

SME growth in the digital era

The moderating role of digital capabilities and institutional quality on digitalisation

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Student:

mr. Y. Slinkman

s1045302

Supervisor:

prof. dr. A.U. Saka-Helmhout

Second reader:

S.G. Anayati

Abstract

This study addresses a gap in the literature regarding digitalisation and firm growth, which often leaves the role of small and medium-sized enterprises (SME) underexplored. It investigates how digitalisation impacts SME growth in terms of turnover and how the relationship is moderated by digital capabilities and institutional quality. Using a quantitative method, the study uses the Flash Eurobarometer 486 (FL486) dataset and World Governance Indicators (WGI) for the 27 European Union (EU) member states. Logistic regression was conducted to analyse the data. The findings show that digitalisation directly and significantly boosts SME growth. This suggests that digital adoption offers strong benefits for SMEs. However, digital capabilities did not significantly strengthen this relationship. Institutional quality also showed no significant effect. Therefore, while digitalisation is a direct driver of SME growth, the expected enhancing roles of digital capabilities and institutional quality are not present in the studied EU sample.

Keywords SME, growth, European Union, digitalisation, resource-based view, digital capabilities, institutional quality, empirical research

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Chapter 1. Introduction

1.1 Background

Digitalisation has been ongoing since the last century, with industries such as banking and airlines as early adopters during the first wave of digitalisation (Zimmermann, 2016). The computer transformed information technology in the 20th century by allowing analogue signals to be converted into digital data and disrupted the traditional data handling methods (Tilson et al., 2010). Since then, the rise of advanced technologies such as artificial intelligence (AI) has continued to transform industries and society at every level. To adapt to these changes and meet evolving consumer expectations, businesses must rethink traditional approaches and explore opportunities to use customer data in a broader context to gain new insights and generate revenue streams (Schwab, 2017).

In 2024, 68% of the global population is online (ITU, 2024). Digital technologies have made communication and knowledge sharing easier and more accessible than ever before, marking the digital era (UN, n.d.). Within this context, the traditional model of small and medium-sized enterprises (SME) with limited geographic focus and low levels of digitalisation is no longer sufficient to sustain growth. SMEs are under growing pressure to adopt strategies to remain competitive and adapt to the changing technological and social landscapes (Denicolai et al., 2021). The digital revolution has pushed SMEs to adopt technologies, but at the same time this has enabled SMEs to align with sustainability goals and pursue innovation (Evers et al., 2023). It also facilitates the optimisation of production processes, streamlining supply chains and reducing costs, which ultimately enhances competitiveness (Rachinger et al., 2018). As SMEs adapt to the digital shift, it becomes increasingly important to understand how digitalisation affects their growth and under which conditions it does.

1.2 Problem statement

While digitalisation has transformed global markets, creating opportunities for SMEs to expand and compete, much of the existing academic literature focuses on larger firms such as multinational enterprises (MNEs) (Drori et al., 2024), or business types such as iBusinesses and New Ventures (Brieger et al., 2022; Brouters et al., 2016). This leaves the role of digitalisation in the growth of SMEs underexplored (Rosyidah et al., 2023).

Although digitalisation provides potential benefits, not all firms are able to fully leverage the advantages. Digitalisation alone does not automatically ensure value extraction from digital tools, as firms must have the necessary capabilities to implement and utilise digital tools effectively. SMEs vary in how they integrate digital technologies, depending not only on their digital capabilities but also on the extent to which the institutional environment enables them to benefit from digitalisation (Mikalef et al., 2021;

Schwens et al., 2011). As a result, there is a widening gap in digital adoption between large firms and SMEs (OECD, 2024). While adopting digital applications is essential for firm survival and competitiveness (Denicolai et al., 2021), it requires integration into broader organisational practices to generate substantial value (North et al., 2019). Capabilities and digital technologies, specifically platforms, may help SMEs identify and exploit digital opportunities (Cenamor et al., 2019), but the extent to which this supports growth remains insufficiently studied. Although some research highlights the role of digital capabilities in successfully enabling digital adoption (Sunday & Chinedu-Eze, 2018), less is known about how they influence the link between digitalisation and SME growth (Anwar et al., 2024).

Another important factor is the institutional environment in which SMEs operate. Country-specific conditions shape how firms develop and grow (Drori et al., 2024; Schwens et al., 2011), and institutional weaknesses such as nonperforming loans (NPL) can hinder firm performance (Saadaoui & Chouchene, 2024). As both firm resources and capabilities are embedded in the broader institutional context, this context is relevant to consider. Despite its importance, this topic remains insufficiently addressed in much of the current literature (Brieger et al., 2022).

In addition, many studies fail to account for Industry 4.0 technologies, such as AI and cloud computing, which enhance automation, innovation and data-driven decision-making (Duman & Akdemir, 2021; Higón & Bonvin, 2024). The inclusion of these technologies improves understanding of how digitalisation affects firm performance, yet they are often excluded from research that focuses on SMEs.

Thus, while digitalisation presents opportunities for SMEs to grow, research remains limited in several ways. Existing research often focuses on larger firms, overlooks the role of digital capabilities in the relationship with SME growth and fails to take institutional quality into account as an external factor. Additionally, many studies do not fully capture digital technologies that are associated with Industry 4.0, such as cloud computing and AI. These gaps hinder a full understanding of the conditions under which digitalisation can enable SME growth and point to the need for further research.

1.3 Research Objective

The gap in the academic literature as described in section 1.2 suggests that more research is needed on the relationship between digitalisation and SME growth. While some studies have explored aspects of this topic, existing research often lacks empirical evidence that extends beyond a narrow focus on specific domestic contexts (Anwar et al., 2024; Higón & Bonvin, 2024; Rosyidah et al., 2023).

The objective of this study is to investigate how digitalisation impacts SME growth and under which conditions this relationship is strengthened or constrained. To do so, this study examines both firm-level factors, specifically digital capabilities and broader contextual factors, such as institutional quality, that shape the ability of SMEs to benefit from digitalisation.

This study builds on the SME digitalisation literature, which studies how smaller firms adopt and benefit from digital tools. It draws on the Resource-Based View (RBV), which considers digital technologies as potentially valuable and rare firm resources that may explain why SMEs vary in the way they manage digital technologies (Barney, 1991). In addition, it engages with institutional theory, which emphasises how the quality of formal institutions can shape the firm's ability to engage in opportunities (North, 1991). This study also incorporates insights from the dynamic capabilities theory, which stresses that firms must not only adopt valuable resources, but also require the ability to sense, seize and reconfigure them to create value (Teece, 2007). By incorporating these theoretical perspectives and analysing SMEs across different European countries, this study aims to provide a more generalisable understanding of the conditions under which digitalisation contributes to SME growth. In doing so, it contributes both theoretically and empirically to the literature on SME digitalisation.

To align with the research objective, the research question is formulated as follows: *How does digitalisation affect SME growth, and to what extent is this relationship moderated by digital capabilities and institutional quality?*

1.4 Relevance

SMEs play a crucial role in the global economy, accounting for over 95% of all businesses in OECD countries. On average, SMEs contribute 45% to median GDP (World Trade Organization, 2016). In the European Union (EU), SMEs make up more than 99% of all firms and employ nearly two-thirds of the workforce in the EU-27 non-financial business sector (NFBS), making them a cornerstone of the European economy (European Commission, 2024). These figures underscore the critical role of SMEs in driving economic growth and development, both globally and within the EU. Given the substantial impact that SMEs have on global economies, understanding how digitalisation influences their growth becomes even more essential.

Building on this, this study extends the understanding of how SMEs can enhance their value using digital technologies. It offers new insights into how SMEs can benefit from digitalisation under context-specific institutional and organisational conditions, which is an area that remains underdeveloped in current research. Because firm resources and capabilities are embedded within the broader institutional setting, this context is relevant for explaining their role in SME growth. By studying the moderating effects of

digital capabilities and institutional quality, this study offers a broader understanding of the conditions under which digitalisation influences SME growth. This not only fills the gap in the literature but also increases the generalisability of the findings by including SMEs from across Europe, offering insights for scholars, policymakers and SMEs themselves.

From a practical perspective, understanding the impact of digitalisation is crucial for managers aiming to stay competitive in a business environment that is rapidly evolving. It can offer further confidence in investing in digital technologies to enhance growth. On a societal level, supporting SME digitalisation contributes to broader economic development and job creation, as SMEs play a significant role in driving economic growth. Policymakers can use the insights to promote the adoption of digital tools by SMEs.

1.5 Outline

This study is structured in six chapters. The next chapter, Chapter 2, provides the theoretical framework. After that, Chapter 3 discusses the methodology used, including the datasets, sources and sampling procedure, operationalisation of variables and the statistical method. Chapter 4 presents the final data and the results. Next, Chapter 5 discusses the findings in relation to existing literature. Finally, Chapter 6 concludes the study by summarising the key insights and offering recommendations, limitations and directions for future research.

Chapter 2. Theoretical framework

2.1 SME growth and its drivers

Growth of a firm is often seen as the most important indicator of long-term success, rather than the achievement of short-term results. The most recognised theory of firm growth is Gibrat's Law, which posits that a firm's growth rate is independent of its initial size. According to this theory, small and large firms have an equal probability of experiencing high or low growth (Edin & Yazdanfar, 2016; Peric & Vitezic, 2016). As firm growth plays a crucial role in fostering economic development, it is important to understand its drivers (Hermelo & Vassolo, 2007).

The drivers of SME growth can be classified into three categories: firm characteristics, firm strategy and macroeconomic conditions (Ipinnaiye et al., 2017). Firm characteristics are associated with a firm's resources, accumulated experience and the nature of the business (Handoyo et al., 2023). These include firm size, initial productivity levels, industry growth and ownership structure. Firm strategy refers to trade, training, research and development (R&D) and the receipt of public support, such as grants and subsidies (Ipinnaiye et al., 2017). Firm growth does not happen in isolation, but within a broader environment that presents both opportunities and challenges (Wakaisuka-Isingoma et al., 2016). This is

shaped by macroeconomic conditions, including GDP growth, inflation, the unemployment rate, the real effective exchange rate (REER) and domestic credit to the private sector (as a percentage of GDP) (Ipinnaiye et al., 2017).

Although digital resources are part of firm characteristics (Audretsch & Belitski, 2024; Piccoli et al., 2024), they are often overlooked in research, with some exceptions (Chaudhuri et al., 2022). This is surprising, given the benefits of digitalisation for enhancing growth (OECD, 2024). As digitalisation reshapes how firms operate and becomes increasingly important to remain competitive in today's digital world (Fabian et al., 2024), this study examines its role as a driver of SME growth.

2.2 Digitalisation and its impact on firm performance

2.2.1 Understanding digitalisation

Digitalisation typically refers to the use of digital technologies to restructure value-creating processes and business models (Björkdahl, 2020). It is commonly defined as a socio-technical process that involves applying digitising techniques within broader social, institutional and business contexts, integrating digital technologies into everyday operations and infrastructures (Tilson et al., 2010). Digitalisation and digital transformation are often used as interchangeable terms (Meier, 2023; Reis et al., 2018), which also applies to digital adoption (Arifin et al., 2023; Guedes et al., 2023; Lee et al., 2020).

Digitalisation is broad in scope, consisting of various technologies that each serve different purposes and requires the integration of strategic assets (OECD, 2021). Digital technology enables business transformation, serving to achieve the strategic and impactful goals of digital transformation. Conversely, business models drive digital transformation and play a crucial role in determining its success (Tekic & Koroteev, 2019).

