

## UNLEASHING THE DIGITAL BARRIER: OBSTACLES AND CHALLENGES OF DIGITAL TRANSFORMATION AMIDST TECHNOLOGICAL ROADBLOCKS

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### Abstract

*The widespread adoption of digital technologies in enterprises remains limited, prompting concerns over the sluggish pace of technological integration. Numerous articles emphasize the urgency of accelerating digital transformation and embracing new technologies. This paper focuses on identifying and examining obstacles hindering the effective utilization of digital tools and technologies in business settings. It conducts a comprehensive assessment of two primary aspects - external and internal factors - through a combination of secondary research and a comparative analysis of primary research findings. The research draws on data from diverse sources, including the ESTAT data repository, surveys on Information and Communication Technology (ICT) usage and e-commerce in enterprises, and the European Commissions report on Small and Medium-sized Enterprises (SMEs), start-ups, scale-ups, and entrepreneurship. By shedding light on these obstacles, this paper aims to provide valuable insights that can facilitate the successful implementation of digital technologies in enterprises.*

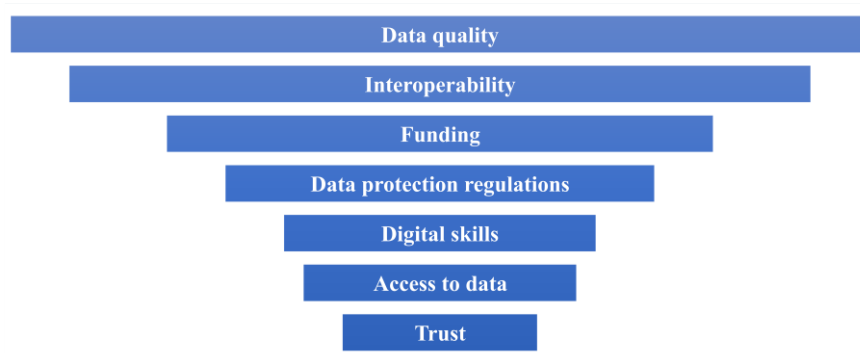
**Keywords:** digital technology, digital transformation, digital skills, ICT usage, technology adoption

### 1. Introduction

Digitalisation has had a profound impact on various facets of the business landscape, leading to significant changes, alterations, and even revolutions. The rapid advancement of technology has necessitated swift adaptation by individuals and corporations alike. As a result, the digital transformation of enterprises has not only improved internal business processes but also elevated the overall standard of living in society. However, despite the widespread influence of digitalisation, a substantial digital gap persists, whether at the level of nations, regions, or specific industries on a global scale. To address this disparity and enhance digital intensity, the need arises for the development and implementation of novel approaches and models. Such models typically encompass a combination of financial incentives and other motivating factors, alongside comprehensive education and training initiatives. Numerous research studies have underscored the indispensable role of digitalisation in driving business innovation and fostering competitiveness (Dodgson et al., 2006; Ferreira et al., 2020; Ollo-López and Aramendía-Muneta, 2012). These studies present compelling data showcasing how the integration of digital technologies can bolster business competitiveness, elevate the quality of products and services, stimulate creativity, and enhance an enterprise's resilience to economic downturns (Dougherty and Dunne, 2012; Ghobakhloo, 2020).

## 2. Factors influencing digitalisation

The first part of the study reviews what factors have an impact on digitalisation, how it is discussed in the literature, and then analyses the ones that stand in the way of digital development. The European Commission's (EC) document titled *Shaping the digital transformation in Europe* identifies basic information and communication technologies (ICTs) as the cornerstone to advanced digitalisation. According to the document, there are two clusters of technologies: 1) enabling technologies and infrastructure, 2) high impact applied technologies. The first cluster includes machine learning, artificial intelligence (AI), big data analytics, quantum and high performance computing, the Internet of Things, next generation internet and 5G/6G infrastructure, cloud computing, digital platforms and distributed ledger technology. The second cluster includes the use of advanced industrial robotics, industrial IoT, virtual and augmented reality, digitally enabled biotechnologies, 3D printing and additive manufacturing (EB, 2020). Four types of digital technologies that can be determined by SMEs are identified according to the Deloitte study (*SME Digitalisation*): connection, process digitalisation and automation, cloud, online presence and collaboration, and communication (Deloitte, 2020). In examining the factors influencing the use of digitalisation technologies, a document issued by OECD identifies three areas as framework conditions: 1) market conditions 2) regulatory environment 3) infrastructure. The enterprises are driven by skills, finance and innovation, while digital technologies are transforming supply chains and business models through digitally driven transformation (OECD, 2021). Another OECD report titled *The Digitalisation of Science, Technology and Innovation* examined the effects of digitalisation on science, technology and innovation and the associated consequences for policy. This report assessed the effects of digitalisation on longstanding policy themes, from access to publicly funded research data, to the diffusion of technology and its absorption by firms. The report contained a questionnaire and asked what major challenges the initiatives of digital science and innovation policy were facing. In their responses to the OECD questionnaire, administrators identified data quality (56%), interoperability (49%), sustainable funding (36%) and data protection regulations (26%) as the biggest challenges facing their initiatives (Figure 1). Other challenges cited less often were access to data, the availability of digital skills and trust in digital technologies.



