformation, highlighting internal factors like digital capabilities and leadership alongside external influences such as market demands and regulatory frameworks. We also underscored the importance of structured frameworks and analyzed how Open Innovation can serve as a critical strategy for navigating the complexities of digital transformation. Together, these insights establish a comprehensive foundation for understanding how SMEs can overcome barriers and strategically leverage digital technologies to achieve sustainable growth and thrive in an increasingly competitive digital landscape.

2. THE CONCEPTUAL FRAMEWORK FOR ACCELERATING SMEs GROWTH THROUGH DIGITAL TRANSFORMATION AND OPEN INNOVATION

The literature we've reviewed highlights the potential of digital transformation and how it can fundamentally change the performance of SMEs through their competitiveness, innovation capacity, and market reach. With the diversity of insights and findings, it becomes crucial to organize this information in a way that provides a clear and structured understanding of the broader picture. To achieve this, we have developed a conceptual framework for accelerating SMEs' growth through digital transformation and open innovation. By integrating insights from the reviewed literature, the framework offers a systematic approach to understanding how digital transformation and open innovation collectively impact SME growth.

The SME Growth Acceleration Framework is designed to:

1. To distinguish the key drivers that enable SME digital transformation and adopt open innovation strategies.

2. To explain the processes through which these drivers contribute to growth, innovation, and market diversification.

3. To provide actionable pathways for SMEs to overcome barriers such as resource constraints, technological inertia, and limited innovation capacity.

The framework is built on these concepts from the literature:

1. Digital Capabilities: The skills, tools, and resources required to leverage digital technologies effectively, as highlighted by Scuotto et al. (2021) and Hassan et al. (2024).

2. Open Innovation: A collaborative approach that involves sourcing knowledge and resources externally while fostering co-creation, as discussed by Appio et al. (2024) and Carrasco-Carvajal et al. (2023).

3. Business Model Innovation: The adaptation of existing business models or the creation of new, digitally enabled ones to enhance competitiveness, as emphasized by Bouwman et al. (2019).

The SME Growth Acceleration Framework consists of four interlinked components: Drivers, Processes, Moderators & Mediators, and Outcomes (Table 6).

Drivers	
Digital Capabilities	Encompassing employee digital skills, IT infrastructure investment, and digital tool adoption.
Innovation capabilities	Including in house creativity, partnerships and collaborative projects.
Internal Readiness	Leadership support, financial resources, and absorptive capacity to implement digital strategies effectively.
External Factors	Regulatory environments, market competition, and customer demands that influence digital adoption.

Table 6: The SME Growth Acceleration Framework components

Processes	
Digital	The strategic integration of digital technologies to optimize operations and customer
Transformation	experiences.
Open Innovation	Leveraging external knowledge and resources to foster innovation and address
Integration	internal resource gaps.
Business Model	Transforming existing business models or developing new ones to diversify revenue
Innovation:	streams and enhance market adaptability. An inevitable process at a time when a
	company is being adjusted in its structural foundations
Moderators and Med	liators
Firm Size	Larger firms may have more resources and capacity to adopt digital transformation.
Internationalization	SME operating in diverse markets may face additional external pressures that
Internationalization	accelerate innovation.
Leadership Vision	Strong leadership aligns organizational priorities and ensures the success of
Leadership vision	transformation efforts.
Absorptive Conscitu	The ability to acquire, assimilate, and apply external knowledge effectively to drive
Absolptive Capacity	innovation and transformation.
Outcomes	
SME Growth	Measured through revenue growth, performance, market diversification, and
SIVIL OIOWII	employee expansion.
Innovation	Development of new products, services, and processes that enhance
Performance	competitiveness.

Source: developed by the author

The framework (Figure 7) is based on the fact that SME growth is achieved through the interaction of its components:

• Drivers such as digital skills, external factors, innovation capabilities, or others provide the foundation for transformation and trigger or keep active Processes.

• Moderating and mediating factors, like leadership vision and absorptive capacity, influence the strength and direction of the process. It also defines ways how the process is happening and how much resources are allocated for them.

• Processes such as digital transformation, open innovation, and business model innovation act as enablers, translating drivers into results. The outcome created by processes is expected to be SME growth via new sales or a lower cost base. These processes also interact with each other as either the outcome or background of other processes or done together.

• Outcomes once again affect Drivers, such as internal readiness, which again influences processes.

It is important to highlight that the framework is very dynamic, with components interacting in a way that reinforces progress. For example, successful digital transformation efforts often result in increased productivity and resource availability. These enable SMEs to reinvest newly opened recourses into their innovation capabilities, further driving digital adoption and market competitiveness. In a similar way, open innovation activities bring new knowledge and tools that, first of all, accelerate digital transformation but also could change a culture of continuous learning and, in this way, the acquisition of new organically acquired digital capabilities.

Figure 7: Conceptual Framework for Accelerating SME Growth through Digital Transformation and Open Innovation



Source: developed by the author

This framework distinguishes itself from existing models by explicitly integrating open innovation with digital transformation, offering a holistic approach to SME growth. Unlike traditional frameworks that treat these areas independently, this model emphasizes their interdependence, particularly in resource optimization, continuous innovation, and business resilience.

Additionally, this framework does not exclude other models dedicated to specific areas; for instance, digital transformation frameworks discussed in the literature part can complement and enhance the digital transformation process within this broader framework.

Practicality of framework

The practicality of this framework is based on adaptability, as it can be applied to SMEs at any stage of their digitalization journey. Whether a company is just beginning its digital transformation or is looking to scale its advanced capabilities, the framework provides an approach for guiding strategic decisions. It starts with understanding the **drivers**, followed by the **moderators and mediators**, and implementing the **processes** to achieve growth and performance.

Drivers: The journey begins with identifying *why* the company wants or is forced for digital transformation. This often starts with external drivers, such as competition, regulatory requirements, resource limitations, or market demand, which create the initial push for change. Together with this, we should understand our starting point: digital readiness. For example, the questions that should also be answered are: Does the organization have employees with foundational digital skills, or are they starting from zero? Are we transitioning from basic tools like pen and paper to Excel or moving to advanced platforms like BI, ERP, or AI-based solutions? Understanding these drivers helps clarify the organization's purpose and readiness for transformation.

Moderators and mediators: Moderators influence the trajectory and outcomes of digital transformation and innovation. Factors like leadership vision determine whether the company has a clear strategy and vision for innovation - be it incremental improvements or radical transformation. Firm size and resource availability further shape the pace and scope of change, as larger enterprises may have more capacity for rapid implementation, whereas smaller firms may need to take gradual steps. Internationalization and absorptive capacity also play key roles: a firm operating across diverse markets may adopt digital tools to navigate varying regulatory environments, while its ability to assimilate and utilize new knowledge impacts how effectively it can integrate external expertise into its processes.

Processes: Once the drivers and moderators' effects are clear, the focus shifts to *how* the company can implement digital transformation and will and how much it goes for open innovation. For example, some companies can go to consultancies, some collaborate with universities or research institutions to accelerate innovation, and some may just use publicly available white papers. Leadership vision and resource constraints identified earlier directly influence this stage. Additionally, the process includes adopting new digital tools and systems, which may range from basic e-commerce platforms to advanced AI-driven solutions, depending on the company's readiness.

Business model innovation is related to digital transformation and open innovation. On the other hand, a change in the business model might require digital transformation and open innovation. While adopting new tools and collaborating with partners, SMEs often need to adjust their business models to capture and deliver value more effectively or just due to new tools applied. These changes

don't always require radical innovation but may involve incremental shifts, such as replacing emailbased ordering systems with e-commerce platforms, which can enhance customer experience and operational efficiency. The goal is to align the business model with digital strategies to sustain growth and improve market performance.

Outcomes: Ultimately, the framework is designed to drive SME growth and innovation performance. By systematically addressing drivers, moderators, processes, and business model adjustments, SMEs can create a sustainable pathway for digital transformation that enhances their competitiveness, adaptability, and long-term success. Also, during the transformation process, new drivers will be created for further transformation, so the outcome of transformation should push the need for further transformation.

To sum up, we suggest a dynamic framework that is built on three key ideas: first, SMEs with higher levels of employee digital skills will experience significantly higher growth rates; second, open innovation activities have a positive and significant impact on digital transformation and SMEs growth; and third, digitally enabled business models enhance growth and market diversification compared to traditional models. By combining these elements, the framework provides a comprehensive pathway for SMEs to leverage digital transformation and open innovation as complementary strategies to achieve sustainable growth and competitiveness in a dynamic market environment.

3. RESEARCH METHODOLOGY

In the following part, we aim to develop and conduct research to validate the proposed framework and confirm insights from the literature analysis. This process will provide empirical evidence to support the study's theoretical foundations. "Research is a systematic process, i.e., there is a system or right way to do research" (Sheppard, 2020). Guided by this principle, our research approach will follow a structured methodology to ensure reliability, accuracy, and relevance in addressing the outlined hypotheses and objectives.

Empirical research will be conducted to test the framework developed. Three hypotheses will be tested during the study of the literature analyzed and the proposed model.

The goal of research: To empirically validate SMEs growth acceleration framework through digital transformation and Open Innovation by testing the hypotheses and checking the relationships between digital capabilities, open innovation, and SMEs growth.

Objectives of the research:

- Analyze the Impact of Digital Capabilities on SME Growth.
- Evaluate the role of open innovation for digital transformation and SME growth.
- Investigate the Effect of Digitally Enabled Business Models.
- Assess the impact of mediating and moderating factors on the digital transformation of SMEs.
- Develop Practical Recommendations.

3.1. Research Assumptions and Hypothesis

Hypothesis 1: SMEs with higher employee digital skills will experience higher growth rates and enhanced innovation performance than those with lower digital skills.

Assumption: Employee digital skills are critical drivers of innovation and growth in SMEs.

Link to literature concepts:

• Scuotto et al. (2021): Claim that individual digital capabilities (skills) strongly correlate with innovation performance and SME growth. Employees' digital skills are critical for exploiting opportunities and driving efficiency.

• Hassan et al. (2024) Highlight that SMEs benefit significantly from dynamic changes driven by skilled labor and digital diffusion. The research emphasizes the role of skilled employees in adopting and leveraging digital tools.

Framework Connection:

• Employee digital skills fall under Digital Capabilities, a primary driver in the framework. These skills empower SMEs to leverage digital tools for process optimization and customer engagement.