In the context of the manufacturing industry, digital technologies have a positive effect on firm performance (Gillani et al., 2020). Moreover, leveraging technologies such as social media, mobile platforms and big data enables firms to enhance their performance, because they foster connections between people, businesses and digital environments (Nwankpa & Datta, 2017). Similarly, Cui and Pan (2015) found that firms that adopt digital technologies are able to reach higher sales growth compared to those without.

The effect on firm performance is also evident in the context of Industry 4.0. Implementing such technologies in manufacturing firms enhances value propositions by improving quality, increasing flexibility and ensuring quicker and more reliable delivery (Szász et al., 2020). Additionally, the

adoption of AI, the Internet of Things (IoT) and big data analytics (BDA) contributes significantly to SME growth. SMEs that combine these digital technologies experience even greater benefits (Ardito et al., 2024). This suggests that digitalisation has a direct and positive effect on firm performance.

To understand the theoretical foundation of the impact of digitalisation on SME growth, the RBV provides a relevant framework (Ardito et al., 2024). This theory analyses firms from the resource side, rather than analysing them from the product side. Firms' resources are either tangible or intangible (Wernerfelt, 1984). A sustained competitive advantage is generated when resources are rare, inimitable and non-substitutable (Barney, 1991). Eventually, the RBV replaced the idea that resources must be non-substitutable. Instead, a firm's success depends on how well it utilises its valuable, rare and imperfectly imitable resources or capabilities within its organisational processes and strategy (Barney, 1995). Applied to digital technologies, the RBV helps to understand their impact on efficiency, financial performance and digital export (Elia et al., 2021), as well as their role in SME growth (Ardito et al., 2024). Research has shown that digital adoption enables SMEs to develop unique resources that improve both productivity and efficiency (Radicic & Petković, 2023; Saleem et al., 2020). This uniqueness lies in digital resources being adaptable, containing value and enabling automated access. These characteristics ensure reuse and recombination, allowing firms to flexibly use them and create new value. This sets digital transformation apart from IT-enabled transformation, as digital resources do not just support technology use but can reshape an organisation's structure and strategy. SMEs can unlock their growth potential by leveraging digital resources (Piccoli et al., 2024).

2.2.2 Digitalisation by SMEs

Although digitalisation has been recognised as a growth enabler, SMEs often face barriers to digital adoption. SMEs are often less likely to fully embrace digital transformation compared to larger firms. As a result, SMEs often restrict adoption to basic functions, such as administration or marketing. Adoption gaps widen as technologies become more complex or require scale implementation. The differences also exist in cloud computing adoption, despite its potential to improve scalability and IT flexibility (OECD, 2021).

Nevertheless, digital technologies offer growth opportunities for SMEs. Online platforms, for instance, help SMEs lower transaction costs and reduce information asymmetries while expanding customer reach and strengthening business networks (OECD, 2021). Empirical evidence from Indian SMEs demonstrates that social media adoption enhances SME financial performance, while also lowering marketing and customer service costs, as they enable SMEs to gain better insight into their products, services and customer needs (Chatterjee & Kar, 2020). Furthermore, the role of financial technology (FinTech) is increasingly recognised in SME growth (Karim et al., 2022; Kraha et al., 2024; Thottoli et

al., 2024). By providing SMEs with alternative sources of financing, such as peer-to-peer lending, crowdfunding and digital payment systems, FinTech reduces their dependency on traditional banks and expands their market reach through digital transactions (Karim et al., 2022). This shows that digital technologies impact SME growth.

Hence, although adoption varies, digital technologies increase efficiency and competitiveness and enable growth. Based on this, the study suggests that SMEs that leverage digital technologies are more likely to grow. Therefore, the following hypothesis is formulated:

- **H1** = Digitalisation has a positive impact on SME growth.

2.3 Digital capabilities

The relationship between digitalisation and SME growth is not uniform across firms, as its effectiveness may be influenced by firm capabilities (Kohtamäki et al., 2019; Yu et al., 2023). To understand how SMEs are approaching digitalisation, it is essential to examine their ability to integrate, build and reconfigure internal and external resources in response to rapidly changing environments, which aligns with the dynamic capabilities framework (North et al., 2019).

Dynamic capabilities play a significant role in managing digital transformation effectively (Anwar et al., 2024; Warner & Wäger, 2019). Within this field, digital capabilities represent the specific skills required to digitalise a firm, enabling businesses to leverage digital technologies effectively (Anwar et al., 2024). Teece (2007) identifies three key components of dynamic capabilities: sensing, seizing and reconfiguring. In the context of digitalisation, sensing refers to the ability to identify, anticipate and capitalise on emerging technologies. As new technologies are introduced, firms may experience capability gaps that hinder adoption and integration. Seizing involves making strategic decisions about the needed changes to fully exploit the value of digital technologies. Finally, reconfiguring involves developing the internal capacity to support digital transformation, including acquiring essential resources such as digital expertise (Ellström et al., 2021).

Despite its potential, many firms struggle to capture its full benefits due to obstacles in shifting organisational habits and work practices (Parviainen et al., 2017). Challenges such as a lack of managerial urgency, technical integration difficulties and limited control can hinder successful implementation. However, when firms overcome these barriers, digital technologies can be aligned with strategic and operational objectives, ensuring a positive impact on firm performance (Ellström et al., 2021). Firms with stronger digital capabilities are better positioned to overcome barriers to digitalisation and adapt to technological advancements, ensuring that digital transformation leads to performance

gains (Mikalef et al., 2021). This suggests that digital capabilities potentially shape how digitalisation impacts SME growth.

More direct evidence of the moderating role of dynamic capabilities comes from research on Chinese firms. Yu et al. (2023) demonstrate that digitalisation has an inverted U-shaped effect on financial performance, meaning that excessive digitalisation may lead to inefficiencies. However, their findings show that firms with strong dynamic capabilities are better equipped to manage digitalisation and fully exploit their digital technologies. While their study focuses on larger firms in China, similar arguments could also apply to SMEs in Europe.

In conclusion, while digitalisation has a positive effect on firm performance, the extent of its impact is not uniform across firms. The ability to sense opportunities, seize technological advantages and reconfigure internal structures determines how well digitalisation translates into firm performance. This suggests that dynamic capabilities have a moderating effect on the relationship between digitalisation and SME growth, which leads to the following hypothesis:

- **H2:** Digital capabilities strengthen the positive effect of digitalisation on SME growth.

2.4 Institutional quality

Despite the significant efforts of the EU to support digital transformation, there are considerable differences in digital adoption among SMEs due to a lack of targets, policy complexity and relatively low level of funding in some countries (Godlovitch & Bodin, 2022). These disparities suggest that the broader institutional context may shape how SMEs engage and benefit from digitalisation.

Institutional theory emphasises that firms are embedded within their broader societal and network structures (Williamson, 2000). The institutional framework of a country is shaped by three pillars: the regulative pillar (laws, policies and regulations), the normative pillar (social norms and values) and the cognitive pillar (shared knowledge and cultural frameworks) (Kostova et al., 2020; Trevino et al., 2008). In this study, institutional quality refers to the functionality of formal institutions in enabling firms to participate and derive value from market activities (Kafouros et al., 2022; North, 1991). These formal institutions consist of a set of rules, including legal, political and economic regulations. Their quality is reflected in elements such as the effectiveness of property rights protection, the judicial system, level of corruption and government efficiency (Kafouros et al., 2022). These formal institutional dimensions interact to either facilitate or constrain digital adoption and firm growth.

Research on both innovation and internationalisation suggests that high institutional quality as a moderator enhances a firm's ability to extract value from its resources, due to efficient factor markets,

low transactions costs and information asymmetries. In contrast, lower institutional quality disrupts these mechanisms, creating barriers that hinder firms from leveraging their resources effectively (Barasa et al., 2017; Brieger et al., 2022). The same is expected to hold for SMEs, where high institutional quality likely strengthens the positive impact of digitalisation on SME growth.

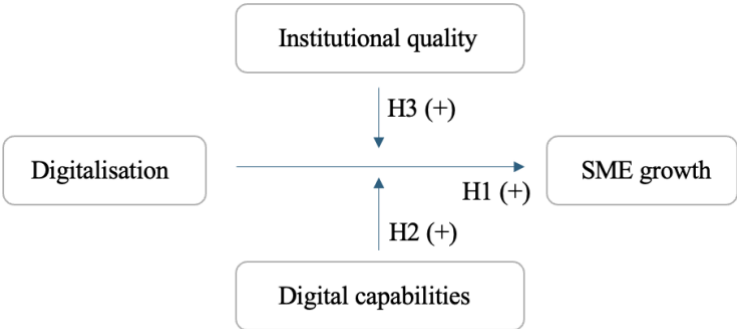
Further evidence on the moderating role of institutional quality comes from research on financial constraints. In African banking systems, a high level of non-performing loans (NPL) has been found to weaken the positive impact of digitalisation on bank performance, as they restrict resources, reduce operational efficiency and hinder customer service improvements (Saadaoui & Chouchene, 2024). Since NPLs are a component of formal institutional structures, this reinforces the idea that low institutional quality can limit the benefits of digital transformation across industries. SMEs operating in environments with low institutional quality may face comparable barriers, preventing them from fully leveraging digitalisation to drive their growth.

These findings support the argument that institutional quality moderates the relationship between digitalisation and SME growth, leading to the following hypothesis:

- **H3:** High institutional quality strengthens the positive effect of digitalisation on SME growth.

2.5 Conceptual model

Figure 1
Conceptual model



Chapter 3. Methodology

3.1 Data selection, sources and sampling approach

This study employs a quantitative method, where evidence is derived for a theory by measuring variables that produce numerical outcomes (Field, 2018). To test the hypotheses as formulated in Chapter 2, the Flash Eurobarometer 486 (FL486) dataset, made available in September 2020, is used to measure all variables except for institutional quality. The FL486 examines the barriers and challenges that smaller firms from various industries face in relation to their growth, transitioning to more sustainable business models and digitalisation. The data collection took place in the period from 19 February to 5 May 2020. Per country, a research agency conducted the survey through telephone interviews, with Kantar being the data provider in most countries. The survey includes both open-ended and categorical questions (European Commission, 2020).

To measure the variable institutional quality, the World Governance Indicators (WGI) are used. They provide data on six indicators of governance: 1) voice and accountability, 2) political stability and absence of violence/terrorism, 3) government effectiveness, 4) regulatory quality, 5) rule of law and 6) control of corruption (World Bank, n.d.). The WGI covers over two hundred economies from 1996 to 2023. These indicators are derived from a diverse set of data sources that reflect perceptions and views of governance quality as reported by experts, as well as survey respondents worldwide (Kaufmann & Kraay, 2024).

The survey of FL486 was conducted across the 27 EU member states and in 12 additional non-EU countries, containing 16365 firms in total. For the purpose of this study, the sampling frame was restricted to SMEs within the EU context. The EU was chosen over the broader European continent due to its unified regulatory framework and internal market (European Union, n.d.). This common structure ensures greater alignment among member states, making comparisons more consistent. For example, while Norway and Iceland are both European but non-EU countries, they have access to the internal market of the EU through the European Economic Area (EEA), but they are not fully subject to EU laws (Eurostat, n.d.). Including them alongside other European countries that are also non-EU states, which lack this access, would introduce inconsistencies in the analysis in this study. Therefore, restricting this study to the 27 EU member states ensures a more coherent comparison. This leaves the following countries in the dataset:

- Austria, Belgium, Bulgaria, Croatia, Cyprus, Czechia, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain and Sweden.