**Figure 1.** Main challenges facing digital science and innovation policy initiatives  
Own editing based on OECD, 2020 p. 171

The European Commission's *Digitalisation of SMEs* report identifies internal and external factors that influence digital transformation. The variables described in the EC report are based on results from relevant literature (Muller et al., 2021) and a synthesis of various papers. The factors that have been

described in the EC report are based on findings from relevant literature (Muller et al., 2021) and a summary of multiple papers. In addition, after evaluating some more pieces of literature (Csiszár, 2022; Rudskoi et al., 2022; Drezgić et al., 2019), the following external and internal components were determined:

#### Internal factors

- Managerial skills
- Access to talent
- Connecting digital strategy to a business model
- Pre-existing business dependencies
- Variation in behavioural characteristics

#### External factors

- Access to communication networks and services
- Access to finance
- High digital technology adoption
- Access to data

This study adopts this classification and due to the difficulty of measuring all of the internal factors, focuses mostly on the examination of external elements.

### 3. Internal Factors

Experts proved that strong managerial skills correlate with higher digital adoption; poor managerial skills stifle productivity gains. High performance work practices also facilitate digital transformation by increasing the company's adaptability to technological change (Sorbe et al., 2019; Horváth et al., 2023). The EC has recently reported that more than 70% of the firms indicated access to talent as a key obstacle to new investments (Morandini et al., 2020). We can conclude that the capacity to advance the competencies of existing employees and swiftly recruit new talent are essential to an effective digital transition. SMEs often have higher skill deficiencies compared to large companies. SMEs also tend to invest less in training for upskilling. According to the 2019 European Commission SME report, the key digital skills deficits are as follows: 41% of SMEs lack software development skills, 35% lack complex data analysis and mathematics skills, one-third cannot access digital strategy skills, find it difficult to acquire digital project management skills; close to 30% lack either website development or data/database management skills, a quarter lack basic data input and processing skills. This shortage of digital skills is also highlighted in various academic papers (Abel-Koch et al., 2019).

The European Investment Bank created the EIBIS Corporate Digitalisation Index, that explores the degree of digital adoption in the European Union and the United States from various perspectives. This composite index summarises indicators on digitalisation as well as firms' assessments of digital infrastructure and investments. The Index consists of six components: use of advanced digital technologies, digital uptake during COVID-19, digital infrastructure, investment in software and data, investment in training of employees, and the use of a strategic monitoring system. It is based on firm-level data collected by EIBIS in 2023. The Index rounds out the European Commission's Digitalisation Economy and Society Index (DESI) index by adding the unique perception of firms. Its infrastructure component captures whether firms consider digital infrastructure as an obstacle to their investment activities. The Index groups the surveyed countries into firms' assessment of digitalisation: frontrunners, strong, medium, moderate and modest.

