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School of Economics
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QUALIFYING MASTER'S THESIS

on the topic

INTERNATIONAL BUSINESS OF IT COMPANIES IN DIGITAL ECONOMICS

Performed by: 2nd year student, group AE-61
Specialty 051 Economics
Educational program Applied Economics
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TASK FOR

MASTER'S QUALIFICATION WORK

________________________________Yang Yixuan ____________________________

(student`s name)

1. The topic of the paper _International business of it companies in digital economics ________

Supervisor ___Bilyovsky Maxim , PhD in economics, Assistant Professor

(supervisor`s name, science degree and academic status)

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2. Submission period of student`s paper _ April, 2025___________________

3. The list of questions, that are need to be carried out

1. reveal the essence and structure of the digital economy, to determine the role of IT companies in its formation.
2. investigate the features of the development and implementation of international business models in the field of information technologies.
3. analyze the state of development of the market infrastructure of the IT sector and e-commerce in Europe and the world.
4. identify current trends and prospects of international business of IT companies.

5. To propose strategic guidelines for strengthening the competitiveness of IT companies in the global market.

4. Plan of paper

№	Names of stages of work
1	Agreeing the contest of research
2	Preparing the first section of paper
3	Improving the first section of paper according to recommendation of supervisor. Preparing second section of paper
4	Improving the second section of paper according to recommendation of supervisor. Preparing third section of paper
5	Improving the third section of paper according to recommendation of supervisor.
6	Preparing the introduction, conclusions of paper. Improving formatting of the list of references
7	Submission of qualification work to the department management and administration

5. Date of issue of the assignment March, 2025

Student ___________ ____Yang Yixuan __
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Supervisor of the paper ____________ __ _ Bilyovsky Maxim _______
Signature name

CONTENT

INTRODUCTION

In the current conditions of digital transformation of the world economy, IT companies play a key role in shaping a new model of economic development. The digital economy is becoming the basis for the functioning of both national and global markets, and the IT sector is a strategic industry that determines the competitiveness of countries and enterprises.

Due to the rapid development of information technologies, international business is undergoing radical changes: forms of trade, models of communication with customers, business processes, sales channels and logistics are changing. IT companies are actively developing international markets, expanding the scope of their presence through e-commerce, cloud services, online platforms and software products.

The significance of studying the international business of IT companies in the digital economy is due to the need for a deeper understanding of the mechanisms of interaction of the global IT market, the challenges of digitalization and the prospects for international expansion. The relevance of the topic is enhanced by the dynamics of the development of digital platforms, new financial and technological instruments, and geoeconomic changes that affect international cooperation.

The purpose of this work is to analyze the state of development of the IT sector, assess the role of IT companies in the digital economy, and identify current trends and prospects for international business in the field of information technologies.

The object of the study is the Processes of functioning and development of international business of IT companies in the digital economy.

The subject of the study is the Organizational, economic and institutional mechanisms of international activity of IT companies, trends and tools of digital transformation of global IT business.

Research objectives:

- To reveal the essence and structure of the digital economy, to determine the role of IT companies in its formation.

- To investigate the features of the development and implementation of international business models in the field of information technologies.

- To analyze the state of development of the market infrastructure of the IT sector and e-commerce in Europe and the world.

- To identify current trends and prospects of international business of IT companies.

- To propose strategic guidelines for strengthening the competitiveness of IT companies in the global market.

The following **research methods** were used in the work: Analysis and generalization of scientific literature for the theoretical substantiation of the conceptual apparatus of the digital economy; Comparative analysis to study the development of the IT sector in different countries; the system approach method was used to study the relationships between digital tools and business strategies; market trends and indicators were visualized using graphical and statistical methods.

The practical significance of the master's thesis lies in the possibility of applying the obtained theoretical conclusions and analytical results to increase the efficiency of international activities of IT companies in the context of digital transformation of the economy. In particular, the recommendations substantiated in the work can be used to develop business internationalization strategies, form digital platforms for the export of IT services, as well as to assess the risks and opportunities of the global digital environment.