3.2 Variables

3.2.1 Dependent variable

This study focuses on growth among SMEs, as growth is not only a performance indicator but also a defining characteristic of SMEs themselves. According to the EU definition, a firm must have less than 250 employees and either an annual turnover below €50 million or a balance sheet total below €43 million to be considered a micro, small or medium-sized enterprise (SME) (European Commission, n.d.). However, due to data limitations in the FL486 dataset, only turnover could be used for determining SME status. Therefore, SME status in this study is based on firms with an annual turnover below €50 million in 2019, as measured by question 4a (Appendix 1, Table 1).

To evaluate how SMEs perform, it is necessary to define growth. There is no universal consensus on how SME growth should be measured (Martín-García & Morán Santor, 2021). Many SME owners prioritise financial performance as it better reflects the firm's market position (Robson & Bennett, 2000). Among financial indicators, turnover growth is the most commonly applied as it indicates a firm's total level of activity and its contribution to economic growth and market competitiveness (Achtenhagen et al., 2010; Robson & Bennett, 2000). In this study, SME growth is therefore operationalised as an increase in turnover between 2016 and 2019, based on question 5_2. The question asks whether the firm experienced turnover growth since 2016 (Appendix 1, Table 2). This resulted in the binary variable SME_Growth. In line with Hair et al. (2018), the variable is coded as 0 for no growth and 1 for growth.

3.2.2 Independent variable

Digitalisation functions as the independent variable in this study. To capture the degree of digitalisation, Audretsch and Belitski (2024) distinguish three types of firms: digitally advanced firms, digitally evolving firms and digitally uncertain firms. Their classification, which is derived from the Digital Driven (2021) report, is based on a matrix considering both the number of digital markets present and the number of digital tools. Since their study focuses on firms in emerging industries, whereas this study examines SMEs across various industries, only the number of digital tools is used for categorisation in this study. However, classifying SMEs into different levels of digitalisation remains valuable for enabling a structured comparison of digital adoption among firms (Fernandez-Vidal et al., 2022).

Audretsch and Belitski (2024) categorise the number of digital tools into at least 10, between 2 and 10, and a maximum of 1, following a classification framework that is originally based on 20 digital tools. Since question 23 of FL486 shows that only seven categories of digital tools are included, the threshold must be adjusted accordingly by using the same 50% and 10%-50% logic. This leads to the classification as presented in Table 1.

Table 1*Level of digitalisation*

Category	Number of digital tools adopted
Digitally advanced	≥ 4
Digitally evolving	2 or 3
Digitally uncertain	≤ 1

A new variable, *Digital_Tool_Count*, was created by summing the seven categories in question 23. Based on this count, the categorical variable *Digitalisation* was created with the three categories as shown above, with *digitally uncertain* functioning as the reference category. Respondent selecting “None of these” were interpreted as having adopted zero tools (Appendix 1, Table 3).

3.2.3 Moderating variables

3.2.3.1 *Digital capabilities*

Digital capabilities are defined as the specific skills required to digitalise a firm, enabling businesses to leverage digital technologies effectively (Anwar et al., 2024). Therefore, measuring digital capabilities involves assessing whether SMEs retain the necessary skills for digitalisation. To capture this, item 2 of question 21 is used to measure this construct. It identifies whether firms report lacking the skills or financing to adopt advanced digital technologies. As this question is negatively formulated, the responses are reverse-coded (Appendix 1, Table 4).

A binary variable, *Digital_Capabilities*, was constructed. Respondents who reported lacking digital skills (q21, item 2) and did not also indicate that they possess skills (not item 8) were coded as 0 (no capabilities). All other valid combinations, as in not reporting lacking skills or explicitly indicating the presence of digital skills by selecting the answer “None of these”, were coded as 1 (capabilities present). Internally inconsistent answers, where respondents selected both lack of skills as well as indicating the possession of skills, were set as system missing because these answers contradict and cannot be interpreted correctly. The absence of capabilities functions as the reference category.

3.2.3.2 *Institutional quality*

This study defines institutional quality as the functionality of formal institutions in enabling firms to participate and derive value from market activities (Kafouros et al., 2022; North, 1991). To measure institutional quality, this study utilises the WGIs, which have a score ranging from -2.5 to 2.5. Specifically, the six WGI indicators are adopted: voice and accountability; political stability and absence of violence/terrorism; government effectiveness; regulatory quality; rule of law; and control of

corruption. These six indicators are often used in prior research to effectively measure institutional quality, reflecting its functionality and contribution to the broader institutional environment (Brieger et al., 2022; Garrone et al., 2019; White et al., 2019). Therefore, using all six indicators aligns with the definition this study adopts.

The six indicators are conceptually complementary and together form a coherent measure of institutional quality. Research suggests that the WGI indicators measure the same broad concept and support averaging them into a single, comprehensive measure (Langbein & Knack, 2010; Law & Azman-Saini, 2012). Institutional quality is therefore calculated as the mean of the six WGI scores per EU member state. The year 2019 is selected as the reference year, as it reflects the institutional context relevant to the outcome measured in the FL486 survey because firm growth is reported for 2019 compared to 2016. Since institutional quality is relatively stable over time, it is unlikely to have changed significantly during that period. Moreover, the year 2020 is excluded due to potential disruption caused by the COVID-19 crisis. A continuous variable IQ was assigned to each country based on the mean value of the six WGI scores from 2019.

3.2.4 Control variables

Control variables protect the validity of the study by accounting for external factors that may influence the results (Field, 2018). Prior research has identified several factors that can affect firm performance, including firm age and industry (Akter et al., 2016; Yu et al., 2023). Firm age is incorporated as a categorical control variable, as younger firms are often more flexible, more willing to adopt new technologies and tend to experience growth more often than older firms (Geroski & Gugler, 2004; Petruzzelli et al., 2018). Firm industry is also controlled for, as digital adoption levels vary across sectors meaning that digitalisation is more relevant and transformative in some sectors than others (Ko et al., 2022). Therefore, a distinction between high and low digitally intensive sectors is made, following the OECD (2018), resulting in a binary variable.

In addition, internationalisation is included as a binary control variable. Digitalisation can facilitate access to foreign markets and enhance firm growth, and internationally active firms tend to adopt innovations more easily (Radicic & Petković, 2023). The final binary control variable is access to finance, as limited access to external funding can constrain firm growth. This is particularly relevant for SMEs, as they often rely more on external finance due to limited internal resources (Supari & Anton, 2022). Controlling for these variables helps isolate the effect of digitalisation and its moderators on SME growth from other firm-specific factors (see Appendix 2 for further details).

3.2.5 Overview

Table 2

Overview variable definitions and operationalisation

Variable	Definition	Operationalisation
<i>Dependent variable</i>		
SME	Micro, small or medium-sized enterprise (European Commission, n.d.)	≤ €50 million turnover
Growth	The increase in turnover	0 = No growth 1 = Growth
<i>Independent variables</i>		
(H1) Digitalisation	The use of digital technologies to enhance firms' value creation (Björkdahl, 2020)	1 = Uncertain: ≤ 1 2 = Evolving: 2 or 3 3 = Advanced: ≥ 4
(H2) Digital capabilities	The specific skills required to digitalise a firm, enabling businesses to leverage digital technologies effectively (Anwar et al., 2024)	0 = No capabilities 1 = Capabilities present
(H3) Institutional quality	The functionality of formal institutions in enabling firms to participate and derive value from market activities (Kafouros et al., 2022; North, 1991)	Value between -2.5 and 2.5
<i>Control variables</i>		
Access to finance		0 = No access to finance 1 = Access to finance
Internationalisation		0 = Domestic only 1 = Internationally active
Firm age		1 = 2015 and after 2 = Between 2000 and 2014 3 = Before 2000
Firm industry		0 = Low digital intensity 1 = High digital intensity

3.3 Statistical method

Given the focus on SME growth as a binary dependent variable, hierarchical logistic regression is conducted to analyse the model. This method adds variables in distinct blocks to the model, which allows for the examination of the incremental contribution of each block while controlling for the effects of variables entered in previous steps (Field, 2018). The standard logistic regression equation is as follows:

$$\text{Ln}\left(\frac{p}{1-p}\right) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_k X_k$$

As SME growth is the dependent variable, the study examines its likelihood. Logistic regression is particularly well-suited to handle a combination of categorical, binary and continuous independent variables (Hair et al., 2018). This is important for this study, as the independent variable digitalisation is categorical, digital capabilities is binary and institutional quality is continuous. In addition, four control variables are included in the model: access to finance (binary), internationalisation (binary), firm age (categorical) and firm industry (binary). The analyses were conducted using IBM SPSS Statistics. Adding the specific variables to the equation, it results in the following:

$$\begin{aligned} \text{Ln}\left(\frac{p \text{ (SME growth)}}{1-p \text{ (SME growth)}}\right) \\ = \beta_0 + \beta_1 \text{ Digitalisation} + \beta_2 \text{ Digital capabilities} + \beta_3 \text{ Institutional quality} \\ + \beta_4 \text{ Access to finance} + \beta_5 \text{ Internationalisation} + \beta_6 \text{ Firm age} \\ + \beta_7 \text{ Firm industry} + \beta_8 (\text{Digitalisation} * \text{Digital capabilities}) \\ + \beta_9 (\text{Digitalisation} * \text{Institutional quality}) \end{aligned}$$

3.4 Data cleaning procedure

Before starting the analysis, the dataset was cleaned to ensure consistency and validity. This was done across all the variables to ensure that only valid and meaningful responses entered the regression. Responses marked as “DK” or “NA” were recoded as system missing values, as they do not provide substantive information and could disturb the analysis or lead to incorrect interpretations. After this initial cleaning and only selecting SMEs from the 27 EU members states, the dataset consisted of n = 7351. As shown in Table 3, the missing values across all variables is very low, ranging from 0% to a maximum of 4.3%. Since this is below the 10% threshold of missing data, it is not expected to cause significant issues (Hair et al., 2018).

Table 3*Missing values*

	SME growth	Digitalisation	Digital capabilities	Institutional quality	Access to finance	Internationalisation	Firm age	Firm industry
N Valid	7219	7280	7351	7351	7034	7270	7271	7351
Missing	132	71	0	0	317	81	80	0

To deal with the missing values, listwise deletion was employed. This method removes any observation if it has a missing value for any of the variables used in the analysis. While it reduces the sample size, it results in a final sample size of $n = 6720$, which is sufficient for reliable results and statistical power (Hair et al., 2018).

3.5 Research ethics

This study is guided by the five research integrity principles: honesty, independence, scrupulousness, transparency and responsibility. The data used for this study come from two external sources: the FL486 dataset from the European Commission and WGI that relies on multiple sources. As the researcher did not collect the data, the main responsibility for data collection and consent of the respondents lies with the institutions that collected the data. However, participants of the FL486 survey were informed of the survey's goal, which was to support future European decision making, and the confidentiality of their responses was ensured by the data collectors.

It is also important to consider the quality and transparency of the data. The WGI uses the Unobserved Components Model (UCM) to minimise measurement mistakes and the dataset is fully replicable (Kaufmann & Kraay, 2024). The FL486 ensures validity by applying standardised data transmission and analysis methods, thereby minimising errors. Moreover, this study considers the ethical standard by citing all sources, clearly documenting the steps in the analysis, being transparent regarding the findings and interpreting the data in an unbiased way.