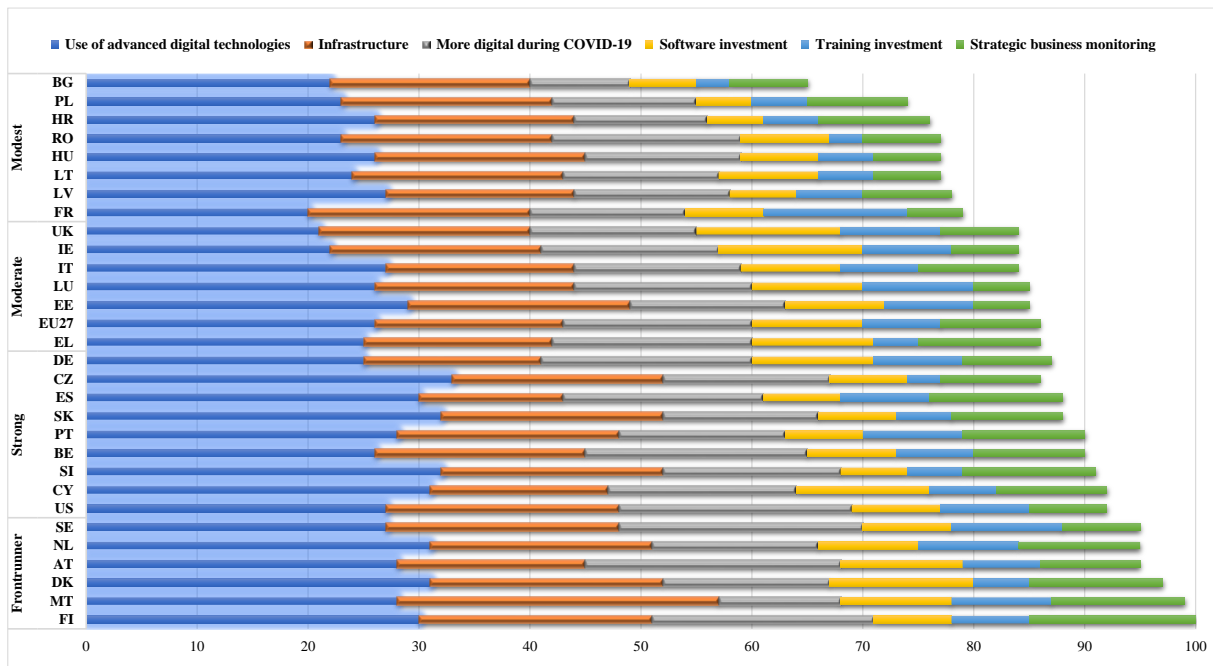


Figure 2. EIBIS Corporate Digitalisation Index, 2022  
Own editing based on EIBIS, 2023

Based on the index (Figure 2) Finland, Malta and Denmark are the top three digital countries, followed by Austria and Netherland. The top-performing EU countries, in selected areas of digitalisation, are Czechia for the use of advanced digital technologies, Austria for more digital during the COVID-19 pandemic, Malta for digital infrastructure, Denmark for investment in software and data, France for investment in employee training, and Finland for the use of formal strategic business monitoring.

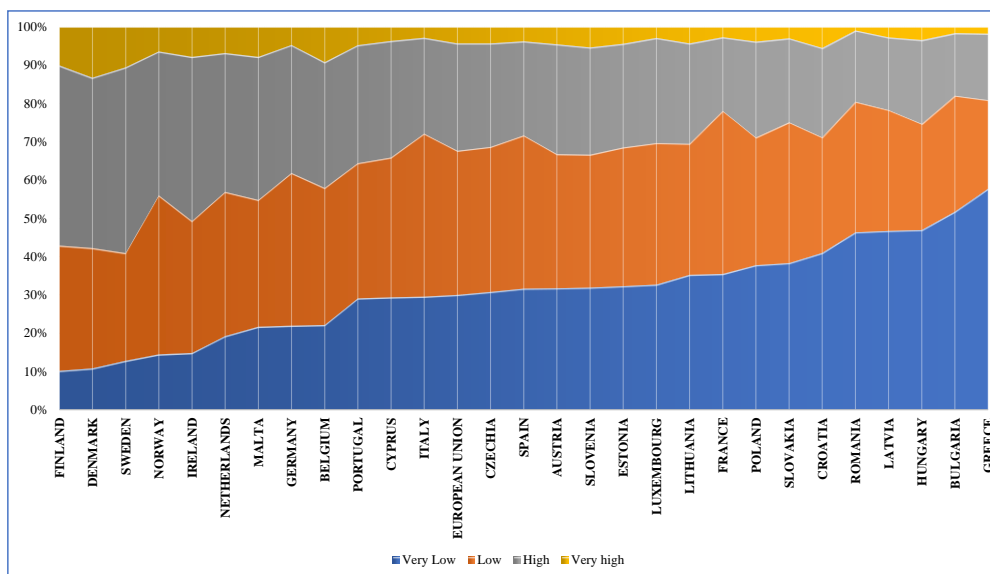
The ability to connect a digital strategy with a business model is also key to digitalisation. However, SMEs often fail to fully realise the consequences of digitalisation for their organisational structures, operations and strategies. The factor of pre-existing business dependencies can also influence digitalisation. Dependency on a technology or security protocol for data storages or on the compatibility of an existing infrastructure can impose constraints on the use of digital technologies. The other factor is the variation in behavioural characteristics which can impact the likelihood of digital transformation. At individual level, fear of losing control, fear of data loss, fear of transparency/acceptance, and fear of job loss impairs the adoption of digital technologies. At group level, adherence to traditional roles or principles, risk aversion and fear of failure are likely to discourage the transition. All these contribute to a company’s innovation culture (Vogelsang et al., 2019).