Hypothesis 2: SMEs that actively engage in open innovation (OI) activities, such as external partnerships and collaborative innovation, will achieve higher levels of digital transformation (e.g., digital tool adoption, process automation) and greater annual business growth compared to those that do not engage in such activities

Assumption: OI is a strategic enabler for SMEs to overcome internal resource limitations and access advanced technologies.

- Main literature evidence:
 - Appio et al. (2024) emphasize OI as a solution to overcome internal limitations like funding and expertise. OI enables SMEs to adopt digital tools effectively.
 - Carrasco-Carvajal et al. (2023) discuss how OI opens access to external knowledge, resources, and technologies, driving innovation and competitiveness.
 - Son et al. (2023) highlight OI strategies, supported by absorptive capacity, are critical for SMEs to leverage external knowledge effectively.
- Link to literature concepts:
 - Open Innovation is a central driver in the framework, enabling SMEs to explore and exploit technology.
 - OI integration supports Digital Transformation and enhances the effectiveness of Business Model Innovation.

Hypothesis 3: SMEs that implement digitally enabled business models (e.g., e-commerce, digital platforms) alongside their traditional operations will experience higher growth rates, greater resilience, and market diversification than SMEs that rely solely on traditional models.

Assumption: Digitally enabled business models create new revenue streams, enhance scalability, and improve resilience.

- Link to literature concepts:
 - Bouwman et al. (2019) demonstrate that SME performance is significantly enhanced by business model innovation driven by digitalization
 - Etienne Fabian et al. (2024) indicate that digitalization supports revenue stream diversification and customer-centric business models, which are critical for scalability.

- Albats et al. (2023): Highlights how OI accelerates business model transformation, enabling SMEs to integrate digital tools and unlock new opportunities.
- Framework Connection:
 - The framework highlights Business Model Innovation as a process linking digital transformation and SME growth. New models leverage Digital Capabilities and external collaboration for sustained performance.

3.2. The Selection of the Empirical Research Method

The Emerald Publishing web page defines "Empirical research as research based on observation and measurement of phenomena, as directly experienced by the researcher. The data thus gathered may be compared against a theory or hypothesis, but the results are still based on real-life experience. The data gathered is all primary, although secondary data from a literature review may form the theoretical background." (Emerald Publishing, 2024). This approach provides insights into observed phenomena by applying scientific methods, allowing for the validation of hypotheses, discovery of patterns, and establishment of causal relationships.

Different literature will offer different research processes. It could also look at a structured nine-step process, as suggested by Sheppard, (2020) (Figure 8).



Figure 8: Process of Undertaking Research

Source: Sheppard, 2020

In the research context, we have already completed several process steps: topic selection, Literature analysis, problem definition, and research question development. The next step is defining general research principles.

It is important to understand the possibilities when choosing a research design. Leavy (2017) distinguishes five major approaches to scientific research, each characterized by distinct methodologies and purposes (Leavy, 2017). His book highlights quantitative, qualitative, mixed methods research (MMR), arts-based research (ABR), and Community-based participatory research (CBPR).

• Quantitative research involves analyzing numerical data and statistical relationships. It employs deductive reasoning to validate or refute theories. This method is particularly effective for explaining, evaluating, or predicting phenomena, emphasizing objectivity and neutrality.

• Qualitative research, in contrast, seeks to explore and understand social phenomena through non-numerical data, such as interviews, observations, and texts. Using inductive reasoning, qualitative research generates theories and provides deep insights into the meanings ascribed to experiences, making it ideal for exploring, describing, or explaining complex social interactions.

• Mixed methods research (MMR) integrates quantitative and qualitative approaches within a single study, enabling a comprehensive understanding of the phenomena under investigation. This approach is particularly valuable for projects requiring explanation and contextual exploration, as it combines the depth of qualitative data with the breadth of quantitative analysis.

• Arts-based research (ABR) - employs creative arts as a medium for inquiry, intertwining theory and practice to evoke emotions, provoke thought, and engage holistically with research questions. This method suits projects aiming to challenge traditional narratives or foster aesthetic understanding.

• Community-based participatory Research (CBPR) emphasizes collaboration between researchers and community stakeholders. This approach actively involves communities in the research process, from problem identification to dissemination of findings, making it particularly suited for initiatives promoting community change or action.

The quantitative approach has been selected for this study due to its alignment with the research objectives and hypotheses. Also, the key strengths of the quantitative approach include its ability to generate statistically significant results, ensure replicability, and provide clear evidence for decision-making. To test the hypotheses, the decision was made to use a quantitively data-driven approach and analyze available open data rather than relying on traditional methods such as interviews or surveys, which, in many cases, can be very local or subjective. Analyzing publicly available macro-level data will allow capturing the diversity of SME performance across different countries. This approach allows

us to examine how varying levels of digital maturity, environmental factors, and market dynamics influence SME growth.

As we aimed to analyze macro-level trends, the study focused on country-level data to ensure consistency and comparability. The priority for country selection was limited to the EU context, as EU member states share similar political, economic, and regulatory frameworks, which are critical for analyzing the impact of digital transformation and open innovation. Additionally, larger economies such as Germany and France were excluded to avoid skewing the analysis, as their scale and economic structures often present unique challenges and opportunities that differ significantly from those of smaller and more open economies. Similarly, countries from entirely different geographical perspectives or with vastly different cultural and economic (and, these days, national security) conditions were excluded to maintain the study's focus on comparable trends and dynamics.

This approach allowed the research to concentrate on economies representing diverse stages of digital transformation and SME development within the EU. It also aligned with the study's aim of exploring actionable insights for SME development in varying economic contexts. Six countries were selected from this perspective: Lithuania, Estonia, Finland, the Netherlands, Czechia, and the EU average.

The selection of these countries reflects their unique contributions to the study. For instance, **the** Netherlands and Finland are among the EU Digital Economy and Society Index (DESI) (European Commision, 2024b)leaders, demonstrating advanced digital ecosystems. However, their inclusion follows distinct rationales: Finland, as a Northern European country, shares similar security challenges with other Baltic states, making it a relevant comparison for regional dynamics, while the Netherlands, as a Western European leader, provides a contrasting perspective from a highly industrialized and innovation-driven economy.

Czechia was selected as a Central European economic leader with the highest GDP per capita among its peers, excluding Poland (Eurostat, 2024), which is a major economy, to focus on a mid-sized economy with significant SME activity. Lithuania and Estonia, both Baltic countries, represent emerging digital economies while sharing similar historical and security backgrounds. However, Estonia, widely recognized as a digital success story, was included for its innovative policies and SMEfriendly initiatives, offering a more diverse perspective than Latvia, which is more closely aligned with Lithuania. Conversely, Lithuania provides valuable insights into a growing digital ecosystem with strong regional potential. The inclusion of the EU average serves as a benchmark, facilitating comparisons against the broader European context.

The target of data gathering was to ensure data accuracy and consistency, as research should rely on well-documented secondary data sources. The official European Union – **Eurostat** Statistical

Office is the key data source selected, recognized for its comprehensive and standardized data collection methodologies across EU member states. Also, it provides detailed Meta Information on how the data was gathered and a glossary of all values. This standardization enables consistent comparisons if selected cross-country comparisons and provides a more comprehensive perspective. For example, by evaluating metrics such as digital skills, ICT adoption, and open innovation activities, we can be sure that data for these metrics are collected similarly. Using it, we can identify patterns and correlations between digital transformation efforts and growth indicators in SMEs.

The study focuses on a set of selected measures (Table 7) that align with the research objectives and hypotheses, such as digital skills availability, represented by the level of digital skills at the national level, the proportion of ICT specialists in the workforce reflecting advanced digital skills, and enterprises investing in ICT skill training to build these capabilities. Additionally, SME performance indicators such as turnover growth, turnover per employee, and market diversification were utilized to assess business outcomes. Other metrics included enterprises collaborating on innovation and cooperation with external partners for AI and business R&D expenditure to capture innovation dynamics. The study also examined the adoption of digital tools, including AI usage, cloud computing, e-commerce turnover, advanced IT tools, and customer-centric digital tools, to explore how these technologies contribute to SME competitiveness and growth. These measures collectively provide a comprehensive foundation for analyzing the relationship between digital transformation, open innovation, and SME performance.

Metric	H1	H2	H3	Explanation
Digital Skills in the market	\checkmark			No, Basic and Above digital skills reflect foundational
				digital capabilities available in a country's workforce.
ICT Specialists in Workforce	\checkmark			Indicates the availability of advanced digital expertise in
				the market for SME.
ICT Skill Trainings	\checkmark			Tracks digital upskilling efforts in the workforce to build
				advanced digital skills in enterprise.
Turnover Growth in SME	\checkmark		\checkmark	Serves as a direct indicator of financial growth linked to
				digitalization.
Turnover per Employee	\checkmark		\checkmark	Helps track productivity workforce and ability to create
				higher value for business.
Enterprises Collaborating on		\checkmark		Highlights OI activities and partnerships with other
Innovation				enterprises for new product development.
Cooperation with external		\checkmark		Highlights openness of enterprises to look for partnership
partners for AI				and OI cooperation to cover internal lack of digital skills
				for advanced digital projects.

Table 7: The list of metrics to be used for Empiric research

Business R&D Expenditure	\checkmark		Reflects business investment in research and innovation.
			Also illustrates business perspective on need to innovate.
Proportion of SME Engaged	\checkmark		Tracks international collaboration opportunities for SME.
Internationally			
Market Diversification	\checkmark	\checkmark	Measurements of expansion into new customer segments
			or/and regions with indications if digitalisation helps to
			expand business.
AI Usage in Enterprises	\checkmark	\checkmark	Tracks the use of AI, Big Data, IoT, and other
			transformative technologies.
Cloud Computing Usage	\checkmark		Indicates adoption of cloud-based digital business
			models.
E-commerce Turnover		\checkmark	Demonstrates success in adopting digital sales channels.
Advanced IT Tools Usage		\checkmark	Measures the adoption of ERP, CRM, and BI systems for
			operational improvement.
Customer-Centric Digital		\checkmark	Highlights the adoption of mobile applications for
Tools Usage			enhancing customer engagement and experience.

Source: developed by the author

The data collected for this study will be analyzed using Microsoft Excel and the ChatGPT 40 model, leveraging its statistical and analytical capabilities. The analysis will include:

• **Correlation Analysis**: To examine the strength and direction of relationships between key variables, such as digital skills, ICT adoption, and SME growth metrics.

• **Descriptive analysis summarizes and describes** the main features of the dataset, providing an overview of trends or defining particular phenomena and patterns (Sheppard, 2020).