Chapter 4. Results

4.1 Descriptive statistics

Based on the numbers of the final sample size, 59.5% of SMEs experienced growth between 2016 and 2019. Most SMEs are digitally uncertain (56.1%), which indicates that digital adoption is still in an early stage for many SMEs. However, 76.8% report having digital capabilities, which indicates that digital skills are more common than the use of digital tools. This may be relevant when interpreting the impact of digitalisation and digital capabilities in the regression models. The average institutional quality score is 1.06 (SD = 0.46), ranging from 0.23 to 1.72. Since each SME received the institutional quality score of its country, the average reflects the country distribution of SMEs in the sample. This suggests that most SMEs operate in countries with moderately strong institutional environments. In terms of firm age, most SMEs were founded before 2000 (48.5%) and between 2000 and 2014 (42.2%), indicating a mature sample. A majority of SMEs are active in low digital intensity sectors (68.9%). Furthermore, 77.9% reported having access to external finance, and 62.0% of the SMEs do not export (Table 4).

Table 4

Descriptive statistics and frequencies

Variable	Frequency	Valid Percent	Cumulative Percent	Min.	Max.	Mean	Std. Deviation
SME growth				-	-	-	-
No growth	2724	40.5	40.5				
Growth	3996	59.5	100.0				
Digitalisation				-	-	-	-
Digitally uncertain	3771	56.1	56.1				
Digitally evolving	2234	33.2	89.4				
Digitally advanced	715	10.6	100.0				
Digital capabilities				-	-	-	-
No capabilities	1558	23.2	23.2				
Capabilities present	5162	76.8	100.0				
Institutional quality				0.23	1.72	1.06	0.46
	-	-	-				
Access to finance				-	-	-	-
No access to finance	1483	22.1	22.1				
Access to finance	5237	77.9	100.0				
Internationalisation				-	-	-	-
Domestic only	4167	62.0	62.0				
Internationally active	2553	38.0	100.0				
Firm age				-	-	-	-
2015 and after	625	9.3	9.3				
Between 2000 and 2014	2837	42.2	51.5				
Before 2000	3258	48.5	100.0				
Firm industry				-	-	-	-
Low digital intensity	2089	31.1	31.1				
High digital intensity	4631	68.9	100.0				

Note. N = 6720 (after listwise deletion). Percentages are based on valid N. - = not applicable.

Although some EU member states have relatively small sample sizes (Italy $n = 49$; Cyprus $n = 62$; Malta $n = 36$; Table 5), these cases are retained in the analysis because logistic regression is relatively robust to unequal group sizes (Field, 2018). Moreover, removing these countries would limit the geographic scope of this study.

Table 5

Number of SME observations per country

		Frequency	Valid Percent	Cumulative Percent
Valid	France	354	5.3	5.3
	Belgium	288	4.3	9.6
	The Netherlands	316	4.7	14.3
	Germany	330	4.9	19.2
	Italy	49	.7	19.9
	Luxembourg	102	1.5	21.4
	Denmark	371	5.5	26.9
	Ireland	214	3.2	30.1
	Greece	252	3.8	33.9
	Spain	343	5.1	39.0
	Portugal	240	3.6	42.5
	Finland	433	6.4	49.0
	Sweden	406	6.0	55.0
	Austria	328	4.9	59.9
	Cyprus	62	.9	60.8
	Czech Republic	323	4.8	65.6
	Estonia	131	1.9	67.6
	Hungary	123	1.8	69.4
	Latvia	246	3.7	73.1
	Lithuania	220	3.3	76.4
	Malta	36	.5	76.9
	Poland	349	5.2	82.1
	Slovakia	236	3.5	85.6
	Slovenia	275	4.1	89.7
	Bulgaria	122	1.8	91.5
	Romania	317	4.7	96.2
	Croatia	254	3.8	100.0
	Total	6720	100.0	

A Pearson correlation matrix was constructed to examine the linear relationships between all variables (Table 6). Most independent variables showed a significant and weak correlation with SME growth. Notably, firm industry shows a non-significant correlation with SME growth ($r = -.002$; $p = .839$), which suggests that firm industry might not be a direct predictor of SME growth. Furthermore, digital capabilities ($r = -.038$; $p = .002$) and firm age ($r = -.121$; $p < .001$) were both found to have a statistically

significant, but weak, negative correlation with SME growth. This provides initial insights and will be further explored in the regression analysis, which takes the multivariate effects into account.

Table 6

Pearson correlation matrix

		1	2	3	4	5	6	7
1. SME growth	r							
	Sig.							
2. Digitalisation	r	.119***						
	Sig.	<.001						
3. Digital capabilities	r	-.038**	-.091***					
	Sig.	.002	<.001					
4. Institutional quality	r	.037**	.172***	-.134***				
	Sig.	.003	<.001	<.001				
5. Access to finance	r	.099***	.123***	-.016	.084***			
	Sig.	<.001	<.001	.189	<.001			
6. Internationalisation	r	.065***	.193***	-.044***	-.027*	.119***		
	Sig.	<.001	<.001	<.001	.027	<.001		
7. Firm age	r	-.121***	.031*	-.053***	.029*	.058***	.040***	
	Sig.	<.001	.011	<.001	.018	<.001	<.001	
8. Firm industry	r	-.002	.097***	-.022	-.047***	.038**	.222***	.042***
	Sig.	.839	<.001	.077	<.001	.002	<.001	<.001

Note. Pearson correlation coefficients. * $p < .05$, ** $p < .01$, *** $p < .001$ (two-tailed). $N = 6720$.

4.2 Assumptions

According to Hair et al. (2018), logistic regression requires a sample size minimum of 10-20 observations per predictor variable, with a recommended minimum of 400. With 9 predictors (including 4 control variables and the 2 interaction terms), the final sample size of $n = 6720$ means that this condition is easily met. Moreover, Hair et al. (2018) recommends that the smallest group of the binary dependent variable should include at least 10 cases per predictor. In this study, 59.5% of firms were classified as growing SMEs (Table 7), which relates to 3996 cases, exceeding the minimum requirement.

Table 7*Frequencies of SME growth*

		Frequency	Valid Percent	Cumulative Percent
Valid	No growth	2724	40.5	40.5
	Growth	3996	59.5	100.0
Total		6720	100.0	

Logistic regression does not require linear relationships between the independent variables and the dependent variable, nor normally distributed residuals. However, an assumption that must be met is that there must be a linear relationship between any continuous predictor and the logit of the dependent variable (Field, 2018; Hair et al., 2018). Since most predictors in this study are categorical, this assumption applies only to institutional quality. The Box-Tidwell test confirmed linearity for institutional quality ($p = .946$) (Appendix 3). Another assumption of logistic regression is the independence of observations (Hair et al., 2018). This assumption is also met, since each observation represents a unique SME from the FL486 dataset.

Furthermore, multicollinearity amongst the independent variables was checked. To mitigate this potential issue and to improve interpretability, the continuous variable institutional quality was grand-mean centered. The highest VIF value is 1.101 and the lowest tolerance is .908, which are well within the acceptable thresholds ($VIF < 10$; $Tolerance > .10$), indicating that multicollinearity is not a concern (Appendix 3). This is further confirmed by the low correlations among predictors as shown in Table 6 in section 4.1, as all correlations are below $r = .30$ (Field, 2018; Hair et al., 2018).

Although logistic regression is relatively robust to outliers, influential outliers are checked using Z-scores for the categorical variables digitalisation and firm age, and the centered continuous variable institutional quality, as centering does not alter the relative position of a data point from its mean. There were no cases outside the -3 to +3 range (Appendix 3), indicating that there are no extreme outliers in these variables (Field, 2018; Hair et al., 2018). This ensures that the model estimations are not influenced by highly unusual data points. In conclusion, all the assumptions are met in this study, which provides a strong basis for the validity and reliability of the model and the findings regarding the outcome variable.

4.3 Regression model analysis

Since a hierarchical logistic regression is conducted, the first model consists of only the four control variables: access to finance, internationalisation, firm age and firm industry. The second model adds the main effects of the independent variable digitalisation and the moderators digital capabilities and

institutional quality on the dependent variable SME growth. The interaction terms of the moderators on the independent variables are added in the third model. For analyses that include institutional quality, the grand-mean centered form is used. When the odds ratios (Exp(B)) are interpreted, it is under the assumption that all other variables in the model are held constant.

The first model explains 4.0% of the variance in SME growth (Nagelkerke $R^2 = .040$) and shows good model fit (Hosmer-Lemeshow $p = .948$). It correctly classifies 60.7% of cases. The -2 Log Likelihood (-2LL) is 8872.084 and serves as a baseline for comparison with the next two models. In this model, access to finance, internationalisation and firm age are statistically significant predictors of SME growth ($p < .001$), supporting their inclusion as meaningful control variables. Although firm industry is not significant ($p = .231$), it is retained in the model to control for its potential effects and to maintain consistency across the hierarchical model stages. Among the significant control variables, firm age stands out. Compared to older firms, younger firms are 144.8% more likely to experience growth ($B = .895$; $p < .001$; $\text{Exp}(B) = 2.448$), while the middle-aged group is 46.7% more likely to grow ($B = .383$; $p < .001$; $\text{Exp}(B) = 1.467$) (Appendix 4). These findings regarding the significant control variables align with the theoretical expectations outlined in Chapter 2.

In the second model, the explained variance in SME growth increases to 5.6% (Nagelkerke $R^2 = .056$). It continues to indicate a good fit between the model and the data (Hosmer-Lemeshow $p = .154$). The reduction in -2LL to 8788.418 shows improvement in the model's predictive power. There is also a slight increase in accurate prediction (from 60.7% to 61.8%). The effects of the control variables remain stable compared to the first model. The model shows that digitalisation is a significant positive predictor of SME growth ($p < .001$), indicating a direct effect. Compared to digitally uncertain firms, digitally evolving firms have 1.440 times higher odds, meaning that those firms are 44.0% more likely to experience growth ($B = .365$; $p < .001$; $\text{Exp}(B) = 1.440$). Digitally advanced firms are 1.812 times more likely, meaning they are 81.2% more likely to experience growth compared to digitally uncertain firms ($B = .594$; $p < .001$; $\text{Exp}(B) = 1.812$). Interestingly, the presence of digital capabilities shows a negative and significant effect ($B = -.157$; $p = .011$; $\text{Exp}(B) = .854$). This means that firms with digital capabilities are 14.6% less likely to experience growth compared to those without digital capabilities. Institutional quality shows no significant direct effect on SME growth ($p = .383$) (Appendix 5).

In the last model, the interaction terms are added. The model fit remains strong (Hosmer-Lemeshow $p = .381$). The model explains the data slightly better than the previous model (-2LL = 8782.307) and the explained variance also slightly increases to 5.7% (Nagelkerke $R^2 = .057$). The percentage correctly predicted remains the same (61.8%). Again, the effects of the control variables remain consistent. For the main effects, the effect of digitalisation on SME growth continues to show the same pattern as Model 2, confirming its direct effect. Institutional quality remains non-significant in its direct effect on SME

growth ($p = .136$). However, the direct effect of digital capabilities on SME growth becomes non-significant in this model ($p = .595$). For the interaction terms, the overall block of both interaction effects showed no statistically significant effect ($p = .106$ and $p = .339$). It is noteworthy that the interaction between digitally evolving firms and digital capabilities shows a significant effect ($B = -.283$; $p = .034$; $\text{Exp}(B) = .754$). Yet, as the interaction block itself is not significant, this result must be interpreted with caution (Field, 2018; Hair et al., 2018) (Appendix 6). An overview of all models is presented in Table 8.