#### 4. External Factors

According to the OECD document, good access to communication networks and services is a prerequisite for digital transformation. Availability and affordability of (high-speed) network connection, devices, software and applications increase the likelihood and benefits of digital transformation. However, the access to them shows significant differences whether they are at the level

of countries, enterprises, governments or individuals. Additionally, there is a growing digital divide between SMEs and large firms. Smaller firms remain less connected (OECD, 2019).

Numerous methodologies and indicators have been developed in recent years to measure digitalisation. Beside EIBIS, the other one is the Digital Intensity Index (DII), a new indicator developed by the European Commission in 2018 to track digitalisation, which primarily monitors the use of digital technologies (Figure 3). The DII is a 12-indicator composite index that ranges from 0 to 12. Based on the findings of an EU survey on ICT usage and e-commerce in enterprises, the levels of DII are categorized into four categories: very low (0-3), low (4-6), high (7-9), and very high (10-12). The baseline digital intensity, as measured by the target, is the use of at least four computing devices and applications. The 12 different digital technologies represent enterprise-wide availability. These include fast broadband internet of at least 30 Mbps, access to the Internet for at least 50% of the employees, mobile internet devices for 20% of the employees, use of ICT specialists, having an ERP (Enterprise Resource Planning) or CRM (Customer Relationship Management) system, having a website, use of any social media platform, purchase of advanced cloud services, having e-invoicing, realizing at least 1% of total sales through e-commerce, and finally, pursuing more than 10% of online sales as B2C (business to consumer).



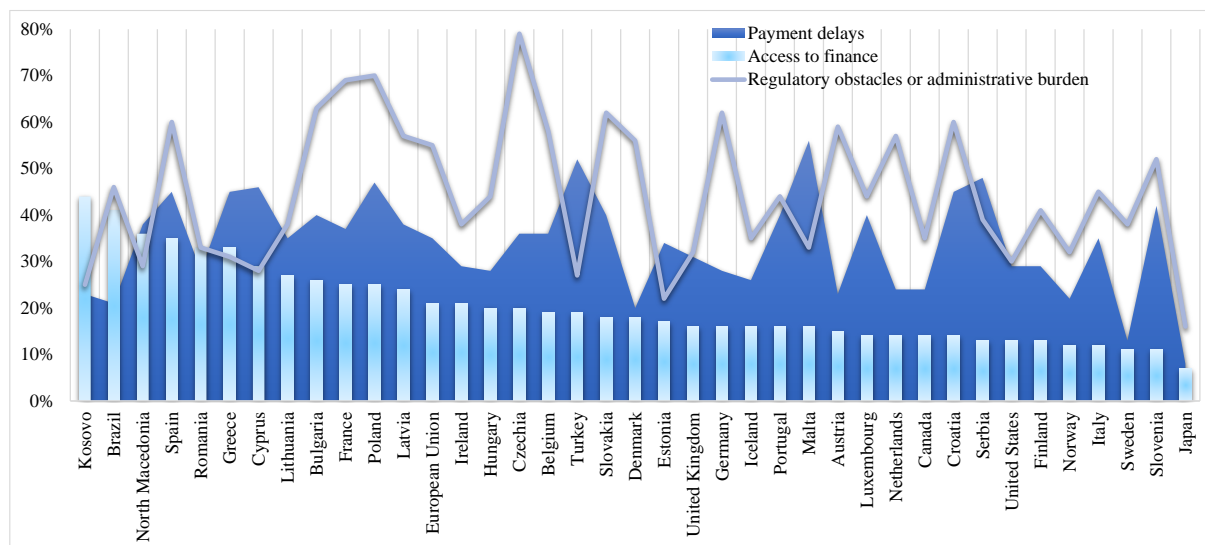
**Figure 3. Digital Intensity Index 2022**

*Own editing based on ESTAT, 2021*

According to the DII, there are only four countries in the EU (Denmark, Sweden, Finland, Belgium) where the proportion of companies with very high DII exceeds 9%. In contrast, enterprises with very low DII are in Latvia, Hungary, Bulgaria and Greece where more than 45 % of businesses have invested only slightly in digital technologies in recent years.

Examining the access to finance is vital to digital transformation. It is often the case that businesses, especially SMEs, do not have the financial reserves needed for digital transformation. Access to appropriate external forms of finance correlates with higher digital adoption rates (OECD, 2019). Looking at the results of the EC's 2020 survey, all SMEs were asked to identify from a list of eight items, the three key areas which pose the biggest problems for their business operations. These factors

were as follows: difficulties with innovation, regulatory obstacles or administrative burden, internationalisation, access to data, access to finance, payment delays, skills, including managerial skills, difficulties with digitalisation and other. The respondents showed that all of the most mentioned factors had been connected to finance and regulations. Regulatory barriers or administrative burden were highlighted by more than half of the businesses (55%) as it is shown in Figure 4. One-third of the respondents listed payment delays as one of their top issues, while 21% mentioned access to financing.