A structured approach to analysis was followed, with careful data collection and cleaning at the outset. In some cases, planned data was unavailable, although it was reported as available. Secondly, variables were grouped into meaningful categories, such as digital skills, open innovation, and SME performance, to provide clearer insights based on the research objectives. We also had to use multiple metrics to check some criteria. For example, we assigned digital skills and the number of ICT specialists together. This allowed us to cross-check information without making assumptions based on one metric. The analysis focused on identifying key trends and patterns rather than relying heavily on visual representations. For example, metrics such as ICT specialists and digital skills were analyzed across countries to highlight differences in digital readiness.

These methods enable the examination of the data and support validating the study's hypotheses.

3.3. Research Findings

3.3.1. SMEs with higher digital skills experience greater growth

As a first step in our research, we performed a macro-level comparison of the selected countries: Lithuania, Estonia, Finland, Netherlands, Czechia, and the EU average. This comparison aimed to evaluate the influence of digital skills on SME growth and sustainability across different levels of digital maturity and economic development. By examining these countries, we sought to uncover the relationship between digital capabilities and SME performance metrics, such as revenue growth and mortality rates.

We analyzed key metrics reflecting each country's digital readiness and its SME to achieve this. Specifically, we focused on the defined below and values summarised in Table 8:

Digital skills availability for companies:

• Digital skills – the population's overall digital competency, categorized into No Skills (%), Basic Skills (%), and Above Basic Skills.

• ICT Specialists (% of Workforce) – The percentage of employees working as ICT specialists, representing advanced technical expertise within the workforce. These are highly advanced Digital skills.

• ICT/IT Skills Building by Enterprises: This table shows the proportion of enterprises that provide ICT/IT training to employees by company size.

Business outcome:

• Revenue Growth (%) – Compound Annual Growth Rate (CAGR) of revenue for SMEs across enterprise sizes for 2021-2023.

• The Mortality Rate of Enterprises (%) is the number of enterprise deaths divided by the number of active enterprises. The percentage of businesses that ceased operations is relative to the total number of active enterprises.

• Net Turnover per Employee (EUR): This figure illustrates the value created by one employee and gives insight into productivity, as direct productivity numbers are unavailable by enterprise size split.

These selected metrics align with Hypothesis 1, which claims that SMEs with higher employee digital skills will experience significantly higher growth rates. Metrics such as the population's digital skills, the proportion of ICT specialists in the workforce, and the percentage of enterprises investing in ICT training directly reflect the availability and development of digital competencies critical for SME success. Additionally, business outcome indicators like revenue growth, enterprise mortality rates, and net turnover per employee provide measurable insights into how digital skills translate into enhanced

productivity and business performance, validating the connection between digital readiness and SME growth.

Key questions we aimed to check in this stage for H1 confirmation:

• How and if do Digital skills (Basic and above basic) in population correlate with SME revenue growth?

• Is there a significant relationship between ICT specialists and Mortality rates?

• Do enterprises that invest more in ICT/IT skills (i.e., building Digital skills in-house) show better financial performance?

• How does Lithuania compare to other countries regarding digital readiness and SME performance?

	Enterprise size	EU27	CZ	EE	LT	NL	FI
Digital skills in	No skills	3,01	1,13	1,89	2,79	0,25	0,62
country (%) (1),	Basic skills	28,24	33,63	27,76	27,01	28,16	28,36
2023	Above basic skills	27,32	35,48	34,84	25,9	54,53	53,63
ICT Specialists	Total						
(% of Workforce)		4,8	4,3	6,7	4,9	6,9	7,6
(2), 2023							
ICT/IT skills	Micro	N/A	N/A	N/A	N/A	N/A	N/A
building (%) (3),	Small	7,11	6	7,04	4,05	11,87	14,43
(2024)	Medium	26,37	25,22	24,38	16,85	37,66	38,84
SME Revenue	Total	0,06	0,09	0,054	0,086	0,067	0,036
Growth (%) (4),	Micro	0,06	0,089	0,061	0,072	0,054	0,025
CARG 2021-2023	Small	0,052	0,046	0,013	0,063	0,057	0,025
	Medium	0,051	0,123	0,053	0,089	0,043	0,029
Mortality Rate	Micro	5,36	2,54	10,93	5,94	1,12	2,66
(%) (5), 2023	SME+ (10+ employees)	0,68	0,32	1,28	0,5	0,2	0,35
Net turnover per	Total	234,86	192,34	180,01	127,42	311,08	306,61
employee (6), 2023	Micro	127,08	100,21	150,02	125,34	178,63	227,23
	Small	192,93	171,42	188,66	130,96	315,5	244,1
	Medium	267	261,36	211,3	152,17	497,25	312,05