SECTION 1. THEORETICAL FOUNDATIONS OF INTERNATIONAL BUSINESS IN DIGITAL ECONOMICS

1.1. DIGITAL ECONOMICS: ECONOMY: GENESIS AND STAGES OF DEVELOPMENT

In the industrial economy era, the supply chain is the core organizational form. The position of an enterprise in the supply chain determines its business model and competitive advantage. Enterprises are highly dependent on specialized division of labor and cooperation with upstream and downstream enterprises. In the digital economy era, new ICT technologies have enabled the expansion of organizational boundaries, providing more opportunities for enterprises to explore and integrate across industries. New platform and ecosystem organizational forms continue to emerge, which have a significant impact on production and consumption. On the C-end (consumer end), multilateral platforms connect different users and generate network effects. On the B-end (enterprise end), industry platforms and ecosystems promote complementary innovation and promote industrial development in traditional industries (Cusumano, 2020; Cusumano et al., 2019). This breaks the relatively rigid position of enterprises in the traditional supply chain, and more users and enterprises are connected through new platform and ecosystem organizations, realizing flexible matching of supply and demand and the aggregation of skills. In the digital economy, the network effect of the platform, the diversity of the platform ecosystem, and the depth and breadth of its capabilities are becoming important factors in the competitiveness of enterprises.

In the industrial economy, companies usually pursue a unified business model based on selling a specific type of product or service. The business model of an enterprise depends largely on the established industry structure and its position in the value chain, and is therefore relatively rigid. In the digital economy, a large number of digital products and services have challenged the traditional, one-size-fits-all business model, as it may not meet the requirements of rapidly changing scenarios (Rong et al., 2013). Enterprises need to take advantage of different scenarios, develop cross-industry, viable services, and build an ecosystem business model. The ecosystem business model integrates several business models of the value community into an ecosystem, taking into account diversity, dynamism, and co-evolution.

Finally, the development of the global industrial economy is led and dominated by industrialized countries. Enterprises in industrialized countries have first-mover advantages and occupy high value-added positions in the global value chain, while low value-added positions are occupied by enterprises in developing countries. The rise of the digital economy has provided new opportunities for developing countries to catch up. Developing countries such as China and India have invested heavily in the development of digital technology and digital markets, and a number of influential digital companies have emerged, such as Alibaba, Tencent, ByteDance in China, and Paytm and Ola in India. Therefore, developing countries should not only seize opportunities and develop their own capabilities, but also cooperate with countries around the world to jointly build a new global digital economy.

Table 1.1 compares the industrial economy with the digital economy and the huge changes brought about by the latter. This requires a new framework to better understand and explore them.

Table 1.1

From an industrial economy to a digital economy

	Industrial economy	Digital economy
New factors:	L(labor)K(capital)	D (data) as the key factor
Factors of production New organization: Industrial organization	Supply chain and value chain: specialization and collaboration with upstream and downstream enterprises	Two-sided platforms and industry platforms: connectivity and capabilities of platform ecosystem
New model: Business model	Single business model: sell specific products/services	Ecosystem business model: integrate multiple business models and coevolve
New context: Global environment	Developed countries lead developing countries to organize global value chain	Digital economy provides new opportunities for developing countries to catch up

Source: constructed by the author

Researchers today proposed a comprehensive framework to better understand the digital economy, the so-called IBCDE framework (Figure 1,1).

I (Infrastructure) refers to the digital infrastructure that serves as the foundation of the digital industry. B (Merchants) and C (Consumers) refer to the platforms that digitize production and consumption activities. D (Data) focuses on the data market and data ecosystem driven by the digital economy. Finally, the development of the digital economy has brought about comprehensive economic changes, which prompts us to consider the economic context (E).