**Figure 4.** Perception of finance and regulations problems for enterprise  
Own editing based on FB486, 2020

Figure 4 shows the results of microenterprises according to access to finance in descending order. There are four countries where at least one third of the enterprises mentioned access to finance: Spain, Romania, Greece and Cyprus. Payment delays are the most mentioned problems among microenterprises. This issue is also widely mentioned by businesses in Croatia, Poland, Spain, Greece, Slovenia. The lowest rates were in Sweden, Denmark and Austria. Regulatory obstacles or administrative burden is the most mentioned problem in 22 countries. Microenterprises in Czechia, France and Poland are the most likely to mention regulatory obstacles or administrative burden.

High take-up of digital technologies is associated with the existence of a dynamic market setting. By more successfully commercializing breakthrough technology, highly inventive enterprises join the market and take market share, whereas inefficient ones are driven out of it. This encourages established businesses to stay as near as possible to the technology frontier (Calvino et al., 2018). In the report of SMEs, start-ups, scale-ups and entrepreneurship in 2020, the enterprises were asked to name which of the listed seven advanced digital technologies, if any, they had adopted to date. The following digital technologies could be chosen: Artificial intelligence (machine learning or technologies identifying objects or persons), Cloud computing (storing and processing files or data on remote servers hosted on the Internet), Robotics (robots used to automate processes, for example in construction or design), Smart devices (smart sensors, smart thermostats), Big data analytics (data mining and predictive analysis), High-speed infrastructure and Blockchain.

According to the report, more than six in ten SMEs (62%) adopted at least one of the listed advanced digital technologies. Cloud computing, that is storing and processing files or data on remote serves



hosted on the Internet, were 43%. Almost one-third of the enterprises used high-speed infrastructure, while one fifth of them installed smart devices. One in ten used big data analytics, while 6% used artificial intelligence. Blockchain and robots are hardly used by 5% of SMEs, respectively (3%). A third of all SMEs (37%) claimed they had not yet adopted any of these advanced digital technologies. Large companies were much more likely than SMEs to have adopted at least one of the listed digital technologies (85% vs 62%), and they were also more likely to have adopted each type of technology asked about. The differences are large in the categories of high-speed infrastructure (57% vs 32%), smart devices (43% vs 21%), big data analytics (31% vs 10%), robotics (22% vs 5%) and artificial intelligence (16% vs 6%), but the gap was considerably smaller in the case of using blockchain (7% vs 3%) (FB, 486).

Figure 5 shows the aggregate result of the countries from top to bottom. The countries got points based on the percentage of their enterprises marked any of the listed technologies and their score were aggregated in the end. It can be observed that there is a considerable variation among the countries. Luxembourg, the Netherlands, Norway, and Iceland adopted the most advanced technologies at the highest rate while Italy, Lithuania or Romania produced the lowest rates in implementing the most advanced technologies. We can see that there is considerable variation across countries.