Table 8: Metrics	of Digital	skills effect or	SME	performance.
			~~~~	p ••••••••••••••••••••••••••••••••••••

Source: developed by the author, based on Eurostat (2024), multiple data sets ((1) -

*isoc_sk_dskl_i21,(2) - isoc_sks_itspt, (3) - isoc_ske_itts, (4), (6) - sbs_sc_ovw, (5) - bd_size)* 

In this comparison, we conducted a descriptive overview of data and later correlation analysis to test the strength of the relationships between digital skills and SME performance metrics. Bellow, in a descriptive way, we provide a general overview of separate metrics and country performance.

#### **Digital Skills**

The Netherlands and Finland are in charge of individuals with above-basic digital skills. In 2023, in the Netherlands, approximately 54.53% of individuals in the workforce possess advanced digital skills, followed closely by Finland with 53.63%. This contrasts sharply with Lithuania, where only 25.9% of individuals have advanced digital skills, alongside a relatively higher percentage of people with no skills (2.79%), compared to just 0.25% in the Netherlands. This reflects the gap in digital competence that could impact the growth potential of SMEs. Big disparities highlight different situations and stages of digital readiness across Europe. It should also be alert for investing in basic digital competencies to drive competitiveness.

# ICT Specialists and ICT/IT Training

When examining the availability of ICT specialists, Finland stands out with the highest percentage of ICT professionals in its workforce at 7.6%, closely followed by the Netherlands at 6.9%. Meanwhile, countries like Czechia and Lithuania lag at 4.3% and 4.9%, respectively. These countries' higher concentrations of ICT specialists likely contribute to their advanced digital infrastructures, making them more equipped to foster digital transformation within SMEs.

In addition, Finland and the Netherlands again stand out in terms of ICT/IT training offered to SMEs by employers. The highest percentages of SMEs (10–249 employees) offer training programs to develop digital skills. The training programs indicate a forward-thinking approach to building digital capabilities.

#### **Revenue Growth (CAGR)**

Regarding revenue growth, Czechia and Estonia exhibit the highest compounded annual growth rates (CAGR) of 3 years in the medium enterprise segment. Czechia leads with a CAGR of 12.3%, followed by Estonia at 5.3%. Estonia also showed strong growth in micro-enterprises, reflecting a dynamic entrepreneurial ecosystem. On the other hand, overall revenue growth appears to be highest in Estonia and Lithuania, indicating that these markets are seeing a broader uptick in economic activity or just growing from a lower base.

#### **Mortality Rates**

Estonia and Lithuania report higher mortality rates for micro-enterprises. Estonia's is especially high—10.93%—and Lithuania's is 5.94%. This indicates a challenging environment for the smallest

businesses to survive, unlike Finland, Czechia, and the Netherlands, where micro-enterprise mortality rates are considerably lower and do not reach 3%. The higher mortality rates in Estonia and Lithuania could reflect challenges such as limited access to digital tools, capital, market opportunities, bad managerial education, etc.

# Net Turnover per Employee: Productivity

The Netherlands and Finland demonstrate the highest net turnover per employee, with particularly strong performance in the Netherlands' medium-sized enterprises—497,25. (This is 86% higher than the EU average of 267,00.) The Netherlands and Finland's higher turnover per employee figures may be attributed to greater productivity and efficiency, enabled by their advanced digital infrastructure and skilled workforce.

This overview easily identifies differences in digital skills, ICT investments, and SME performance across Europe. The data assumes that countries leading in digital capabilities, such as Finland and the Netherlands, are performing better in economic growth and SME resilience. For smaller countries like Estonia, Lithuania, and Czechia, enhancing digital skills in the population and highly advanced ICT skills in enterprise-level ICT training or attracting more people to ICT studies could unlock significant potential for growth and competitiveness for SMEs.

# **Correlation Analysis: Digital Skills vs. Business Outcomes**

To continue understanding different digital skills metrics on SMEs' performance, we ran a correlation analysis to check how digital skills correlate with business outcome metrics. The correlation matrix is provided in Figure 9.



# Figure 9: Correlation Matrix – Digital skills on SME growth.

Insights on correlation analysis of how Digital Skills in enterprises affect SME growth:

The above basic digital skills show negative correlations with revenue growth in micro enterprises (-0.65) and small enterprises (-0.51). This could indicate that smaller businesses face challenges in attracting good employees to the country or translating digital capabilities into business growth due to other resource constraints, limited market access, or inefficiencies in leveraging advanced skills.

In contrast, medium-sized enterprises show a positive correlation (0.54), highlighting that larger SMEs are better equipped to utilize advanced skills for growth. Also, as Digital skills are defined as a general value at the national level, it could mean larger enterprises can easily access a better workforce.

A strong negative correlation between revenue growth and the availability of ITC Specialists in the market across all enterprise sizes, particularly for medium enterprises (-0.82), suggests inefficiencies in ICT resources. This may reflect a disconnect between ICT investments and business strategy or industry-specific challenges in realizing measurable returns.

Enterprises with a higher percentage of employees lacking digital skills experience higher mortality rates— total enterprises (0.60) and micro enterprises (0.50). Meanwhile, regarding skilled workers' availability, we can see a negative correlation between mortality rates for total enterprises (-0.57) and micro enterprises (-0.46). This shows the critical importance of digital skills in ensuring firm business survival.

Positive correlations with Net turnover per employee across all enterprise sizes, particularly in small enterprises (0.89) and micro enterprises (0.82). This suggests that advanced skills directly boost employee productivity and operational efficiency.

A strong positive correlation between net turnover per employee and the availability of ICT professionals in the market, especially for micro-enterprises (0.93), highlights the economic benefits of robust ICT infrastructure and expertise in driving higher output per employee.

A negative correlation with Net turnover per person across all enterprise sizes, especially in small enterprises (-0.77) and medium enterprises (-0.75), reveals the economic disadvantages of Digital skill deficits, underscoring the need for digital upskilling.

ICT training correlates positively with revenue growth, particularly for medium-sized enterprises (0.54). This suggests that structured training programs can significantly enhance business performance and underscores the importance of workforce development initiatives tailored to enterprise size.

By summing up the correlation analysis, we can say that first, Digital Skills Drive Productivity. Advanced digital skills ("Above Basic Skills") and ICT Specialist availability in the market are consistently associated with higher net turnover per employee, particularly in small and medium enterprises. Secondly, the lack of digital skills in the market causes a risk to the survival and growth of SMEs. The High levels of "No Skills" correlate with increased mortality rates of enterprises in the market and lower revenue growth, especially for micro-enterprises. Thirdly, training your ICT specialist and investing in their skills is a good investment: ICT training, especially for medium enterprises, shows strong potential to enhance revenue growth. And finally, Small Enterprises face challenges: While digital skills boost turnover, their impact on revenue growth for small enterprises is less pronounced, suggesting barriers to fully utilizing digital capabilities available in the market.

Answers to questions we raised and we aimed to check the H1 confirmation perspective

• How and if do the population's Digital Skills (Basic and Above Basic) correlate with SME revenue growth?

**Answer:** Partially. The analysis revealed a weak or negative correlation between the above basic digital skills and revenue growth for micro (-0.65) and small enterprises (-0.51). However, medium enterprises exhibited a positive correlation (0.54), suggesting that while digital skills may not immediately translate to revenue growth for smaller firms, larger SMEs are better positioned to leverage these skills for growth.

#### • Is there a significant relationship between ICT specialists and mortality rates?

**Answer:** Yes. A negative correlation (-0.57) was observed between ICT specialists in the workforce and total enterprise mortality rates, demonstrating the protective effect of digital skills on business survival. This highlights the critical importance of a digitally skilled workforce in ensuring SME resilience and longevity.

# • Do enterprises that invest more in ICT/IT skills building show better financial performance?

**Answer:** Yes. ICT training correlates positively with revenue growth for medium enterprises (0.54), indicating that structured digital upskilling programs can enhance business performance. However, the financial impact is less pronounced for micro and small enterprises, where correlations were weaker.

# • How does Lithuania compare to other countries regarding digital readiness and SME performance?

Answer: Yes, but with notable gaps. Lithuania lags behind countries like Finland and the Netherlands in most metrics, including above basic digital skills (25.9% vs. Finland's 53.63%) and ICT specialists in the workforce (4.9% vs. Finland's 7.6%). This gap correlates with lower productivity and growth metrics, such as Lithuania's lower net turnover per employee ( $\in$ 152.17 for medium enterprises) compared to the Netherlands ( $\notin$ 497.25). These disparities highlight the need for targeted interventions to enhance digital skills and workforce readiness.

To conclude the first part of the research, we can claim that the analysis aligns with Hypothesis 1. With all limitations, we can confirm that Digital skills are a critical driver of SME growth and sustainability. While the relationship between digital skills and revenue growth is not always direct, the findings highlight that digital capabilities contribute to business success via performance and survival. Advanced digital skills, for example, correlate strongly with productivity, as evidenced by higher net turnover per employee in digitally advanced countries like the Netherlands and Finland. This increase in productivity ultimately positions these firms for sustained growth. The availability of ICT specialists and enterprise-level investments in ICT training show positive correlations with business outcomes, further validating the hypothesis.

#### 3.3.2. SME engaging in Open Innovation achieve greater Digital Transformation and Growth

To analyze Hypothesis 2, we continued to stay at the macro level analysis by keeping the same approach with a target to compare different countries. We focus on metrics that reflect both Open innovation engagement and the outcomes of Digital transformation and Growth:

Key metrics used for research were grouped under the logic below. Absolute numbers of metrics are provided in Table 9:

#### **Open Innovation (OI) Activities:**

• Collaborative Innovation (%): Proportion of enterprises engaged in joint innovation activities with external organizations (e.g., other businesses, universities, research institutions).

• Co-operation with External Partners for AI Projects (%): Reflects specific open innovation efforts focused on AI-driven solutions, openness, and intention to cooperate with external partners for AI or even other Digitalisation projects.

• Business R&D Expenditure (% of GDP): Indicator for innovation intensity in a country driven by private enterprises and reflecting enterprise commitment to collaborative and external innovation.

#### **Digital Transformation Outcomes:**

• Cloud Computing Usage (%): Indicator of digital tool adoption by enterprises. Used dimension of how many enterprises: "Buy cloud computing services over the internet."

• AI usage (%): Measures integrating artificial intelligence into enterprise processes and strategies. It also indicates that the company is open to using other advanced digital tools. We selected the companies that use at least 1 AI tool.

#### **Business Growth Metrics:**

• Revenue Growth (CAGR, %): Annualized growth rate of SME, segmented by size (Micro, Small, Medium).

• Market Diversification (%): For this metric, we take Turnover share from new or significantly improved products from Eurostat's Community Innovation Survey (CIS). This measure reflects the impact of innovation activities on expansion.

These metrics align with Hypothesis 2, which claims that OI activities positively and significantly impact digital transformation and SME growth. Metrics such as Collaborative Innovation, cooperation with External Partners for AI Projects, and Business R&D Expenditure reflect the intensity and scope of open innovation efforts, showcasing how external collaborations drive innovation and digital adoption. Additionally, digital transformation outcomes like Cloud Computing Usage and AI Usage capture the practical integration of advanced digital tools, often enabled by OI initiatives. Business growth metrics, such as Revenue Growth and Market Diversification, provide