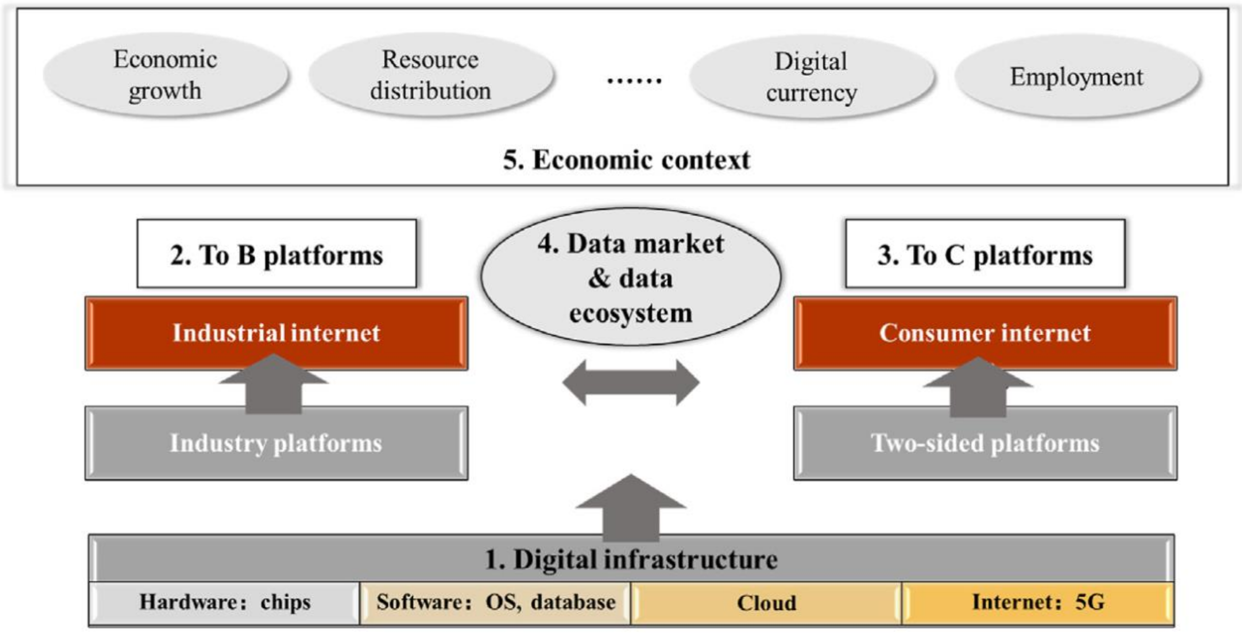


Figure 1.1 – An integrated IBCDE framework for digital economy

Source: constructed by the author

In order to better understand the digital economy, this study proposes a comprehensive framework, the so-called IBCDE framework (Figure 1.1). I (Infrastructure) refers to the digital infrastructure that serves as the foundation of the digital industry. B (Merchants) and C (Consumers) refer to platforms that digitize production and consumption activities. D (Data) focuses on the data market and data ecosystem driven by the digital economy. Finally, the development of the digital economy has brought about comprehensive economic changes, which prompts us to consider the electronic environment (economy).

Digital infrastructure. At present, the digital economy with ICT as the core element of infrastructure is increasingly becoming an important force to further stimulate economic growth (Sturgeon, 2021). Many industries are undergoing digital transformation. Every industrial revolution in history has been accompanied by changes in infrastructure. Traditional commercial infrastructure cannot support the operating model and scale of digital business. As a new type of infrastructure system, digital infrastructure is based on information networks and supports the digital development of the economy and society. It fully integrates the new generation of information technology, takes data as the core production factor, and focuses on the perception, transmission, storage, calculation, processing and security of data.

The new generation of digital infrastructure mainly includes four aspects: (1) hardware (such as chips, servers, etc.), (2) software (such as operating systems, databases, etc.), (3) cloud (such as cloud computing or cloud services, etc.), and (4) new networks (including 5G and the Internet of Things, which cover broadband real-time transmission and distribution of data, data storage, computing and processing, and data mining, respectively). For example, the Internet of Things can equip billions of everyday objects with advanced sensors and wireless networks, promote the digital transformation of traditional offline products and services, and create more digital business opportunities (Krotov, 2017; Sestino et al., 2020). IoT devices and related services (e.g., mobile phones, social networks, machines) continuously generate data by connecting and monitoring objects and people. Big data can be defined as consumers generating unstructured behavioral data (Erevelles et al., 2016), which can support decision-making processes and improve business performance (Raguseo, 2018). Therefore, data exchange through ICT-based telecommunications networks is crucial to the development of the digital economy (Kim, 2006). The digitization of any product or activity means converting it into a binary language consisting of zeros and ones. Simply put, everything on the Internet is presented in the form of numbers (i.e. data). Therefore, big data analysis requires big data infrastructure. ICT supports the synchronous integration of market supply and demand information through relevant platforms. By reducing information redundancy, market transaction costs can also be reduced and operational efficiency can be improved. For example, Ivanov et al. (2022) proposed cloud supply chain, which refers to the interconnection of some physical and digital assets through the cloud, aiming to manage online supply chain networks.