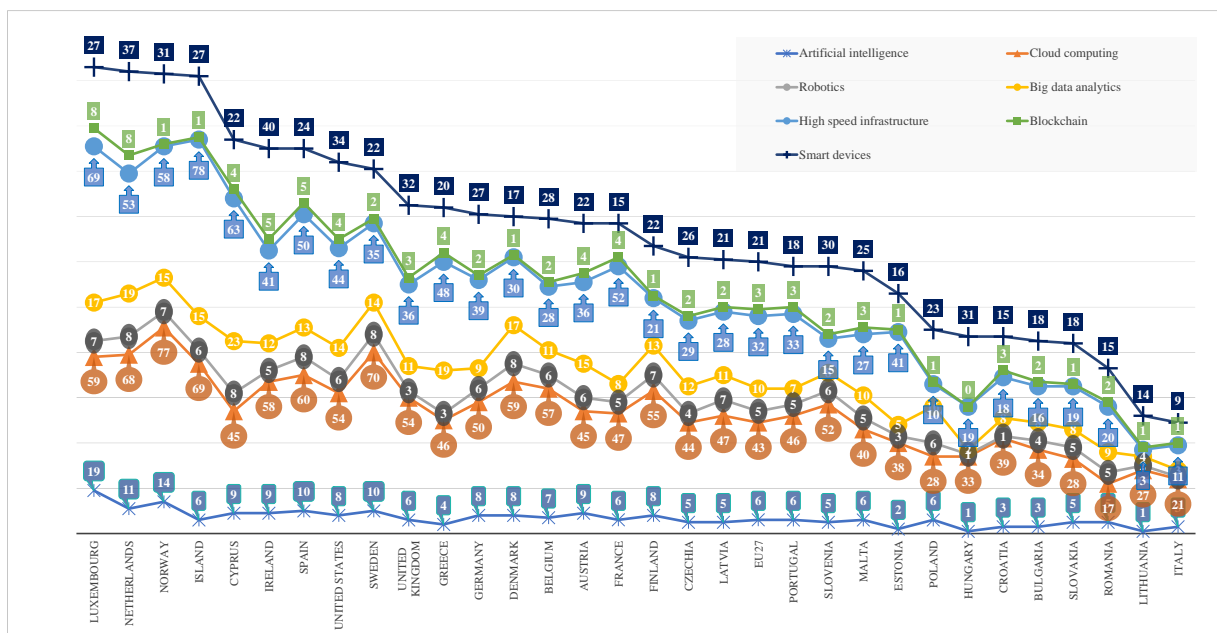


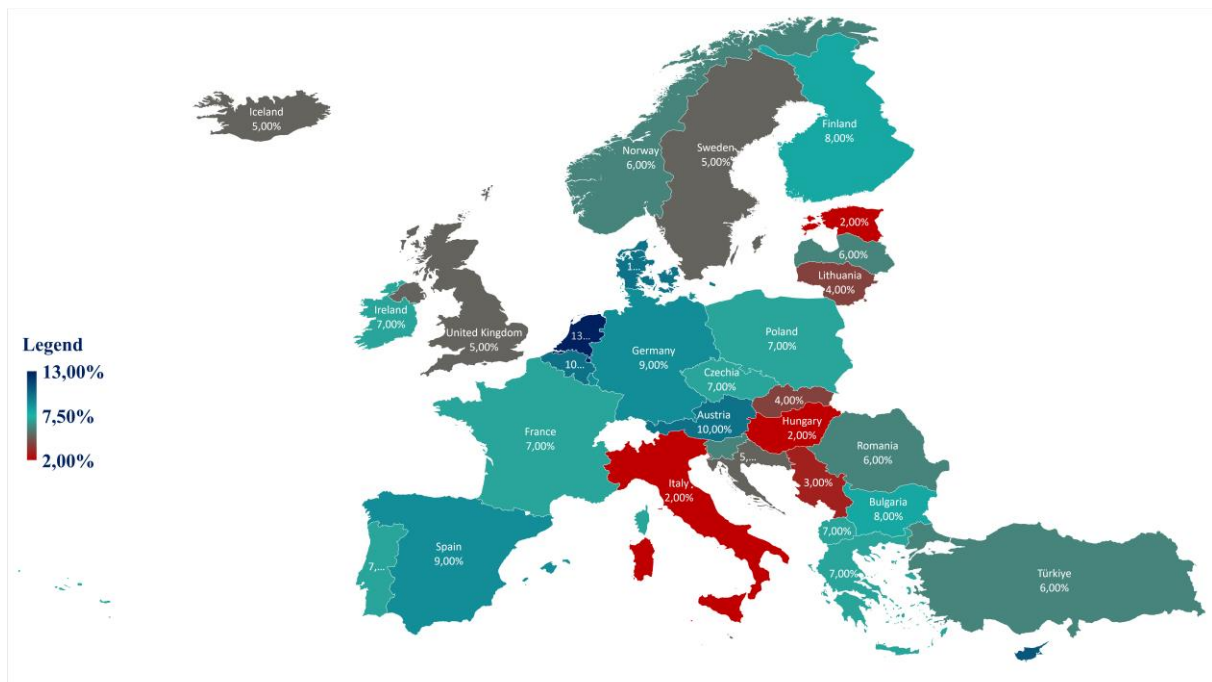
Figure 5. Adopted digital technologies in enterprises  
Own editing based on FB486, 2020

The overall analysis shows that Luxembourg, the Netherlands, Norway and Island are consistently amongst the most likely countries to have adopted each specific type of technology, while Italy, Lithuania and Romania are amongst the least likely to have done so. Six countries have at least one in ten SMEs using artificial intelligence (AI), including Luxembourg (19%), Norway (14%), the Netherlands (11%), Sweden, Spain, and Turkey (all at 10%). Comparatively, 1% of SMEs in Hungary and Lithuania have adopted it. The percentage of SMEs using cloud computing varies by country, from 70% (Sweden, the Netherlands) to 17% in Romania. There are only seven countries where at least half

of all SMEs surveyed have adopted high-speed infrastructure: Iceland, Luxembourg, Cyprus, Norway, the Netherlands, France, and Spain (50%). The lowest rates, varying between 3 and 10% are in Lithuania, in Poland and in Italy.