measurable evidence of how open innovation contributes to broader business success, demonstrating the link between collaborative efforts, digital advancements, and SME performance.

# Key questions we aimed to check in this stage for H2 confirmation:

• Do SMEs in countries with higher engagement in open innovation activities (e.g., collaborative innovation) show greater digital tool adoption (e.g., cloud computing, CRM usage)?

• Is there a significant relationship between R&D expenditure by business and business growth metrics (e.g., revenue growth, market diversification)?

• How does the level of open innovation activity in Lithuania compare to more digitally advanced countries (e.g., Finland, Netherlands)?

• Does open innovation contribute differently to growth for SMEs of different sizes (Micro, Small, Medium)?

	Enterprises size	EU27	CZ	EE	LT	NL	FI
Enterprises that co-operated	Total	21,5	20,3	36,9	22,8	26,4	41,2
(%), (1), 2022	Small	17,8	14,8	33,2	19,8	24,2	38
	Medium	30,7	30,6	48,2	29,3	31	48,4
Business R&D Expenditure	Total	N/A	0,68	0,82	0,38	1,22	1,7
(% of GDP), (2), 2022	Small	N/A	0,07	0,11	0,09	0,14	0,19
	Medium	N/A	0,13	0,17	0,15	0,21	0,28
Cooperation with external	Total	N/A	N/A	N/A	N/A	N/A	N/A
<b>partners for AI (%),</b> (3), 2022	Small	2,7	1,32	3,27	2	4,74	3,33
	Medium	5,84	2,43	5,92	5,04	9,87	11,76
Cloud Computing Usage	Total	N/A	N/A	N/A	N/A	N/A	N/A
(%), (4), 2023	Small	41,71	42,94	54,69	32,71	57,93	75,01
	Medium	58,97	60,04	74	57,37	72,11	91,47
AI Usage (%), (5), 2022	Total	N/A	N/A	N/A	N/A	N/A	N/A
	Small	6,38	4	4,12	3,4	11,04	11,48
	Medium	13,04	9,79	8,78	19,09	26,4	50,88
Revenue Growth (CAGR,	Total	0,06	0,09	0,054	0,086	0,067	0,036
<b>%),</b> (6), CARG 2021-2023	Small	0,052	0,046	0,013	0,063	0,057	0,025
	Medium	0,051	0,123	0,053	0,089	0,043	0,029
Market Diversification (%),	Total	15,7	19,6	18,3	11,3	13,3	19,8
(7), 2022	Small	12,6	15,5	18,3	9,2	9,9	15,9
	Medium	14,6	9,4	18,7	8,3	9,6	14,9

Table 9: Metrics of OI activities' effect on digital transformation and SME performance.

Source: developed by the author, based on Eurostat (2024), multiple data sets: (1) - inn_cis13_co (2) - rd_e_berdsize (3), (5) - isoc_eb_ai, (4)- isoc_cicce_use (6) - sbs_sc_ovw, (7) - inn_cis13_prodt

In the following part, we overview key metrics in countries and discuss how open innovation (OI) initiatives, such as business collaborations and AI-driven partnerships, drive digital transformation and growth for SMEs.

#### **Open Innovation Activities**

Based on the countries and data reviewed, Finland and Estonia emerge as leaders in OI among SMEs. Medium-sized enterprises in Finland have the highest cooperation levels, with 48.4% of enterprises cooperating in business activities with external partners. Estonia follows with 48.2%. This indicates a possible strong culture of collaboration in these countries, driven by robust innovation ecosystems.

In contrast, Lithuania shows the lowest result in cooperation engagement, with 22.8% of enterprises overall and 29.3% between medium size cooperating with external entities, slightly above the EU average of 21.5% overall but below medium (30.7%). This limited engagement may prevent Lithuania's SMEs from realizing the benefits of external partnerships, particularly in advancing digital transformation, and lead to a slow loss of completeness.

Co-operation for AI projects further illustrates these disparities. Medium enterprises in Finland lead, with 11.76% actively collaborating on AI-driven initiatives. It, of course, showcases a forward-thinking approach to advanced digital tools. The Netherlands follows with 9.87%, while Lithuania lags at 5.04%. However, Czechia sows even worse results when cooperating in AI projects at only 2.43%. These figures suggest that countries with a strong focus on AI partnerships are better equipped to leverage digital transformation opportunities.

As a final open innovation criterion, business R&D expenditure as a percentage of GDP further highlights these differences. Finland leads with 1.7%, followed by the Netherlands at 1.22%. This illustrates significant resource allocation from businesses for innovation. On the other hand, Lithuania and Czechia report significant business investment in R&D, which reached 0.38% and 0.68%, respectively.

#### **Digital Transformation Outcomes**

Cloud computing and AI usage are key indicators of digital transformation that help draw a trendline for a country's business attitude. Medium-sized enterprises in Finland stand out, with 91.47% adopting cloud computing. Estonia follows at 74.0%, while Lithuania lags, with just 57.37% of medium enterprises using cloud technology. Among small enterprises, Lithuania falls further behind at 32.71%, indicating a significant digital gap that could limit competitiveness.

Conversely, competing with digitally enhanced rivals using traditional methods for Lithuania might remind us of pitting Aztec warriors against Spanish conquistadors.

AI usage mirrors these trends. Medium enterprises in Finland demonstrate exceptional AI adoption at 50.88%, while the Netherlands achieves 26.4%. Lithuania's medium enterprises report 19.09%, and small enterprises show minimal adoption at 3.4%. This highlights a critical gap in leveraging advanced technologies, particularly for smaller firms in emerging markets.

#### **Business Growth and Market Diversification**

Revenue growth (CAGR) from 2021 to 2023 highlights the potential of medium enterprises to capitalize on digital transformation and open innovation. Czechia leads in development, with medium enterprises achieving an impressive 12.3% CAGR, followed by Lithuania at 8.9%. Even though both countries are not the best in digital adoption, they have shown significant growth and performance. Also, small enterprises in Estonia report the lowest growth rate at 1.3%, suggesting that even in digitally advanced ecosystems, smaller firms may struggle to achieve growth benefits brought by Digital transformation.

On the other hand, market diversification, measured as the revenue share from new markets or products, further shows the added value of Digital transformation. Estonia demonstrates consistent diversification across enterprise sizes, with medium enterprises reaching 18.7% of the turnover share; this illustrates its dynamic innovation environment. Meanwhile, Lithuania's small enterprises lag at 9.2%, reflecting limited market expansion efforts. In the long term, this might affect further growth opportunities, as these diversified new products might bring nice growth for SMEs.

To conclude this overview, we came up with three key takeaways: Countries that lead leads in all metrics. Finland and Estonia consistently lead in OI and digital transformation metrics, while Lithuania faces challenges in fostering collaboration and adopting advanced tools. These gaps indicate the need for targeted strategies to improve Lithuania's innovation ecosystem and avoid losing competitiveness shortly. Secondly, Size Matters. Medium-sized enterprises outpace small enterprises across all metrics. Its main standouts are in AI usage, cloud adoption, and growth. This suggests that medium firms are better positioned to leverage digital tools and external collaborations, while smaller firms may require additional support to compete effectively. This, of course, might be again driven by more prominent companies having access to better, more skilled human resources or just allocating dedicated staff. Finally, OI Activities Drive Digital Transformation. Enterprises in countries with higher levels of cooperation, particularly in AI projects, show more substantial digital transformation outcomes, highlighting the importance of partnerships for technological advancement.

#### **Correlation Analysis: Open Innovation, Digital Transformation and Growth**

To emphasize the importance of open innovation, we conducted a correlation analysis to explore the relationship between cooperation activities, AI projects, and R&D expenditures regarding cloud usage, AI usage, revenue growth, and market diversification. The correlations of different metrics are provided in Figure X.



# Figure 10: Correlation Matrix – Open innovation activities affect

In the following section, we will overlook the correlation analysis findings, as seen in the correlation matrix (Figure 10). we have positive, negative, low, or close to zero correlations.

A strong positive correlation between Cooperation on Business Activities and Cloud Usage (0.87) highlights the role of collaborative efforts in adopting advanced digital technologies, particularly cloud computing, which can drive efficiency and innovation.

A high positive correlation between Cooperation for AI Projects and AI Usage (0.91) highlights the critical importance of partnerships in advancing AI adoption, reflecting the value of joint efforts in overcoming technological barriers and integrating AI solutions. The strong positive correlation between R&D Expenditure and both Cloud Usage (0.94) and AI Usage (0.89) illustrates the pivotal role of research and development in fostering digital transformation, enabling businesses to leverage cutting-edge technologies effectively.

On the other hand, a weak negative correlation between Cooperation on Business Activities and Revenue Growth (CAGR) (-0.26), as well as between Cooperation for AI Projects and Revenue Growth (CAGR) (-0.28), suggests that while cooperation supports technological advancement, its financial benefits may not be immediate and require a longer-term perspective.

Finally, the moderate positive correlation between Cooperation on Business Activities and Market Diversification (0.49) indicates that collaborative initiatives can contribute to expanding into new markets, though their impact on revenue growth may take time to materialize.

By summarising the correlation analysis, we can draw conclusions about the following strategic implications. First, collaboration drives digital adoption. Collaboration on business activities and AI projects is associated with higher adoption of advanced technologies such as cloud computing and AI. It highlights the importance of partnerships in enabling digital transformation, especially for small and medium-sized enterprises. Second, R&D investment enables technology integration. The higher R&D spending is positively correlated with the adoption of cloud and AI technologies. This highlights the value of R&D as a strategic enabler for SME to remain competitive and innovate in the digital era. Third, short-term revenue gains may be limited. While collaboration and R&D drive digital adoption, their immediate impact on revenue growth appears to be limited or and short term might be affected due to economy cycles. SME should consider these investments as part of a long-term growth strategy, rather than expecting quick financial returns. Also, as we saw in previous analysis, digital transformation can affect performance and survival of enterprises. Finally, collaboration suggest that partnerships can help SME expand into new markets, although the process may take time and sustained effort to fully realise the benefits.

#### Answers to questions we raised and we aimed to check H2 confirmation perspective

• Do SME in countries with higher engagement in open innovation (e.g., business cooperation, AI partnerships) achieve greater digital transformation outcomes (e.g., AI and cloud usage)?

Answer: Yes. SME in Finland and the Netherlands, which exhibit high levels of business cooperation and AI partnerships, show significantly higher adoption of advanced digital tools such as AI usage and cloud computing. For example, Finland leads in AI usage (50.88%) and cloud adoption

(91.47%) among medium enterprises, confirming the role of open innovation in fostering digital transformation.

• Is there a significant relationship between co-operation for AI projects and a company's likelihood of adopting other advanced digital tools?

**Answer**: Yes. The strong positive correlation between cooperation for AI projects and AI usage (0.91) highlights the critical role of partnerships in advancing digital adoption. This indicates that engaging in AI partnerships enhances the likelihood of adopting other advanced tools, aligning with the broader goal of digital transformation.

# • How does Lithuania compare to digitally advanced countries like Finland and the Netherlands in terms of digital tool adoption and business growth?

**Answer**: Partially. Lithuania lags Finland and the Netherlands in both digital adoption and growth metrics. For example, Lithuania's medium enterprises report lower AI usage (19.09%), and cloud adoption (57.37%) compared to Finland (50.88% and 91.47%, respectively). Additionally, Lithuania's revenue growth (CAGR) for medium enterprises is **8.9%**, trailing behind digitally advanced peers like Finland. However, Lithuania shows modest progress in some areas, such as cloud usage among small enterprises (32.71%).

• Does the integration of AI solutions correlate with improved business growth metrics, such as revenue growth and market diversification?

Answer: Partially. While AI usage shows moderate correlations with market diversification (0.49), its relationship with revenue growth (CAGR) is weak or negative (-0.31). This suggests that while AI contributes to broader market reach, its short-term financial benefits may be limited by implementation costs or delayed ROI.

In our view, the results of the descriptive and correlational analyses are consistent with Hypothesis 2. The findings highlight the importance of open innovation as a driver of digital transformation and business growth for SME. The significant positive correlations between collaborative activities, such as partnerships for AI projects, and the adoption of digital tools (e.g., cloud and AI usage) confirm the role of cooperative efforts in overcoming technological barriers and advancing digital capabilities. Moreover, the strong relationship between R&D spending and digital transformation outcomes highlights the strategic importance of innovation investments in enabling SME to effectively integrate cutting-edge technologies. While the immediate financial benefits of open innovation, such as sales growth, may appear limited, the moderate correlation with market diversification highlights its potential to unlock long-term growth opportunities through expanded market reach and innovative offerings. These findings confirm that open innovation is an essential