Table 8

Logistic regression results

Estimates	Model 1			Model 2			Model 3		
	B	Sig.	Exp(B)	B	Sig.	Exp(B)	B	Sig.	Exp(B)
Access to finance(1)	.490***	<.001	1.632	.437***	<.001	1.548	.436***	<.001	1.546
Internationalisation(1)	.270***	<.001	1.310	.195***	<.001	1.215	.194***	<.001	1.214
Firm age		<.001			<.001			<.001	
Firm age(1)	.895**	<.001	2.448	.914***	<.001	2.495	.912***	<.001	2.490
Firm age(2)	.383**	<.001	1.467	.412***	<.001	1.510	.411***	<.001	1.508
Firm industry(1)	-.067	.231	.935	-.090	.110	.914	-.085	.134	.919
Digitalisation					<.001			<.001	
Digitalisation(1)				.365***	<.001	1.440	.587***	<.001	1.799
Digitalisation(2)				.594***	<.001	1.812	.660***	<.001	1.936
Digital capabilities(1)				-.157*	.011	.854	-.045	.595	.956
Institutional quality(c)				.049	.383	1.050	.106	.136	1.112
DC*DL								.106	
DC(1)*DL(1)							-.283*	.034	.754
DC(1)*DL(2)							-.094	.646	.910
DL*IQ(c)								.339	
DL(1)*IQ(c)							-.182	.147	.834
DL(2)*IQ(c)							-.006	.975	.994
Nagelkerke R ²		.040			.056			.057	
Hosmer-Lemeshow		.948			.154			.381	
-2LL		8872.084			8788.418			8782.307	
Percentage correctly predicted		60.7%			61.8%			61.8%	

Note. * $p < .05$, ** $p < .01$, *** $p < .001$ (two-tailed). DC = Digital capabilities; DL = Digitalisation; IQ = Institutional quality; (c) = grand-mean centered. Full coding of all variables can be found in the appendices for each model.

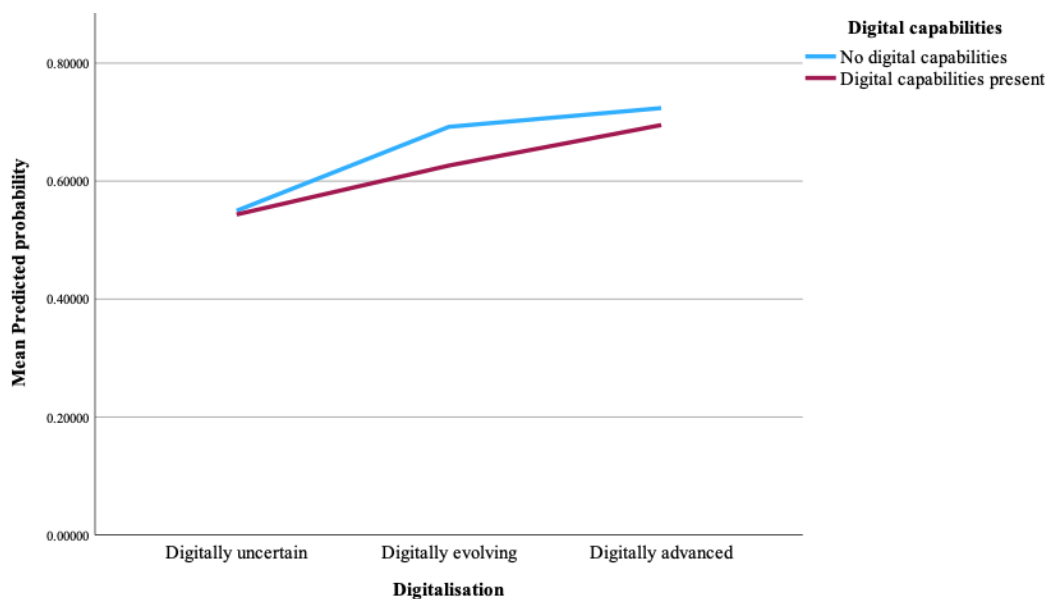
4.4 Validation of hypotheses

The results in Table 8 are used to assess if the hypotheses as formulated in Chapter 2 must be rejected or accepted. H1 (Digitalisation has a positive impact on SME growth) is **accepted**. In Model 2, digitalisation significantly predicts SME growth. Compared to digitally uncertain firms and all else being equal, digitally evolving firms are 44.0% more likely to experience growth ($\text{Exp}(B) = 1.440$), and digitally advanced firms are 81.2% more likely to grow ($\text{Exp}(B) = 1.812$). In Model 3, after adding the interaction terms, the main effects of digitalisation remain significant and show the same pattern. This confirms that the positive impact of digitalisation on SME growth is robust.

H2 (Digital capabilities strengthen the positive effect of digitalisation on SME growth) is **rejected**, as the overall interaction between digital capabilities and digitalisation is not significant ($p = .106$). Furthermore, digital capabilities showed a significant negative direct effect on SME growth in Model 2 ($B = -.157$; $p = .011$; $\text{Exp}(B) = .854$). While this direct effect became non-significant in Model 3 ($p = .595$), which suggests that its influence depends on digitalisation, a specific dummy interaction term did show a significant negative effect on SME growth ($B = -.283$; $p = .034$; $\text{Exp}(B) = .754$). It indicates that for digitally evolving firms (compared to digitally uncertain firms), the presence of digital capabilities reduces the odds of SME growth. These findings contradict the hypothesis further, as digital capabilities did not strengthen but rather seem to negatively affect SME growth in certain contexts. The interaction plot visually supports the findings (Graph 1). However, since the overall block of interaction terms is not significant, this must be interpreted with caution, meaning no hard conclusions can be drawn from it (Field, 2018; Hair et al., 2018).

Graph 1

*Interaction plot digitalisation*digital capabilities*



H3 (High institutional quality strengthens the positive effect of digitalisation on SME growth) is **rejected**, because the interaction term between digitalisation and institutional quality is not significant ($p = .339$). Furthermore, the direct relationship between institutional quality and SME growth is also not confirmed in any of the models. Therefore, high institutional quality does not function as a facilitator of the positive impact of digitalisation on SME growth.

4.5 Robustness checks

To ensure the model is robust, two robustness checks are conducted. The first considers the sample size of the subgroups. Although there is no universal threshold for excluding specific subgroups, countries with $n < 70$ are removed (Hair et al., 2018). This reduced the overall sample from 6720 to 6573 SMEs. Overall, the results are highly consistent with the original models. However, the interaction term digitalisation*digital capabilities becomes marginally significant in a negative direction at the 10% level in Model 3 ($p = .085$), while it was originally non-significant ($p = .106$). This means that the overall interaction effect is less stable across different samples, which therefore must be interpreted with caution (see Appendix 7 for further details).

Removing firm industry is used as a robustness check. This decision is based on two observations. First, firm industry showed no significant correlation with SME growth in the correlation matrix as discussed in section 4.1, indicating that there is no linear relationship between this control variable and SME growth. Second, firm industry remained non-significant across all the logistic regression models. Thus, removing this variable allows for testing whether it influenced other variables or the overall model performance. The results show that excluding firm industry does not change any of the key model outcomes. All the results were almost identical. However, one small difference is observed again: the interaction effect between digitalisation and digital capabilities becomes marginally significant at the 10% level ($p = .097$) (see Appendix 8 for further details).

In conclusion, the robustness checks confirm that the findings are stable. Only the interaction between digitalisation and digital capabilities shows a slight variation as it turns marginally significant in both checks. This reinforces the need for cautious interpretation of the moderation effect but does not change this study's core findings.

Chapter 5. Discussion

This study highlighted the debate in the digitalisation literature regarding the way digital technologies affect SME growth and under which conditions this effect persists. This chapter discusses the key findings of the logistic regression analysis in relation to existing literature as discussed in Chapter 2.

A central finding of this study is that digitalisation directly and significantly contributes to SME growth. Compared to digitally uncertain firms, digitally evolving firms were more likely to experience growth, and digitally advanced firms were even more likely. This finding strongly aligns with the RBV, which states that digital tools can be valuable and rare resources that enhance competitive advantage when they are embedded in the firm operations (Ardito et al., 2024; Barney, 1991; Piccoli et al., 2024). The results support prior research that observes that digitalisation enhances different aspects of firm performance, including productivity, innovation and growth (Chatterjee & Kar, 2020; Cui & Pan, 2015; Radicic & Petković, 2023; Saleem et al., 2020; Szász et al., 2020). The significance of the direct effect of digitalisation in the presence of the moderating factors institutional quality and digital capabilities suggests that adopting digital inherently offers benefits to SMEs, regardless of the influence these moderators have. This shows that even relatively basic digitalisation leads to positive outcomes.

Regarding digital capabilities, their relationship with SME growth is proven to be more complex and nuanced than initially hypothesised. Prior research suggests that firms with digital capabilities are more likely to extract value from digitalisation (Kohtamäki et al., 2019; Mikalef et al., 2021; Yu et al., 2023). However, the results of this study do not support this. Contrary to the expectations from the dynamic capabilities theory (Teece, 2007), this study did not find that digital capabilities strengthen the positive effect of digitalisation on SME growth. More specifically, their direct effect on SME growth seems to be rather negative than positive when there are no moderators considered. This suggests that solely possessing digital capabilities does not offer growth benefits, regardless of their interaction with digitalisation. Although one specific dummy interaction showed a negative effect, the overall block was not significant and the robustness checks only revealed marginal significance, meaning no conclusions can be drawn from it. These complex findings suggest that the possessing digital capabilities does not guarantee improved growth outcomes by itself.

The descriptive statistics help to put this result in context. A large proportion of SMEs in the sample reported to have digital capabilities, even if many of the SMEs were considered digitally uncertain. This indicates a potential misalignment between perceived skills and actual implementation, as highlighted by Stich et al. (2020). Firms might possess digital skills but fail to embed them effectively into the broader firm objectives and strategy (Ellström et al., 2021). Additionally, research on the microfoundations of dynamic capabilities highlights internal barriers, such as limited human resource

management, that may prevent firms from effectively sensing digital opportunities, seizing technological advantages and reconfiguring internal resources for digital transformation, even when capabilities are present (Kowalski et al., 2024). While the dynamic capabilities theory emphasises that capabilities are necessary to unlock the value of digital resources (Teece, 2007), the findings of this study suggest that digitalisation may still enhance growth even when capabilities are absent. The complex findings reinforce the argument that digital capabilities do not guarantee improved growth outcomes (North et al., 2019).

Another unexpected finding is that the moderating effect of institutional quality was not present in this study, despite the theoretical expectations that institutions influence the ability of SMEs to benefit from digitalisation (Barasa et al., 2017; Brieger et al., 2022). Furthermore, institutional quality also did not have a direct effect on SME growth. However, recent research highlights the crucial role of institutional quality in promoting the adoption and use of digital technologies. This suggests that the impact of institutional quality might be more prominent on the adoption of technology, rather than affecting firm-level growth outcomes once the technologies are adopted (Hwang & Venter, 2025). From this perspective, the non-significant outcome in this study could be explained by the relatively homogeneous context of the institutional environment within the EU sample. With an average institutional quality score of 1.06 (on a -2.5 to +2.5 scale) and a standard deviation of 0.46, the sample indicates a relatively strong institutional context with limited variance. It is likely that a minimum threshold for institutional quality to benefit from digitalisation has already been met across the sample and the impact of it becomes less noticeable. Consequently, if this study were conducted on a sample with a larger standard deviation in institutional quality, such as developing or emerging economies with more heterogeneous institutional contexts, the effect of institutional quality might become significant. In such environments, institutional weaknesses can present substantial barriers and the difference between institutional quality could be large enough to significantly affect how digitalisation affects SME growth. This could be a boundary condition for the role of institutional quality in the analysed contexts.