SMEs that have used smart devices range in percentage from 53 % in Turkey, Ireland, the Netherlands, the United States, the United Kingdom, Norway, and Hungary (31 %) to 9 percent in Italy and Lithuania, according to the survey. The percentage of SMEs that have used big data analytics is highest in Cyprus (23 %), the Netherlands (19 %), and Greece (19 %), compared to Hungary (2 %), Italy (3 %), and Lithuania (4 %). Fewer than one in ten SMEs worldwide have implemented robotics, with the Netherlands, Sweden, Spain, Cyprus, and Denmark having the greatest percentages. The Netherlands and Luxembourg each have 8% of SMEs that used blockchain, while in Hungary, none or very few of the SMEs surveyed did so. There is no huge difference between the percentage of SMEs in the US and the EU that have adopted big data analytics (14 % vs 10 %) and high speed infrastructure (44 % vs 32 %).

Access to data is another key determinant in the ability of companies to leverage. SMEs have disadvantaged positioning due to their limited access to the large volumes of data needed to train machine-learning algorithms. They are also more vulnerable in terms of protecting their data and have difficulty in effectively managing data risks in compliance with regulations (OECD, 2021). There are five countries where at least one in ten SMEs say access to data is one of the main problems: the Netherlands (13%), Cyprus (11%), Denmark, Belgium and Austria (all 10%) (Figure 6).



**Figure 6.** Access to data  
Own editing based on FB486, 2020

Figure 7 shows the aggregate result of countries from bottom to top. The countries got points based on the percentage of their enterprises marked any of the listed technologies and their score were aggregated in the end. Uncertainty regarding future digital standards is cited by almost one-fourth of



respondents as a hurdle, while 23% cite a lack of funding or regulatory restrictions (also 23 %). One in five SMEs report that IT security concerns and a lack of skills are obstacles to digitalisation, while 19 percentage point to the lack of IT infrastructure and 17 % cite internal reluctance to change. No one of these is an obstacle to digitalisation in their company, according to about one third of respondents.

If we examine the highest ratio in countries, we can see that the lack of financial resources as a barrier to digitalisation is most often mentioned by SMEs. The ratio is highest in Spain, Latvia and France and least mentioned by those in Slovenia, Austria and the Netherlands. SMEs in Spain, France and Ireland are the most likely to see regulatory obstacles as a barrier to digitalisation. At least one third of SMEs in Ireland, France, and Luxembourg and Spain say a lack of skills is an obstacle. SMEs in Ireland, and France, Spain and Luxembourg are the most likely to mention internal resistance to change as a barrier to digitalisation, particularly compared to those in Estonia (2%), Hungary (4%), and Lithuania and Greece (both 5%).

The report shows that the older the company, the more likely they are to mention internal resistance to change as a barrier to digitalisation. More than six in ten SMEs say they are facing at least one of the listed barriers to digitalisation in their enterprise. Start-ups are more likely to mention the lack of financial resources and both start-ups and scale-ups cite regulatory obstacles more frequently than other SMEs as one of the barriers to digitalisation. Large companies are much more likely to say there is at least one barrier to digitalisation in their enterprise, compared to SMEs (77% vs 62%). In particular, large companies are much more likely to mention internal resistance to change (35% vs 17%), and they are also more likely to mention a lack of skills (27% vs 20%), and uncertainty about future digital standards (30% vs 24%). There is little difference for the other barriers mentioned.