aspect of SME competitiveness, fostering not only technological advancement but also resilience and adaptability in an increasingly digital economy.

#### 3.3.3. SME performance by using digitally enabled Business Models

For Hypothesis 3, we continued with macro-level data analysis, aiming to define common trends among countries related to different SME sizes. By analyzing how digitally enabled business models affect SME performance, we examined the following metrics: the adoption of digitally enabled business models and SME growth metrics. The absolute values of the metrics used for analysis are provided in Table 10

#### Adoption of Digitally Enabled Business Models:

• Enterprises Using Advanced Software (ERP, CRM, BI) (%): Reflects the integration of advanced digital tools for resource planning, customer management, and business intelligence, essential for modern business operations.

• Enterprises Providing Online Ordering or Reservation Services (%): Measures the share of SMEs leveraging their websites for direct sales or customer engagement, indicating a shift to digital-first business models.

Enterprises with Mobile Apps for Clients (%): Indicates the adoption of digital tools such as app-based customer engagement solutions and service strategies, reflecting digital transformation at a customer-first level. Additionally, it shows the penetration of customer-first digital technologies in daily operations

#### **Growth Metrics:**

• Revenue Growth (%), CAGR 2021–2023: Measures the annualized growth rate of revenue over the past three years, reflecting overall business performance.

• Net Turnover per Employee (EUR): Captures productivity improvements, often enabled by digital transformation.

• Export per Enterprise (thousand EUR): Highlights the ability of SME to expand into international markets, leveraging digital tools for broader reach. Calculated number based on Absolute metrics of export by enterprise size and number of enterprises.

• Share of Turnover from E-Commerce (%): Indicates the extent to which digital channels contribute to total revenue, a direct measure of digital model success.

These metrics align with Hypothesis 3, which states that digitally enabled business models enhance SME growth and facilitate market diversification. Metrics such as Enterprises Using Advanced Software (ERP, CRM, BI), Online Ordering or Reservation Services, and Mobile Apps for Clients reflect the integration of digital tools that enable streamlined operations, customer-centric strategies, and data-driven decision-making, all of which are critical for modern, digitally enabled business models. Growth metrics like Revenue Growth, Net Turnover per Employee, and Export per Enterprise highlight the advantages of adopting these models, showcasing improvements in productivity, market expansion, and international reach. Furthermore, the Share of Turnover from E-Commerce directly measures the success of these digital models in generating revenue.

# Key questions we raised and we aimed to check in this stage for H3 confirmation:

• Do SME that adopt advanced software tools (ERP, CRM, BI) exhibit higher revenue growth and productivity?

• Is there a significant relationship between online ordering capabilities and growth metrics such as export levels and net turnover per employee?

• How does Lithuania compare to digitally advanced countries like Finland and the Netherlands in adopting digitally enabled business models?

• Is there a correlation between the share of turnover from e-commerce and SME growth and market expansion?

	Enter. size	EU27	CZ	EE	LT	NL	FI
Enterprises using software	Small	44,62	26,25	32,31	41,12	59,28	65,79
(ERP, CRM, BI), (1) 2023	Medium	72,22	59,59	65,4	58,21	83,52	91,65
Enterprises website	Small	21,22	32,74	17,05	18,1	37,27	28,76
(%) (2), 2023	Medium	25,83	33,68	26,71	25,41	34,05	35,18
Enterprises having a	Small	7,16	6	3,94	2,93	7,91	12,16
<b>mobile APP</b> , (3), 2023	Medium	11,71	7,16	5,82	6	13,37	19,86
Revenue Growth (%),	Small	0,052	0,046	0,013	0,063	0,057	0,025
CARG 2021-2023, (4)	Medium	0,051	0,123	0,053	0,089	0,043	0,029
Net turnover per employee,	Small	192,93	171,42	188,66	130,96	315,5	244,1
2023 (5)	Medium	267	261,36	211,3	152,17	497,25	312,05
Export, tEUR per	Small	1 670,48	2 330,02	1 463,58	1 123,55	6 393,75	1 374,69
<b>enterprise,</b> 2022, (6)	Medium	10 340,88	8 976,38	11 831,33	6 221,55	37 472,92	12 102,63
Share of turnover from E-	Small	8,29	5,93	7,84	13,14	12,09	N/A
<b>commerce (%),</b> (7), 2022	Medium	15,28	29,8	14,79	14,16	14,64	N/A

Table 10: Metrics for SME Digitally Enabled Business performance affect

Source: developed by the author, based on Eurostat (2024), multiple data sets: (1)-isoc_eb_iip, (2), (3) - isoc_ciweb (4), (5) - sbs_sc_ovw, (6) - ext_tec01, (7) - isoc_ec_esels

The adoption of digitally enabled business models is a critical outcome of digital transformation of companies and key factor influencing SME growth and enabling market diversification via new income sources (e.g. export). By integrating advanced software, offering online ordering capabilities, and utilizing mobile apps, SME can enhance their digital engagement and competitiveness. We have looked, how the adoption of these technologies across different countries and their relationship with growth metrics such as revenue growth, productivity, and export performance in whole country perspective.

#### **Digitally Enabled Business Models**

Based on the countries and data reviewed, Finland and the Netherlands can be defined as leaders in the adoption of digitally enabled business models among SME from selected countries. Mediumsized enterprises in Finland exhibit the highest adoption rates for advanced software tools such as ERP, CRM, and BI, with even 91.65% of businesses utilizing these solutions. The Netherlands follows closely, with 83.52% of medium enterprises adopting these tools. These high adoption rates likely reflect a strong emphasis on process optimization and data-driven decision-making in these countries.

In contrast, Lithuania and Czechia show significantly lower adoption rates. While 58.21% of medium enterprises in Lithuania and 59.59% in Czechia report using advanced software, their small enterprises go lower, with Lithuania at 41.12% and Czechia at 26.25%. This disparity highlights potential barriers such as limited resources skills or awareness among smaller enterprises, which may hinder their ability to compete effectively in the digital economy.

The use of online ordering capabilities through enterprise websites also varies significantly. The Netherlands leads, with 37.27% of small enterprises and 34.05% of medium enterprises enabling online ordering or reservations. This reflects a mature digital sales infrastructure and a strategic focus on e-commerce. In Lithuania, only 18.1% of small enterprises and 25.41% of medium enterprises offer similar capabilities, indicating a slower shift towards digital-first sales strategies. Estonia, despite its digital reputation, also shows low possibilities for other directly to order from enterprises with only - 17.05% of small enterprises and 26.71% of medium.

Mobile app usage for client further highlights the digital gap. Medium enterprises in Finland again take the lead, with 19.86% having mobile apps for purposes such as loyalty programs or customer support. Small enterprises in Finland also demonstrate strong adoption, at 12.16%. In contrast, Lithuania, with just 6% of medium enterprises and 2.93% of small enterprises using mobile apps. Estonia shows also low adoption rates, with 5.82% of medium enterprises and 3.94% of small

enterprises. It illustrates the digital gap and the need for greater emphasis on consumer-facing digital tools.

#### **SMEs Growth affect**

In terms of growth metrics, general SME growth and productivity via Net Turnover per employee was already overviewed in previous sections. So now we will only look on new metrics.

First, export performance provides further insights into the benefits of digitally enabled business models. Medium enterprises in the Netherlands dominate, exporting  $\notin 37,472$  tEUR per enterprise, a figure unmatched by any other country. Lithuania's medium enterprises export  $\notin 6,221$  tEUR per enterprise, reflecting a significant gap in leveraging digital tools to access international markets. Small enterprises in Lithuania fare even worse, exporting just  $\notin 1,123$  tEUR per enterprise, compared to  $\notin 6,394$  tEUR for small enterprises in the Netherlands.

Finally, the share of turnover from e-commerce highlights the varying success of digital sales strategies. Czechia's medium enterprises lead with 29.8% of turnover generated through e-commerce, followed by Lithuania at 14.16%. Small enterprises in Lithuania, however, achieve a relatively strong 13.14%, indicating some progress in integrating digital sales channels despite overall lagging digital adoption.

In summary, we can take 4 keys take aways based on descriptive analysis of data results. First, digital adoption drives export competitiveness. Countries and enterprises with higher adoption rates of advanced digital tools, such as ERP, CRM, and mobile apps, demonstrate superior export performance. Medium enterprises in the Netherlands, with the highest adoption rates, also dominate export capabilities, showcasing the value of digital transformation in accessing international markets. Secondly, Small Enterprises are behind in Digital Readiness. Based on data, across all country's small enterprises lag their medium-sized counterparts in adopting digitally enabled business models. This highlights the need for targeted support, such as financial incentives or digital training programs, to help smaller enterprises bridge the gap and compete effectively. Thirdly, E-Commerce is essential revenue driver in these days. The share of turnover from e-commerce demonstrates its critical role in revenue generation, particularly for medium enterprises. Countries like Czechia, where medium enterprises lead with 29.8% of turnover from e-commerce, underscore the importance of integrating digital sales channels into business models. And finally, data overview shows, that Lithuania needs for Digital Acceleration and its needed urgently. Lithuania's lower adoption rates of digital tools and weaker export performance compared to peers like Finland and the Netherlands suggest a pressing need for targeted interventions. Strengthening the digital infrastructure and encouraging SME to adopt advanced tools could unlock significant growth potential and competitiveness.

#### **Correlation Analysis: SME performance in Digitally enabled Business Models**

To continue the analysis, we ran a correlation analysis. The results are provided in the Correlation matrix (Figure 11). The following paragraphs provide some key points about the results.



Figure 11: Correlation Matrix – Digital Adoption vs Growth

A strong positive correlation identified between Advanced Software Usage and Net Turnover per Employee (0.71). This result illustrates the crucial role of digital tools like ERP, CRM, and BI in driving productivity, streamlining operations, and optimizing resource management. Advanced digital technologies are essential for performance. Similarly, Advanced Software Usage also has a high correlation with Export per Enterprise (0.67), reflecting the importance of advanced software in enabling or at least necessary for enterprises to scale into international markets by enhancing supply chain efficiency and customer engagement. During the analysis, we defined the moderate positive correlation between Online Ordering and Net Turnover per Employee (0.64) and Export per Enterprise (0.46), showing the value of digital-first sales channels in improving transaction efficiency and expanding cross-border reach. Moreover, Online Ordering's relationship with Share of Turnover from E-Commerce (0.35) highlights the alignment of online ordering capabilities with e-commerce success; it also shows its role as a key driver of digital sales transformation. Of course, the correlation between Online Ordering and the Share of Turnover from E-commerce can sound obvious, but having Online ordering does not define results in operation.

There is also a strong positive correlation between the use of mobile apps and Net sales per employee (0.66). This correlation illustrates mobile-first strategies' significance in enhancing customer engagement and operational efficiency. Also, it illustrates expectations to connect with end customers digitally and create relationships, not just transactional cooperation. Mobile App Usage also moderately correlates with Export per Enterprise (0.49). Such correlation might also reflect its contribution to reaching international customers through localized and accessible digital platforms or at least a common trend that Digitally advanced enterprises use a broad scope of Digital tools, starting with ERP, CRM, and BI, but not limiting themself and going wider with App's, AI and other.

In contrast, the weak or negative correlations between these digital adoption metrics and Revenue Growth CAGR (e.g., Mobile App Usage: -0.31) suggest that while these tools enhance productivity, e-commerce revenue, and market expansion, their impact on short-term revenue growth may be less pronounced, potentially due to implementation costs, delayed ROI or just economic cycle.