Overall, this study finds that digitalisation directly drives SME growth but the relationship with the moderators digital capabilities and institutional quality is more complex than initially assumed.

Chapter 6. Conclusion

6.1 Conclusion

The objective of this study was to investigate how digitalisation affects SME growth and to what extent this relationship is moderated by digital capabilities and institutional quality, as formulated in the research question.

The study found that digitalisation positively contributes to SME growth. This positive effect remained robust across all models, indicating that the adoption of digital tools offers monetary benefits to SMEs, regardless of the influence of the moderating factors. Higher levels of digitalisation consistently lead to a greater likelihood of SME growth. The relationship with digital capabilities is more complex and nuanced than hypothesised. While a positive moderating relationship of digital capabilities was expected, this study found no statistically significant moderating effect on the relationship between digitalisation and SME growth. For institutional quality, the study also found no statistically significant moderating effect on the relationship between digitalisation and SME growth.

Overall, this study concludes that digitalisation directly drives SME growth, but neither digital capabilities nor the expected strengthening effect of institutional quality were found to significantly moderate this relationship in the relatively highly developed EU region.

6.2 Theoretical implications

As outlined in Chapter 1, prior research often overlooked SMEs, did not emphasise the role of digital capabilities, or ignored the broader institutional context (Anwar et al., 2024; Drori et al., 2024; Rosyidah et al., 2023). By analysing digitalisation, digital capabilities and institutional quality in one model and focusing specifically on SMEs in the EU, this study contributes to the SME literature by offering perspectives that help clarify under which conditions digitalisation contributes to SME growth.

The robust and consistent finding that digitalisation directly contributes to SME growth supports the theoretical foundation of the RBV. It confirms that digital technologies can serve as valuable, rare and imperfectly imitable resources for the competitive advantage of firms (Barney, 1991, 1995). The fact that the effect of digitalisation even persists when the moderators are present reinforces the RBV's idea that the sole adoption of resources matters, confirming that digital resources offer an inherent value for SME growth. This confirms the relevance of the RBV in the digital era and suggests that in developed environments, adopting digital technologies already provides substantial growth potential.

In addition, the findings provide a nuanced contribution to the dynamic capabilities theory within the SME context. While the theory highlights the importance of sensing, seizing and reconfiguring digital opportunities (Teece, 2007), the findings in this study suggest that simply possessing such capabilities is not sufficient to realise growth. Prior research supports this by noting that internal misalignment and organisational barriers may limit their effectiveness if they are not strategically embedded into the firm (Kowalski et al., 2024).

6.3 Practical implications

Besides theoretical implications, this study also has practical implications. To begin with, managers should not view the adoption of digital tools as an administrative necessity, but as an asset that fosters firm growth and enhances competitiveness. Prioritising higher levels of digital adoption is likely to result in increased turnover. Next, the complex findings regarding digital capabilities underscore that managers should not invest in such skills without strategic alignment. Managers need to ensure that digital capabilities are not only present but also actively leveraged. This means developing a clear digital strategy that links capabilities to growth objectives to avoid potential misaligned investments. Furthermore, while supportive external environments can be beneficial, they do not necessarily determine how digitalisation translates into growth. For managers, this implies that the competitive advantage in the digital age is primarily built from within the firm. Finally, for policymakers, the findings suggest that policies that promote digital adoption are justified as it leads to firm growth. Given the substantial impact of SMEs in driving economic growth and development in society, governments should continue to invest in digital infrastructure and create incentives, such as subsidies, that lower the barriers for SMEs to adopt digital technologies.

6.4 Limitations and suggestions for future research

As with any other empirical research, this study has several limitations that must be acknowledged. Firstly, a limitation from the operationalisation of SME growth arises. While SME status was based on annual turnover below €50 million, other criteria for SME definition such as employees could not be utilised. This was due to significant data limitations, specifically a very high missingness rate for the employee growth item (q5_1). Relying solely on turnover for growth and SME classification might not capture the full dimensions of SME growth and does not fully align with the EU definition (European Commission, n.d.). Consequently, despite the large sample size ($n = 6720$), the generalisability of the findings to all SMEs might be affected.

Secondly, the measurement of digital capabilities relies on a single item in the FL486 survey that considered having no skills, including managerial skills, as a barrier to digitalisation, which was negatively formulated and reverse-coded (q21). While this study interpreted it as the presence of

capabilities, prior research emphasises that digital capabilities are multidimensional, including technical, managerial and strategic skills (Ellström et al., 2021). The simplified measurement used in this study might not fully capture the broader organisational context of digital capabilities and its relationship with digitalisation. Future research should therefore aim to incorporate a more multidimensional and nuanced view of digital capabilities, as suggested by Antonucci et al. (2020). Building on the non-significant, sometimes negative, and unstable effects of digital capabilities in the main models and robustness checks, qualitative research could further explore the complex relationship with digitalisation and SME growth. It could provide a deeper understanding of the microfoundations of how digital capabilities work within SMEs, showing how they sense, seize and reconfigure digital opportunities.

Thirdly, this study relied on cross-sectional data, which restricts the ability to assess how the relationship between digitalisation and SME growth evolves over time. Understanding such processes often requires longitudinal data, which captures changes in variables over a longer period. The use of cross-sectional data limits the ability to determine causal relationships. For instance, it can be that growing firms are simply more likely to adopt digital technologies or that digitalisation leads to growth, referring to the potential issue of reverse causality. Although longitudinal studies do not always offer a complete solution (Audretsch & Belitski, 2024), it is useful to understand the relationships better, as Wamba et al. (2017) suggest.

Finally, future research could expand the geographical scope by including different regions, especially comparing developed countries with developing ones, to assess whether institutional quality plays a role when SMEs operate in more diverse institutional contexts.

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Appendices

Appendix 1. Survey items

Table 1

SME

Survey item	Question	Answer item(s)
Q4a	What was the annual turnover of your enterprise in 2019? If you are not sure, please provide your best estimate.	<ol style="list-style-type: none">1. 100,000 euros or less2. More than 100,000 and up to 500,000 euros3. More than 500,000 and up to 1 million euros4. More than 1 million and up to 2 million euros5. More than 2 million and up to 5 million euros6. More than 5 million and up to 10 million euros7. More than 10 million and up to 50 million euros8. More than 50 million euros

Table 2

Growth

Survey item	Question	Answer item(s)
Q5_2	Since 2016, how much has your enterprise grown, if at all, in terms of: turnover	<ol style="list-style-type: none">1. It has decreased2. It has remained stable3. It has grown by less than 30%

Table 3*Digitalisation*

Survey item	Question	Answer item(s)
Q23	Which of the following digital technologies, if any, has your enterprise adopted to date?	1. Artificial intelligence, e.g. machine learning or technologies identifying objects or persons, etc. 2. Cloud computing, i.e. storing and processing files or data on remote servers hosted on the internet 3. Robotics, i.e. robots used to automate processes for example in construction or design, etc. 4. Smart devices, e.g. smart sensors, smart thermostats, etc. 5. Big data analytics, e.g. data mining and predictive analysis 6. High speed infrastructure 7. Blockchain 8. None of these

Table 4*Digital capabilities*

Survey item	Question	Answer item(s)
Q21	Which of the following, if any, is a barrier to digitalisation in your enterprise?	2. Lack of skills, including managerial skills 8. None of these

Appendix 2. Control variables

The first control variable included is firm age, as derived from question 1 (“In what year was your enterprise first registered? If you are not sure, please provide your best estimate”). In the FL486 dataset, responses are grouped into the following categories: 2019 and after; between 2015 and 2018; between 2000 and 2014; and before 2000. Since the data collection took place in early 2020, the first two categories are combined. This results in the categorical variable *Firm_Age*, consisting of three groups: 2015 and after (youngest firms), 2000-2014, and before 2000 (oldest firms). The last category, representing the oldest firms, serves as the reference category.

The second control variable is firm industry and is constructed from the 15 NACE codes provided in the FL486 dataset (`nace_a`). Based on the classification by the OECD (2018), which measures digital intensity using factors such as ICT investment, digital tasks and the use of digital infrastructure, these codes are recoded into a binary variable. The following industries are classified as having low digital intensity (code 0): mining and quarrying (B); electricity, gas, steam and air conditioning supply (D); water supply, sewerage, waste management/remediation activity (E); construction (F); transportation and storage (H); accommodation and food service activities (I); real estate activities (L); education (P); human health and social work activities (Q); and arts, entertainment and recreation (R). Industries classified as high digital intensity (code 1) include: manufacturing (C); wholesale and retail trade, repair of motor vehicles (G); information and communication (J); financial and insurance activities (K); professional, scientific and technical activities (M); and administrative and support service activities (N). This results in the binary variable `Firm_Industry`, where low digital intensity serves as the reference group.

Internationalisation is the third control variable and is derived from question 11 (“To which international markets, if any, did your enterprise export goods or services in 2019?”). Response options are: none, your enterprise only operates in (country where the survey took place); EU countries; Other European countries outside of the EU (incl. Russia); North America; Latin America and the Caribbean; China; Rest of Asia and the Pacific; and Middle East and Africa. A binary variable is created where firms that did not indicate any foreign market are considered as domestic only (code 0), and firms that selected at least one foreign region are considered as internationally active (code 1). The domestic only category functions as the reference category.

The final control variable is access to finance, measured by question 10 (“Would your enterprise be able to obtain external financing in case of need?”). Firms that responded probably not or definitely not are considered to have no access to finance (code 0), while those that responded definitely yes or probably yes are considered as having access to finance (code 1). This results in the binary variable `Access_To_Finance`, with no access to finance as the reference category.

Appendix 3. Assumptions

Box-Tidwell

	B	S.E.	Wald	df	Sig.	Exp(B)
Institutional quality	.040	.218	.034	1	.855	1.041
IQ_BoxTidwell	.015	.224	.005	1	.946	1.015
Firm age	-.437	.040	117.082	1	<.001	.646
Digitalisation	.322	.040	64.457	1	<.001	1.380
Digital capabilities	-.160	.062	6.717	1	.010	.852
Access to finance	.438	.061	51.251	1	<.001	1.549
Internationalisation	.194	.055	12.361	1	<.001	1.214
Firm industry	-.091	.056	2.609	1	.106	.913
Constant	.675	.232	8.438	1	.004	1.963

a. Variable(s) entered on step 1: Institutional quality, IQ_BoxTidwell, Firm age, Digitalisation, Digital capabilities, Access to finance, Internationalisation, Firm industry.

Multicollinearity

Model	Collinearity Statistics	
	Tolerance	VIF
1		
(Constant)		
Digitalisation	.917	1.091
Digital capabilities	.974	1.027
Institutional quality	.944	1.059
(centered)		
Access to finance	.968	1.033
Internationalisation	.908	1.101
Firm age	.991	1.009
Firm industry	.944	1.060

a. Dependent Variable: SME growth

Outliers

Digitalisation

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	.00	6720	100.0	100.0	100.0

Firm age

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	.00	6720	100.0	100.0	100.0

Institutional quality (centered)

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	.00	6720	100.0	100.0	100.0

Appendix 4. Logistic regression analysis - Model 1

Categorical Variables Codings

			Parameter coding	
		Frequency	(1)	(2)
Firm age	2015 and after	625	1.000	.000
	Between 2000 and 2014	2837	.000	1.000
	Before 2000	3258	.000	.000
Firm industry	Low digital intensity	2089	.000	
	High digital intensity	4631	1.000	
Internationalisation	Domestic only	4167	.000	
	Internationally active	2553	1.000	
Access to finance	No access to finance	1483	.000	
	Access to finance	5237	1.000	

Omnibus Tests of Model Coefficients

		Chi-square	df	Sig.
Step 1	Step	201.584	5	<.001
	Block	201.584	5	<.001
	Model	201.584	5	<.001

Model Summary

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	8872.084 ^a	.030	.040

a. Estimation terminated at iteration number 4 because parameter estimates changed by less than .001.