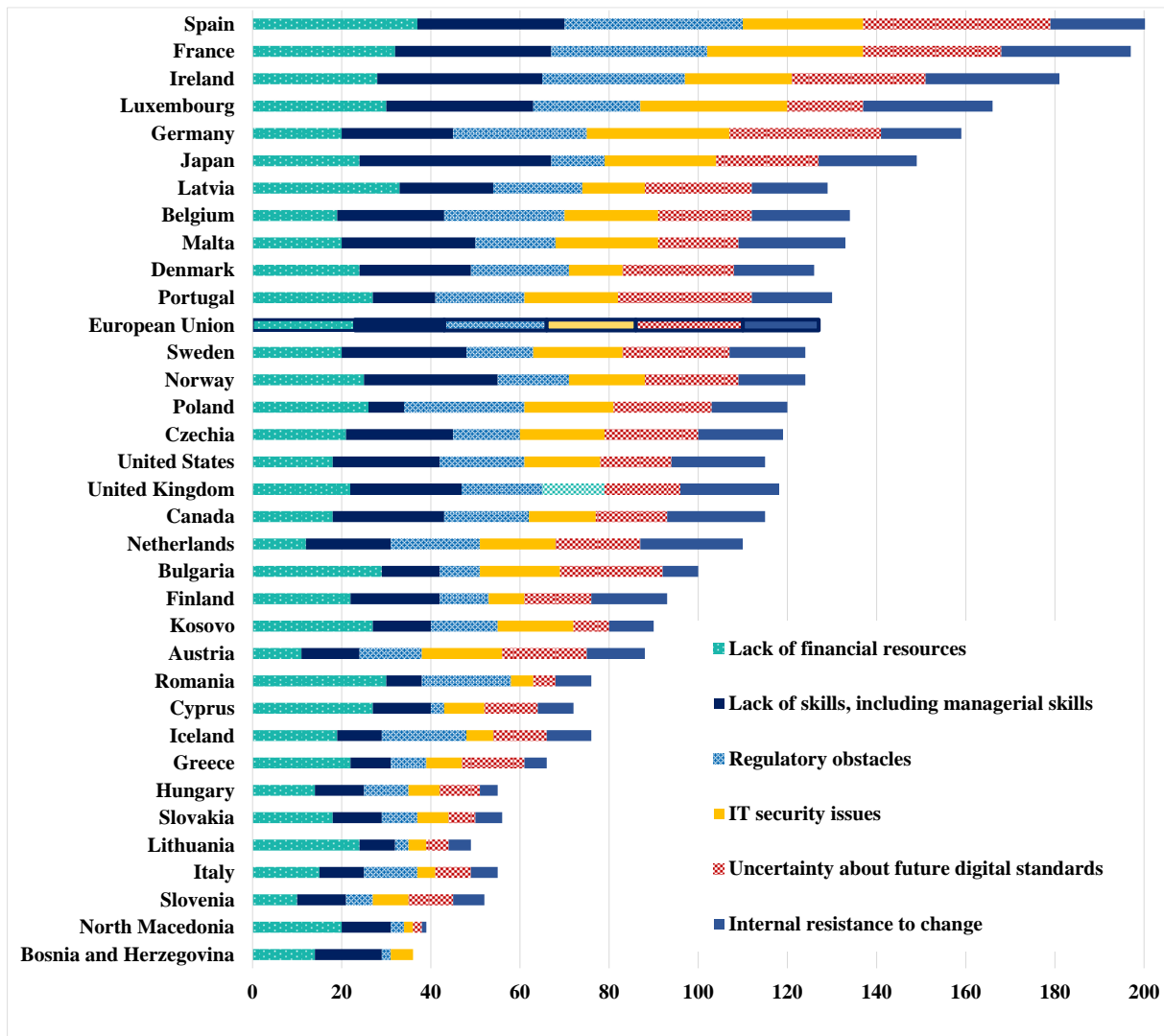


Figure 7. Obstacles in digitalisation in enterprises  
Own editing based on FB486, 2020

## 5. Conclusion

The study examined the barriers to digital development, both internal and external. In the case of internal factors, it was revealed that managerial skills influenced development, and the skills and abilities of employees were decisive. Based on the literature reviewed, it can be concluded that developing the competencies of existing employees and recruiting new talent are essential for an effective digital transformation. The analysis confirmed that the main obstacles to increasing the level of digitalisation are currently the lack of awareness of the potential of digital technologies, as well as the lack of skills and technical expertise of employees integrating essential or advanced digital technologies into business processes. It can also be noted that there is a growing digital divide between SMEs and large companies.

Small and medium-sized enterprises often face greater skills shortages than large companies and tend to invest less in skills training. However, SMEs often do not fully recognise the impact of digitalisation on their organisational structure, operations and strategy. According to reports, although the use of various digital tools has been increased among EU businesses and the vast majority of them are progressing with digitalisation, they are held back by uncertainty about future digital standards, IT security issues and IT infrastructure shortages.

Based on OECD reports, good access to communication networks and services is also a prerequisite for digital transformation. High-speed network connectivity, availability and affordability of devices, software and applications increase the likelihood and benefits of digital transformation. Access to finance is vital for digital transformation, with analyses showing that access to appropriate forms of external finance correlates with higher digital transition rates. According to the study's analysis, most of the most frequently cited barriers to the adoption of digital technologies at company level relate to finance and regulation. The main regulatory obstacles include administrative burden, payment delays and access to financial resources. There are significant differences in the use of digital technologies. As a final conclusion, it can be stated that today the introduction of digital technologies is hindered by many factors that companies will have to focus on and incorporate into their strategies in the future if they want to keep up with the development of digitalization.

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