By summarising the correlation analysis, we can highlight these key points for SME growth via digitally enabled business models. First of all, focusing on advanced software is critical. SMEs should prioritize implementing advanced software as it significantly impacts productivity and export potential. Secondly, optimization of E-Commerce infrastructure is needed. Enhance online ordering and advanced software adoption to align with e-commerce revenue growth. Third, Investments in Customer-first technologies like Mobile Apps and others. While Mobile apps sound like an amicable solution, of course, they should complement a broader customer-first digital strategy rather than act as a standalone focus. Long-Term Strategy: SMEs should view digital adoption as a long-term investment for growth, operational efficiency, and market expansion rather than a short-term revenue booster. Short-term growth might be affected by other factors, such as Economic cycles.

Answers to questions we raised and we aimed to check the H3 confirmation perspective

• Do SMEs that adopt advanced software tools (ERP, CRM, BI) exhibit higher revenue growth and productivity?
**Answer**: Yes. The strong positive correlation between advanced software usage and net turnover per employee (0.71) demonstrates that SMEs adopting these tools achieve higher productivity. Additionally, the positive correlation with exports per enterprise (0.67) reflects the role of advanced software in enabling international scalability. However, the weak correlation with revenue growth CAGR suggests that financial benefits may take longer to materialize.

# • Is there a significant relationship between online ordering capabilities and growth metrics such as export levels and net turnover per employee?

Answer: Yes. Online ordering correlates positively with net turnover per employee (0.64) and export per enterprise (0.46), highlighting its importance in improving efficiency and accessing crossborder markets. The relationship with e-commerce turnover (0.35) further underscores its contribution to digital sales transformation.

# • How does Lithuania compare to digitally advanced countries like Finland and the Netherlands in adopting digitally enabled business models?

**Answer**: Partially. Lithuania lags behind Finland and the Netherlands in most metrics, including advanced software usage, online ordering capabilities, and mobile app adoption. This reflects a slower pace of digital transformation and a significant gap in leveraging digital tools to drive growth and market expansion. However, Lithuania shows moderate progress in small enterprise e-commerce turnover share (13.14%), indicating some potential for improvement.

# • Is there a correlation between the share of turnover from e-commerce and SME growth and market expansion?

**Answer**: Partially. While a moderate relationship exists between e-commerce turnover and online ordering (0.35), the direct impact on growth metrics such as revenue growth or export levels remains unclear. This suggests that while e-commerce contributes to market reach, its financial benefits may depend on other factors like the quality of implementation and market conditions.

In our view, the results of the descriptive and correlational analyses are consistent with Hypothesis 3. The findings highlight the significant role of digitally enabled business models in driving SME growth and market diversification. Strong positive correlations between advanced software usage (e.g., ERP, CRM, BI) and key performance indicators such as Net turnover per employee and Export performance underscore the importance of these tools in enhancing productivity and enabling SMEs to access international markets. Similarly, aligning online ordering capabilities and mobile app usage with improved export potential and digital sales revenues illustrates the transformative impact of digital-first strategies on SME operations. However, while digitally enabled business models demonstrate clear productivity and market reach advantages, their short-term financial benefits, such

as revenue growth, appear less pronounced. However, this result might be affected by short-term factors (like the COVID-19 pandemic) or economic cycles.

### 3.4. Summing Up the Research

This research has provided insights into the relationships between Digital transformation, Open Innovation, and SME growth. This relationship is in line with the framework developed earlier. Analyzing different metrics from Eurostat, correlations, and descriptive findings, we have examined how digital skills, open innovation activities, and digitally enabled business models interlink in driving SME performance.

The research confirmed the significance of digital skills in enhancing SME productivity and resilience. Advanced digital skills acquired via ICT specialist availability strongly correlate with higher net employee turnover and export performance. However, the findings also highlight disparities between small and medium enterprises and countries like Finland and Lithuania, emphasizing the need for targeted interventions to bridge these gaps.

Open innovation emerged as a key enabler of digital transformation. As a sample in AI-focused projects, collaboration with external partners was shown to drive the adoption of advanced digital tools such as cloud computing and AI. While the financial benefits of open innovation on short-term revenue growth were less pronounced, its potential to support long-term market diversification and technological advancement was evident. Again, Finland and the Netherlands led such cooperation projects, illustrating the gap between countries.

Finally, the adoption of digitally enabled business models, such as online ordering and mobile apps, is widely available in Digitally advanced countries. And, of course, it strongly correlates to improved productivity, market reach, and export potential.

In conclusion, this research highlights the critical link of digital transformation and open innovation with SME growth, validating the proposed framework. However, the proposed framework must be tailored to specific sectoral needs and capabilities across different regions and industries. Regional differences in Europe are quite big. In digitally advanced economies like Finland and the Netherlands, where digital skills and innovation ecosystems are well-developed, SMEs are better positioned, and countries implement customer-first digital strategies and participate in open innovation projects. On the other side, emerging digital economies such as Lithuania or Estonia may need to prioritize building foundational digital skills and even only start partnerships with research institutions or governments. Policymakers in these regions can support these steps by addressing gaps in infrastructure, providing incentives for collaborative innovation, and investing in digital upskilling programs. The framework strategies, in reality, should be applied based on regional and sectoral context.

#### 3.4.1. Limitations and future possibilities for research

While providing valuable insights into the relationship between digital skills and SME performance, this analysis has several limitations. First, the study includes a limited number of countries, which, while diverse, do not capture the full range of economic and digital maturity levels across Europe. Expanding the analysis to additional countries would allow for more comprehensive and robust findings. Second, the absence of sector-specific analysis means we cannot fully account for differences between industries, as some industries might be more digital than others. For example, digital skills may have a greater impact in technology-intensive sectors than traditional industries like manufacturing or traditional services, where adoption barriers might be higher.

The analysis also relies on a relatively short period for revenue growth data (2021-2023), which includes post-COVID-19 recovery and war in Ukraine. The growth figures during this period may have been influenced by short-term government policies or temporary economic measures rather than sustained business performance. A short period was selected because Eurostat has updated its methodology for collecting revenue data since 2021, potentially introducing inconsistencies with prior data trends. However, cleaning up or accessing data from different sources would be possible. Another limitation is the availability of digital skills data, aggregated over a long period, and may not accurately reflect recent developments in digital readiness. Limited data availability also restricted the analysis from using tools such as regression analysis, as the data quality was insufficient or inconsistent. Lastly, lacking a qualitative component limits our understanding of why certain trends emerge. For example, high mortality rates among micro-enterprises could stem from their inability to attract digitally skilled employees, requiring further exploration through interviews or case studies.

Future research should expand the scope to include more countries with varying levels of digital maturity and economic development. A sector-specific analysis is also crucial to uncover how digital readiness varies by industry and its specific impact on productivity, growth, and survival.

Moreover, extending the analysis timeframe to include long-term revenue growth data would provide deeper insights into sustained trends while minimizing distortions from short-term events like the COVID-19 pandemic. Research could also explore how digital adoption evolves, particularly in response to technological changes and market conditions.

Lastly, integrating qualitative methods, such as interviews or case studies, would help uncover nuanced challenges SMEs face, such as resource constraints, managerial barriers, workforce availability, and, most importantly – the importance of Leadership moderation for Digital transformation and Open Innovation activities.

## 4. PRACTICAL USE OF CONDUCTED RESEARCH

The findings from this research allow us to generate insights-based recommendations for policymakers and business leaders.

## **Recommendations for National Political Perspective**

*Enhancement of digital skills programs for society.* Governments should prioritize national digital skills-building programs for the whole population. This should include basic and above-basic digital skills-building initiatives for the general population, prioritizing the existing and future workforce. Advanced digital skills (e.g., AI, data analytics) that will support SME growth also should be supported. These programs can be delivered through partnerships with educational institutions (both formal and informal), technology providers (EdTech), and, most importantly, SMEs themselves. The programs should be developed in 3 different levels that would also fit enterprises' Digital maturity levels:

• Foundational training programs that introduce essential tools such as spreadsheets, cloud platforms, and email systems. (for SMEs with lower digital maturity)

• Design training programs or grants programs to upskill employees using advanced tools like CRM, ERP, and BI systems. (for SMEs with moderate digital maturity)

• Support specialized training or funding programs in advanced topics such as AI, blockchain, and cybersecurity, ensuring alignment with industry-specific needs. (SME with higher digital maturity)

Support for SMEs by supporting Advanced Tool adoption in their operations. Policymakers should develop incentives, such as grants or tax benefits, for SMEs to adopt advanced digital tools like AI, ERP, CRM, and BI systems and their proper integration. These tools have significant correlations with productivity. Most importantly, these programs and the possibility of joining them must not be burdened with excessive bio-bureaucratic barriers, as it is in the national government's interest to have companies participate.

• Provide micro-grants for simple tools like basic accounting software or online ordering platforms.

• Offer tax credits and financial incentives to implement interconnected systems such as ERP or advanced inventory management tools.

• Support R&D projects and co-development initiatives to integrate cutting-edge tools such as AI-driven analytics or predictive maintenance systems.

Development of managerial skills development programs. Some managers' education may end when their formal university education ends. If they try to take an interest in something, this interest will not be structured and directed in the right direction. Programs enhancing managerial digital skills are essential. However, in many cases, Managers play a critical role in driving digital transformation within SMEs. Equipping managers with the necessary skills or understanding of why and how digital technologies can significantly improve their performance is essential.

• Introduce workshops on the basics of digital transformation and its relevance to business strategy.

• Develop structured programs to manage digital change and align team skills and operational digital strategies.

• Develop advanced leadership programs emphasizing scaling digital initiatives, managing open innovation, and navigating global ecosystems.

*Encourage Collaborative ecosystems*. Policymakers should promote initiatives that encourage partnerships between SMEs and external entities. This can include different types of funding for open innovation hubs, where SMEs can engage in joint projects with larger enterprises, academic institutions, or technology providers to drive innovation and digital adoption. Support programs for adopting advanced tools or managerial skills development can also be shaped collaboratively.

• Develop local partnerships with community hubs or universities to access shared expertise and basic digital tools.

- Establish regional innovation hubs focused on joint projects like IoT, AI, or data analytics.
- Fund collaborations or industry-specific partnerships to develop next-generation solutions.