Hosmer and Lemeshow Test

Step	Chi-square	df	Sig.
1	2.202	7	.948

Classification Table^a

	Observed		Predicted		Percentage Correct
			SME growth		
			No growth	Growth	
Step 1	SME growth	No growth	361	2363	13.3
		Growth	277	3719	93.1
	Overall Percentage				60.7

a. The cut value is .500

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1 ^a	Access to finance(1)	.490	.060	65.546	1	<.001	1.632
	Internationalisation(1)	.270	.054	24.965	1	<.001	1.310
	Firm age			109.959	2	<.001	
	Firm age(1)	.895	.098	83.702	1	<.001	2.448
	Firm age(2)	.383	.053	52.371	1	<.001	1.467
	Firm industry(1)	-.067	.056	1.438	1	.231	.935
	Constant	-.287	.071	16.507	1	<.001	.751

a. Variable(s) entered on step 1: Access to finance, Internationalisation, Firm age, Firm industry.

Appendix 5. Logistic regression analysis - Model 2

Categorical Variables Codings

		Frequency	Parameter coding	
			(1)	(2)
Firm age	2015 and after	625	1.000	.000
	Between 2000 and 2014	2837	.000	1.000
	Before 2000	3258	.000	.000
Digitalisation	Digitally uncertain	3771	.000	.000
	Digitally evolving	2234	1.000	.000
	Digitally advanced	715	.000	1.000
Internationalisation	Domestic only	4167	.000	
	Internationally active	2553	1.000	
Digital capabilities	No digital capabilities	1558	.000	
	Digital capabilities present	5162	1.000	
Firm industry	Low digital intensity	2089	.000	
	High digital intensity	4631	1.000	
Access to finance	No access to finance	1483	.000	
	Access to finance	5237	1.000	

Omnibus Tests of Model Coefficients

		Chi-square	df	Sig.
Step 1	Step	285.250	9	<.001
	Block	285.250	9	<.001
	Model	285.250	9	<.001

Model Summary

Step	-2 Log likelihood	Cox & Snell R	Nagelkerke R
		Square	Square
1	8788.418 ^a	.042	.056

a. Estimation terminated at iteration number 4 because parameter estimates changed by less than .001.

Hosmer and Lemeshow Test

Step	Chi-square	df	Sig.
1	11.947	8	.154

Classification Table^a

	Observed		Predicted		Percentage Correct
			SME growth	Growth	
Step 1	SME growth	No growth	743	1981	27.3
		Growth	583	3413	85.4
Overall Percentage					61.8

a. The cut value is .500

Variables in the Equation

		B	S.E.	Wald	df	Sig.	Exp(B)	
Step 1 ^a	Access to finance(1)	.437	.061	50.947	1	<.001	1.548	
	Internationalisation(1)	.195	.055	12.496	1	<.001	1.215	
	Firm age			117.037	2	<.001		
	Firm age(1)	.914	.099	86.148	1	<.001	2.495	
	Firm age(2)	.412	.054	59.271	1	<.001	1.510	
	Firm industry(1)	-.090	.056	2.552	1	.110	.914	
	Digitalisation			66.005	2	<.001		
	Digitalisation(1)	.365	.057	40.937	1	<.001	1.440	
	Digitalisation(2)	.594	.092	42.068	1	<.001	1.812	
	Digital capabilities(1)	-.157	.062	6.533	1	.011	.854	
	Institutional quality (centered)	.049	.056	.762	1	.383	1.050	
	Constant		-.273	.087	9.851	1	.002	.761

a. Variable(s) entered on step 1: Access to finance, Internationalisation, Firm age, Firm industry, Digitalisation, Digital capabilities, Institutional quality (centered).

Appendix 6. Logistic regression analysis - Model 3

Categorical Variables Codings

		Frequency	Parameter coding	
			(1)	(2)
Firm age	2015 and after	625	1.000	.000
	Between 2000 and 2014	2837	.000	1.000
	Before 2000	3258	.000	.000
Digitalisation	Digitally uncertain	3771	.000	.000
	Digitally evolving	2234	1.000	.000
	Digitally advanced	715	.000	1.000
Internationalisation	Domestic only	4167	.000	
	Internationally active	2553	1.000	
Digital capabilities	No digital capabilities	1558	.000	
	Digital capabilities present	5162	1.000	
Firm industry	Low digital intensity	2089	.000	
	High digital intensity	4631	1.000	
Access to finance	No access to finance	1483	.000	
	Access to finance	5237	1.000	

Omnibus Tests of Model Coefficients

		Chi-square	df	Sig.
Step 1	Step	291.361	13	<.001
	Block	291.361	13	<.001
	Model	291.361	13	<.001

Model Summary

Step	-2 Log likelihood	Cox & Snell R	Nagelkerke R
		Square	Square
1	8782.307 ^a	.042	.057

a. Estimation terminated at iteration number 4 because parameter estimates changed by less than .001.

Hosmer and Lemeshow Test

Step	Chi-square	df	Sig.
1	8.560	8	.381

Classification Table^a

	Observed	Predicted		Percentage Correct	
		No growth	Growth		
Step 1	SME growth	No growth	707	2017	26.0
		Growth	549	3447	86.3
Overall Percentage					61.8

a. The cut value is .500

Variables in the Equation

	B	S.E.	Wald	df	Sig.	Exp(B)
Step 1 ^a						
Access to finance(1)	.436	.061	50.658	1	<.001	1.546
Internationalisation(1)	.194	.055	12.394	1	<.001	1.214
Firm age			116.347	2	<.001	
Firm age(1)	.912	.099	85.744	1	<.001	2.490
Firm age(2)	.411	.054	58.830	1	<.001	1.508
Firm industry(1)	-.085	.057	2.248	1	.134	.919
Digitalisation			30.772	2	<.001	
Digitalisation(1)	.587	.118	24.898	1	<.001	1.799
Digitalisation(2)	.660	.180	13.517	1	<.001	1.936
Digital capabilities(1)	-.045	.084	.282	1	.595	.956
Institutional quality (centered)	.106	.071	2.221	1	.136	1.112
Digital capabilities * Digitalisation			4.491	2	.106	
Digital capabilities(1) by Digitalisation(1)	-.283	.134	4.482	1	.034	.754
Digital capabilities(1) by Digitalisation(2)	-.094	.205	.211	1	.646	.910
Digitalisation * Institutional quality (centered)			2.165	2	.339	
Digitalisation(1) by Institutional quality (centered)	-.182	.125	2.099	1	.147	.834
Digitalisation(2) by Institutional quality (centered)	-.006	.207	.001	1	.975	.994
Constant	-.361	.099	13.374	1	<.001	.697

a. Variable(s) entered on step 1: Access to finance, Internationalisation, Firm age, Firm industry, Digitalisation, Digital capabilities, Institutional quality (centered), Digital capabilities * Digitalisation , Digitalisation * Institutional quality (centered) .

Appendix 7. Robustness check - Sample size

The countries excluded were Italy ($n = 49$), Cyprus ($n = 62$) and Malta ($n = 36$). After exclusion, the sample size was reduced from 6720 to 6573 SMEs. The results of the logistic regression models remain consistent with the main analysis. The model fit remains acceptable and remains the same as the original model (Hosmer-Lemeshow $p = .948$). Nagelkerke R^2 values are also nearly identical across all models, except for Model 1, where there is a minor increase from .040 to .041. The control variables, except for firm industry ($p = .218$), are all significant again and show the same patterns as in the original model.

Model 2 continues to confirm the robustness of the model after excluding the low represented countries. Digitalisation remains a significant positive predictor, showing the same pattern as in the original model. Compared to digitally uncertain firms, digitally evolving firms have 1.143 times higher odds, meaning they are 43.1% more likely to experience growth ($B = .359$; $p < .001$; $\text{Exp}(B) = 1.431$), all else being equal. For digitally advanced firms, the odds are 1.774 times higher ($B = .573$; $p < .001$; $\text{Exp}(B) = 1.774$). The presence of digital capabilities continues to show a significant negative direct impact on SME growth compared to the absence of these capabilities ($B = -.161$; $p = .010$; $\text{Exp}(B) = .852$). Institutional quality remains non-significant ($B = .042$; $p = .463$; $\text{Exp}(B) = 1.043$).

In Model 3, both interaction terms are again non-significant at the 5% level (digitalisation*digital capabilities: $p = .085$; digitalisation*institutional quality: $p = .326$). However, digitalisation*digital capabilities now show a marginally significant effect at the 10% level for the overall block ($p = .085$), instead of being non-significant in the original model. Crucially, the specific dummy interaction term digitalisation(1)*digital capabilities(1) remains statistically significant, consistent with the original model. This indicates that the interaction is not consistently present across all levels of digitalisation. This effect is therefore present in both the original and the robustness samples ($B = -.297$; $p = .028$; $\text{Exp}(B) = .743$). It appears to be sensitive to sample composition, as the significance of the overall block became marginally significant. However, the main effect of digital capabilities becomes non-significant again after adding the interaction terms ($p = .596$), which is the same as in the original model. Institutional quality also remains non-significant in Model 3 ($p = .189$). Overall, these results generally confirm that the original findings are not driven by countries with small sample sizes, demonstrating the robustness of most of the conclusions. However, the nuanced finding about the interaction effect of digitalisation*digital capabilities suggests that the effect is less stable across different samples, although such effects should be interpreted with caution.

Number of SMEs per country

		Frequency	Valid Percent	Cumulative Percent
Valid	France	354	5.4	5.4
	Belgium	288	4.4	9.8
	The Netherlands	316	4.8	14.6
	Germany	330	5.0	19.6
	Luxembourg	102	1.6	21.1
	Denmark	371	5.6	26.8
	Ireland	214	3.3	30.0
	Greece	252	3.8	33.9
	Spain	343	5.2	39.1
	Portugal	240	3.7	42.8
	Finland	433	6.6	49.3
	Sweden	406	6.2	55.5
	Austria	328	5.0	60.5
	Czech Republic	323	4.9	65.4
	Estonia	131	2.0	67.4
	Hungary	123	1.9	69.3
	Latvia	246	3.7	73.0
	Lithuania	220	3.3	76.4
	Poland	349	5.3	81.7
	Slovakia	236	3.6	85.3
	Slovenia	275	4.2	89.5
	Bulgaria	122	1.9	91.3
	Romania	317	4.8	96.1
	Croatia	254	3.9	100.0
	Total	6573	100.0	

Model 1

Omnibus Tests of Model Coefficients (Model 1)

		Chi-square	df	Sig.
Step 1	Step	200.900	5	<.001
	Block	200.900	5	<.001
	Model	200.900	5	<.001

Model Summary (Model 1)

Step	-2 Log likelihood	Cox & Snell R	Nagelkerke R
		Square	Square
1	8663.889 ^a	.030	.041

a. Estimation terminated at iteration number 4 because parameter estimates changed by less than .001.