### **Recommendations for a Practical Business Perspective**

Invest in own workforce Digital Skills building. SMEs should actively invest in building their employees' Digital and ICT skills. If needed, training programs for simple skills or investing in

advanced areas like AI, cloud computing, and data management can enhance productivity and foster innovation. Of course, all these trainings should align with core SME operations.

• SMEs with minimal digital skills should invest in basic digital literacy training to ensure employees are comfortable with core technologies.

• SMEs with intermediate digital practices should focus on role-specific skills, such as CRM software, cloud-based collaboration platforms, or business intelligence tools.

• SMEs with advanced digital operations should offer specialized AI, machine learning, and predictive analytics training tailored to their industry needs.

*Partnerships for Innovation*. Businesses should actively seek partnerships with external entities to co-develop digital solutions. The research highlights the positive impact of collaboration, particularly in AI projects, on digital transformation. Of course, we should expect a similar effect in other advanced ITC projects. Such partnerships can help SMEs access new technologies, share risks, and overcome resource limitations. Also, it's important to accept we can't build everything ourselves. And it's all right to ask for help from professionals on some topics.

• SMEs with minimal digital skills should partner with local technology providers to introduce foundational tools and solutions.

• SMEs with moderate digitalization should collaborate with industry peers, regional innovation hubs, or consultancies to co-develop mid-level digital solutions.

• To stay ahead of emerging trends, SMEs with advanced digital maturity should partner with research institutions, tech giants, or global innovation networks.

Adopt a Customer-First digital strategy and use digital tools to implement it. SMEs should integrate customer-facing technologies like mobile apps and online ordering systems into their business models. These tools can enhance customer engagement and align with broader e-commerce strategies, driving long-term growth and market diversification.

• SMEs with minimal digital adoption can start by implementing simple online order forms or basic e-commerce capabilities.

• SMEs with moderate digital strategies should optimize customer engagement through advanced CRM tools, targeted marketing campaigns, and omnichannel experiences.

• SMEs with advanced digital operations should focus on AI-driven personalization, mobile apps, and customer data analytics to deliver highly tailored experiences.

Actively leverage government support programs. In all countries, we can find different existing government support programs. SMEs should actively utilize available government programs and

incentives aimed at digital transformation. Such initiatives can reduce the financial and operational barriers to digital adoption. And, of course, not afraid to enter partnership initiatives when the know-how is needed to cut through red tape.

• SMEs with minimal digital should leverage programs for first-level digital adoption, such as grants for website development or accounting software.

• SMEs with intermediate needs should explore funding for connected tools like ERP systems and advanced digital platforms.

• Advanced SMEs should seek R&D tax credits and innovation grants to implement experimental or high-tech solutions.

## CONCLUSIONS

1. The study defines digital transformation as a key process that can address multiple challenges (such as survival or productivity) SMEs face. The research revealed that internal factors, such as digital skills and leadership, and external pressures, such as market dynamics and regulatory frameworks, drive digital transformation. SMEs frequently skip the digital transformation process due to resource limitations and a lack of skills. Digital transformation is a complex process that requires SMEs to engage in strategic planning for its adoption. Open Innovation (OI) emerged as a critical mechanism to overcome barriers to digital transformation. By adopting inbound, outbound, or coupled OI strategies, SMEs can access external knowledge, collaborate effectively, and integrate new technologies to foster innovation and overcome barriers.

2. The introduced conceptual framework illustrates how drivers for digital transformation (such as digital capabilities and internal readiness), processes (digital transformation and open innovations), and enablers (such as leadership and available resources) enhance SME growth. The framework captures how internal drivers like digital skills and leadership and external factors such as market demand and technology availability propel the digital transformation. It also defines the framework as highly dynamic, with changes in one part immediately affecting others. Business model innovation (BMI) is also part of the model, activated as soon as digital transformation and open innovation processes commence.

**3.** Through macro-level research using publicly available data, we defined significant relationships between digital skills, OI activities, digitally enabled business models, and SME performance. The research revealed that SMEs in digitally advanced economies demonstrate superior performance, with higher adoption rates of digital-first business models. These businesses are more resilient and competitive. The findings also highlighted differences in digital adoption levels and performance gaps across regions, emphasizing the need for urgent, targeted policies to minimize these gaps.

4. Future studies should expand the quantity of data by including a wider range of countries and exploring specific industry sectors with varying levels of digital adoption. A broader dataset would provide a more nuanced view and reduce the influence or bias introduced by generalized data. Qualitative methods, such as interviewing business leaders from these industries, should be integrated and compared with macro data to provide deeper insights. This approach would offer a rich perspective, capturing the outcomes and underlying reasoning at the individual level.

The research identified the need for tailored solutions for SMEs at different stages of digital maturity. Recommendations must be developed accordingly. While general digital skills are essential across the board, advanced specialist training and support programs are particularly critical for digitally advanced economies. Solutions for SMEs fall into two main categories: enhancing digital skills and addressing resource challenges. Based on varying levels of digital adoption, these tailored recommendations were developed as part of this work.

## LITERATURE LIST

1. Albats, E., Podmetina, D., & Vanhaverbeke, W. (2023). Open innovation in SMEs: A process view towards business model innovation. *Journal of Small Business Management*, *61*(6), 2519–2560. https://doi.org/10.1080/00472778.2021.1913595

2. Appio, F. P., Cacciatore, E., Cesaroni, F., Crupi, A., & Marozzo, V. (2024). Open innovation at the digital frontier: Unraveling the paradoxes and roadmaps for SMEs' successful digital transformation. *European Journal of Innovation Management*, 27(9), 223–247. https://doi.org/10.1108/EJIM-04-2023-0343

3. Arranz, C. F. A., Arroyabe, M. F., Arranz, N., & De Arroyabe, J. C. F. (2023). Digitalisation dynamics in SMEsSME: An approach from systems dynamics and artificial intelligence. *Technological Forecasting and Social Change*, *196*, 122880. https://doi.org/10.1016/j.techfore.2023.122880

4. Barrett, G., Dooley, L., & Bogue, J. (2021). Open innovation within high-tech SME: A study of the entrepreneurial founder's influence on open innovation practices. *Technovation*, *103*, 102232. https://doi.org/10.1016/j.technovation.2021.102232

5. Bouwman, H., Nikou, S., & De Reuver, M. (2019). Digitalization, business models, and SMEsSME: How do business model innovation practices improve performance of digitalizing SMEs? *Telecommunications Policy*, *43*(9), 101828. https://doi.org/10.1016/j.telpol.2019.101828

6. Carrasco-Carvajal, O., Castillo-Vergara, M., & García-Pérez-de-Lema, D. (2023). Measuring open innovation in SMEs: An overview of current research. *Review of Managerial Science*, *17*(2), 397–442. https://doi.org/10.1007/s11846-022-00533-9

7. Chesbrough, H., & Bogers, M. (2014). *Explicating Open Innovation: Clarifying an Emerging Paradigm for Understanding Innovation*.

 Clemente-Almendros, J. A., Nicoara-Popescu, D., & Pastor-Sanz, I. (2024). Digital transformation in SMEs: Understanding its determinants and size heterogeneity. *Technology in Society*, 77, 102483. https://doi.org/10.1016/j.techsoc.2024.102483

9. Costa Melo, Dr. I., Queiroz, G. A., Alves Junior, P. N., Sousa, T. B. D., Yushimito, W. F., & Pereira, J. (2023). Sustainable digital transformation in small and medium enterprises (SMEs): A review on performance. *Heliyon*, *9*(3), e13908. https://doi.org/10.1016/j.heliyon.2023.e13908

10. Emerald Publishing. (2024). *How to... Conduct empirical research*. https://www.emeraldgrouppublishing.com/how-to/research-methods/conduct-empirical-research#what-is-empirical-research

11. Erjavec, E., Redek, T., & Kostevc, Č. (2023). SMEs "Growing Smart": The Complementarity of Intangible and Digital Investment in Small Firms and Their Contribution to Firm Performance. *Economic and Business Review*, *25*(4), 216–232. https://doi.org/10.15458/2335-4216.1328

12. Etienne Fabian, N., Dong, J. Q., Broekhuizen, T., & Verhoef, P. C. (2024). Business value of SME digitalisation: When does it pay off more? *European Journal of Information Systems*, *33*(3), 383–402. https://doi.org/10.1080/0960085X.2023.2167671

13. European Commision. (2024a). *SME definition (Last check: 2024-12-30)*. https://single-market-economy.ec.europa.eu/smes/sme-fundamentals/sme-definition_en

14. European Commision. (2024b). *The Digital Economy and Society Index (DESI) (Last checked 2024-12-31)*. https://digital-strategy.ec.europa.eu/en/policies/desi

15. European Commission. Directorate General for Internal Market, Industry, Entrepreneurship and SMEs. & European Commission. Joint Research Centre. (2024). *Annual report on European SMEs* 2023/2024: SME performance review 2023/2024. Publications Office. https://data.europa.eu/doi/10.2826/355464

16. Eurostat. (2024). *Multiple data sets on business, economy and digital society (last check 2024.12.30)*. [Dataset]. https://ec.europa.eu/eurostat/

17. Hassan, S. S., Meisner, K., Krause, K., Bzhalava, L., & Moog, P. (2024). Is digitalization a source of innovation? Exploring the role of digital diffusion in SME innovation performance. *Small Business Economics*, *62*(4), 1469–1491. https://doi.org/10.1007/s11187-023-00826-7

18. Jafari-Sadeghi, V., Garcia-Perez, A., Candelo, E., & Couturier, J. (2021). Exploring the impact of digital transformation on technology entrepreneurship and technological market expansion: The role of technology readiness, exploration and exploitation. *Journal of Business Research*, *124*, 100–111. https://doi.org/10.1016/j.jbusres.2020.11.020

19. Keith, O., Mark, S., & Amanda, D. (2024). *What is digital transformation? (Last check 2024-12-30)*. https://www.ibm.com/topics/digital-transformation

20. Kindström, D., Carlborg, P., & Nord, T. (2024). Challenges for growing SMEs: A managerial perspective. *Journal of Small Business Management*, 62(2), 700–723. https://doi.org/10.1080/00472778.2022.2082456

21. Leavy, P. (2017). Research design: Quantitative, qualitative, mixed methods, arts-based, and community-based participatory research approaches. The Guilford Press.

22. LR Seimas. (2024). Lietuvos Respublikos įmonių ir įmonių grupių atskaitomybės įstatymas(Lastcheck—2024-12-30).https://e-

23. McKinsey. (2024). *What is digital transformation? (Last check—2024-12-30)*. https://www.mckinsey.com/featured-insights/mckinsey-explainers/what-is-digital-transformation#/

24. North, K., Aramburu, N., & Lorenzo, O. J. (2019). Promoting digitally enabled growth in SMEs: A framework proposal. *Journal of Enterprise Information Management*, *33*(1), 238–262. https://doi.org/10.1108/JEIM-04-2019-0103

25. OECD. (2024). SME digitalisation (Last check—2024-12-30).

26. Omrani, N., Rejeb, N., Maalaoui, A., Dabić, M., & Kraus, S. (2024). Drivers of Digital Transformation in SMEs. *IEEE Transactions on Engineering Management*, *71*, 5030–5043. https://doi.org/10.1109/TEM.2022.3215727

27. Scuotto, V., Nicotra, M., Del Giudice, M., Krueger, N., & Gregori, G. L. (2021). A microfoundational perspective on SMEs' growth in the digital transformation era. *Journal of Business Research*, *129*, 382–392. https://doi.org/10.1016/j.jbusres.2021.01.045

28. Sheppard, V. (2020). Research Methods for the Social Sciences: An Introduction.

29. Skare, M., De Las Mercedes De Obesso, M., & Ribeiro-Navarrete, S. (2023). Digital transformation and European small and medium enterprises (SMEs): A comparative study using digital economy and society index data. *International Journal of Information Management*, 68, 102594. https://doi.org/10.1016/j.ijinfomgt.2022.102594

30. Son, S. C., Zo, H., Jeong, M., & Steinberger, T. (2023). Open innovation strategy and performance of SMEs in the IT industry located in Korea's innovation clusters: The role of government subsidies. *Asian Journal of Technology Innovation*, 1–23. https://doi.org/10.1080/19761597.2023.2208641

31. Vrečko, I., Tominc, P., & Širec, K. (2023). Enhancing the Performance of High-Growth Smalland Medium-Sized Enterprises through Effective Project-Management Processes and Stakeholder Engagement: A Systems Perspective. *Systems*, *11*(10), 511. https://doi.org/10.3390/systems11100511

32. World Economic Forum. (2022). *Future Readiness of SMEs and Mid-Sized Companies: A Year On* (p. 28). World Economic Forum. https://www.weforum.org/publications/future-readiness-of-smes-and-mid-sized-companies-a-year-on/