Hosmer and Lemeshow Test (Model 1)

Step	Chi-square	df	Sig.
1	2.203	7	.948

Classification Table^a (Model 1)

	Observed		Predicted		Percentage Correct
			SME growth	Growth	
Step 1	SME growth	No growth	350	2301	13.2
		Growth	268	3654	93.2
Overall Percentage					60.9

a. The cut value is .500

Variables in the Equation (Model 1)

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1 ^a	Access to finance(1)	.493	.061	65.038	1	<.001	1.637
	Internationalisation(1)	.266	.055	23.716	1	<.001	1.305
	Firm age			111.232	2	<.001	
	Firm age(1)	.918	.099	85.335	1	<.001	2.504
	Firm age(2)	.387	.054	52.338	1	<.001	1.473
	Firm industry(1)	-.070	.057	1.518	1	.218	.933
	Constant	-.283	.071	15.805	1	<.001	.753

a. Variable(s) entered on step 1: Access to finance, Internationalisation, Firm age, Firm industry.

Model 2

Omnibus Tests of Model Coefficients (Model 2)

		Chi-square	df	Sig.
Step 1	Step	278.560	9	<.001
	Block	278.560	9	<.001
	Model	278.560	9	<.001

Model Summary (Model 2)

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	8586.229 ^a	.041	.056

a. Estimation terminated at iteration number 4 because parameter estimates changed by less than .001.

Hosmer and Lemeshow Test (Model 2)

Step	Chi-square	df	Sig.
1	6.744	8	.565

Classification Table^a (Model 2)

Observed		Predicted		Percentage Correct	
		SME growth	No growth		
Step 1	SME growth	No growth	687	1964	25.9
		Growth	Growth	540	3382
Overall Percentage					61.9

a. The cut value is .500

Variables in the Equation (Model 2)

	B	S.E.	Wald	df	Sig.	Exp(B)
Step 1 ^a Access to finance(1)	.442	.062	51.136	1	<.001	1.556
Internationalisation(1)	.193	.056	12.022	1	<.001	1.213
Firm age			118.720	2	<.001	
Firm age(1)	.939	.100	88.285	1	<.001	2.558
Firm age(2)	.417	.054	59.260	1	<.001	1.517
Firm industry(1)	-.094	.057	2.713	1	.100	.910
Digitalisation			61.253	2	<.001	
Digitalisation(1)	.359	.058	38.692	1	<.001	1.431
Digitalisation(2)	.573	.092	38.470	1	<.001	1.774
Digital capabilities(1)	-.161	.062	6.621	1	.010	.852
Institutional quality (centered)	.042	.057	.539	1	.463	1.043
Constant	-.267	.088	9.198	1	.002	.766

a. Variable(s) entered on step 1: Access to finance, Internationalisation, Firm age, Firm industry, Digitalisation, Digital capabilities, Institutional quality (centered).

Model 3

Omnibus Tests of Model Coefficients (Model 3)

	Chi-square	df	Sig.
Step 1 Step	285.144	13	<.001
Block	285.144	13	<.001
Model	285.144	13	<.001

Model Summary (Model 3)

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	8579.644 ^a	.042	.057

a. Estimation terminated at iteration number 4 because parameter estimates changed by less than .001.

Hosmer and Lemeshow Test (Model 3)

Step	Chi-square	df	Sig.
1	10.929	8	.206

Classification Table^a (Model 3)

Observed		Predicted		
		SME growth		Percentage
		No growth	Growth	Correct
Step 1	SME growth	672	1979	25.3
	Growth	526	3396	86.6
Overall Percentage				61.9

a. The cut value is .500

Variables in the Equation (Model 3)

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1 ^a	Access to finance(1)	.442	.062	50.835	1	<.001	1.555
	Internationalisation(1)	.192	.056	11.879	1	<.001	1.212
	Firm age			118.243	2	<.001	
	Firm age(1)	.938	.100	88.062	1	<.001	2.556
	Firm age(2)	.416	.054	58.895	1	<.001	1.516
	Firm industry(1)	-.088	.057	2.392	1	.122	.915
	Digitalisation			29.193	2	<.001	
	Digitalisation(1)	.594	.119	24.770	1	<.001	1.811
	Digitalisation(2)	.612	.181	11.363	1	<.001	1.844
	Digital capabilities(1)	-.045	.086	.281	1	.596	.956
	Institutional quality (centered)	.094	.072	1.722	1	.189	1.099
	Digital capabilities * Digitalisation			4.919	2	.085	
	Digital capabilities(1) by Digitalisation(1)	-.297	.135	4.839	1	.028	.743
	Digital capabilities(1) by Digitalisation(2)	-.063	.207	.092	1	.762	.939
	Digitalisation * Institutional quality (centered)			2.242	2	.326	
	Digitalisation(1) by Institutional quality (centered)	-.179	.126	2.011	1	.156	.836
	Digitalisation(2) by Institutional quality (centered)	.041	.208	.038	1	.844	1.042
	Constant	-.358	.100	12.801	1	<.001	.699

a. Variable(s) entered on step 1: Access to finance, Internationalisation, Firm age, Firm industry, Digitalisation, Digital capabilities, Institutional quality (centered), Digital capabilities * Digitalisation , Digitalisation * Institutional quality (centered) .

Appendix 8. Robustness check – Excluding a variable

Excluding the control variable firm industry had no effect on model performance for Model 1. The explained variance remains 4.0% (Nagelkerke $R^2 = .040$), classification accuracy remained 60.7% and the model fit remained good (Hosmer-Lemeshow $p = .921$). The other three control variables, access to finance, internationalisation and firm age, are again all statistically significant predictors of SME growth.

In Model 2, all outcomes were nearly identical to the original model. The explained variance remains the same at 5.6% (Nagelkerke $R^2 = .056$) as well as the classification rate (61.8%). The model continues to show an acceptable fit (Hosmer-Lemeshow $p = .108$). The main effects remain stable: digital capabilities remains a negative and significant predictor ($B = -.156$; $p = .011$; $\text{Exp}(B) = .856$), while institutional quality remains a non-significant effect ($B = .054$; $p = .333$; $\text{Exp}(B) = 1.056$)

When the interaction terms are added in Model 3, overall model fit and explanatory power remain stable again, as well as the main effects. However, a small change in the interaction effect is observed. While the overall effect of digital capabilities*digitalisation was non-significant in the original model ($p = .106$), it now becomes marginally significant at the 10% level after removing firm industry ($p = .097$). However, as this effect is still only marginally significant, the overall block of interaction terms remains non-significant, so this result should be interpreted with caution.

Model 1

Omnibus Tests of Model Coefficients (Model 1)

		Chi-square	df	Sig.
Step 1	Step	200.144	4	<.001
	Block	200.144	4	<.001
	Model	200.144	4	<.001

Model Summary (Model 1)

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	8873.524 ^a	.029	.040

a. Estimation terminated at iteration number 4 because parameter estimates changed by less than .001.

Hosmer and Lemeshow Test (Model 1)

Step	Chi-square	df	Sig.
1	1.986	6	.921

Classification Table^a (Model 1)

	Observed		Predicted		Percentage Correct
			No growth	Growth	
Step 1	SME growth	No growth	361	2363	13.3
		Growth	277	3719	93.1
Overall Percentage					60.7

a. The cut value is .500

Variables in the Equation (Model 1)

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1 ^a	Access to finance(1)	.489	.060	65.342	1	<.001	1.630
	Internationalisation(1)	.256	.053	23.547	1	<.001	1.291
	Firm age			110.767	2	<.001	
	Firm age(1)	.898	.098	84.369	1	<.001	2.456
	Firm age(2)	.384	.053	52.671	1	<.001	1.468
	Constant	-.328	.062	28.135	1	<.001	.720

a. Variable(s) entered on step 1: Access to finance, Internationalisation, Firm age.

Model 2

Omnibus Tests of Model Coefficients (Model 2)

		Chi-square	df	Sig.
Step 1	Step	282.692	8	<.001
	Block	282.692	8	<.001
	Model	282.692	8	<.001

Model Summary (Model 2)

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	8790.975 ^a	.041	.056

a. Estimation terminated at iteration number 4 because parameter estimates changed by less than .001.

Hosmer and Lemeshow Test (Model 2)

Step	Chi-square	df	Sig.
1	13.109	8	.108

Classification Table^a (Model 2)

Observed		Predicted		Percentage Correct
		No growth	Growth	
Step 1	SME growth	831	1893	30.5
	No growth	672	3324	83.2
Overall Percentage				61.8

a. The cut value is .500

Variables in the Equation (Model 2)

		B	S.E.	Wald	df	Sig.	Exp(B)
Step 1 ^a	Access to finance(1)	.435	.061	50.696	1	<.001	1.546
	Internationalisation(1)	.177	.054	10.755	1	.001	1.194
	Firm age			118.167	2	<.001	
	Firm age(1)	.918	.098	87.036	1	<.001	2.505
	Firm age(2)	.414	.054	59.745	1	<.001	1.512
	Digitalisation			64.755	2	<.001	
	Digitalisation(1)	.362	.057	40.321	1	<.001	1.436
	Digitalisation(2)	.586	.091	41.014	1	<.001	1.797
	Digital capabilities(1)	-.156	.062	6.409	1	.011	.856
	Institutional quality (centered)	.054	.056	.937	1	.333	1.056
	Constant	-.328	.080	16.832	1	<.001	.720

a. Variable(s) entered on step 1: Access to finance, Internationalisation, Firm age, Digitalisation, Digital capabilities, Institutional quality (centered).

Model 3

Omnibus Tests of Model Coefficients (Model 3)

		Chi-square	df	Sig.
Step 1	Step	289.108	12	<.001
	Block	289.108	12	<.001
	Model	289.108	12	<.001

Model Summary (Model 3)

Step	-2 Log likelihood	Cox & Snell R Square	Nagelkerke R Square
1	8784.560 ^a	.042	.057

a. Estimation terminated at iteration number 4 because parameter estimates changed by less than .001.

Hosmer and Lemeshow Test (Model 3)

Step	Chi-square	df	Sig.
1	7.118	8	.524

Classification Table^a (Model 3)

Observed		Predicted		
		SME growth		Percentage Correct
Step 1	SME growth	No growth	Growth	26.3
		No growth	716	
		Growth	568	85.8
Overall Percentage				61.7

a. The cut value is .500

Variables in the Equation (Model 3)

	B	S.E.	Wald	df	Sig.	Exp(B)
Step 1 ^a						
Access to finance(1)	.435	.061	50.399	1	<.001	1.544
Internationalisation(1)	.177	.054	10.790	1	.001	1.194
Firm age			117.362	2	<.001	
Firm age(1)	.916	.098	86.551	1	<.001	2.499
Firm age(2)	.412	.054	59.247	1	<.001	1.510
Digitalisation			30.733	2	<.001	
Digitalisation(1)	.588	.118	25.008	1	<.001	1.801
Digitalisation(2)	.655	.180	13.328	1	<.001	1.926
Digital capabilities(1)	-.041	.084	.238	1	.626	.960
Institutional quality (centered)	.114	.071	2.578	1	.108	1.121
Digital capabilities * Digitalisation			4.658	2	.097	
Digital capabilities(1) by Digitalisation(1)	-.288	.133	4.650	1	.031	.750
Digital capabilities(1) by Digitalisation(2)	-.097	.205	.227	1	.634	.907
Digitalisation * Institutional quality (centered)			2.334	2	.311	
Digitalisation(1) by Institutional quality (centered)	-.189	.125	2.283	1	.131	.827
Digitalisation(2) by Institutional quality (centered)	-.015	.207	.005	1	.944	.986
Constant	-.415	.092	20.168	1	<.001	.661

a. Variable(s) entered on step 1: Access to finance, Internationalisation, Firm age, Digitalisation, Digital capabilities, Institutional quality (centered), Digital capabilities * Digitalisation , Digitalisation * Institutional quality (centered) .