According to the theory of comparative advantage and first-mover advantage, the digital economy based on digital platforms, intelligence and related business ecosystems can open up new opportunities for technological progress and economic development. Countries or companies with more developed digital infrastructure have greater competitive advantages in developing digital technologies, realizing digital industry modernization, and building digital ecosystems. Digital infrastructure has become a new driving force for the digital transformation of traditional industries, helping traditional industries to continue to improve.

Digital infrastructure is closely linked to the development of digital technology, and strong digital infrastructure supports the application of digital technology in economic activities. On the production side, companies with strong digital technology strength often build industry platforms to incubate and manage supply chains based on digital technology. Compared with traditional bilateral platforms that coordinate platform access for buyers and sellers and increase platform user benefits through carefully designed matching mechanisms, industry platforms mainly share capabilities such as technical standards, organizational frameworks, and common technologies to improve the production efficiency of enterprises and generate strong network effects. These companies supported by industry platforms are usually highly complementary to each other, so they are called complementors (Jacobidies et al., 2018). The trend of building industry platforms has attracted considerable research interest (Cusumano, 2020; Gawer and Cusumano, 2014; Xing et al., 2016). In these studies, technology platforms (e.g., Iansiti, 2021) and innovation platforms (Cusumano et al., 2019) are also used to describe industry platforms.

When we examine the characteristics of industry platforms, we find that there are some differences between two-sided platforms and the above-mentioned industry platforms.

1. First, two-sided platforms connect users on the consumer side, and industry platforms connect enterprises on the production side.

2. Second, in two-sided or multi-sided platforms, different user groups interact across platforms, and the buyer-seller relationship is usually single-tier. However, industry platforms can connect companies at multiple levels in the supply chain, forming a multi-tier market structure. In some cases, companies can build two-sided platforms and industry platforms at the same time. The combination of the two platform types can form a hybrid platform (Cusumano et al., 2019).

Android is a typical example of a hybrid platform. The two-sided market includes different types of applications and Android users. The large number of applications released by the Android App Store formed a strong cross-platform network effect, helping Android surpass Nokia's Symbian system in the smartphone era. In addition to the two-sided market, various supply chains have also been formed based on the Android system. The application supply chain is an example. This includes the development of development tools (Dev), the development of applications, and the release of applications. Companies such as Google, Huawei, and Tencent are developing practical development tools for developers, while companies such as Saffron Tech, Facebook, and Tencent employ a large number of application developers. Finally, companies such as Google Play, Galaxy Play, and WeApp release these applications. Before users can download these applications, Android is open to upstream developers, creating a comfortable development environment for them. The success of the Android system is not only based on the two-sided market with a strong network effect, but more importantly, the supply chain supported by Android technology. With the rapid development of the digital economy, more and more industrial platforms are being integrated into production, including the ARM architecture that supports chip development and the 5G standard that supports 5G applications. Therefore, more attention should be paid to the industrial platform that builds a solid digital infrastructure for the entire digital economy.

As more and more industrial platforms connect with complementary partners in various industries, the Industrial Internet has also entered a rapid development stage. Complementary companies using digital technologies with the same technical standards can now more easily connect with each other. Complementors can come from all parts of the supply chain. The introduction of digital technology has undoubtedly promoted the digitalization of the entire supply chain. These digital technologies in the Industrial Internet are generally divided into three categories: (1) digital technologies for infrastructure as a service (IAAS), (2) digital technologies for platform as a service (PAAS), and (3) digital technologies for software as a service (SAAS). Industry platforms are generally located at the IAAS level and play a role at the PAAS level, while complementors generally operate at the SAAS level with the support of industry platforms. Therefore, the final product of the entire platform ecosystem is inseparable from the collaboration of digital infrastructure, industry platforms and complementors. At the same time, this close cooperation enables the entire platform ecosystem to respond quickly to the needs of end users, thereby achieving mass customization. Due to the generally high industry knowledge threshold of complementors, it is unlikely that industry platforms will achieve a comprehensive victory in the Industrial Internet market.

Therefore, the new characteristics of industrial platforms and the Industrial Internet require more research to understand the economics and business models behind them. In fact, there are already some studies on industrial platforms and the Industrial Internet (e.g., Economides and Katsamakas, 2006). Economides and Katsamakas (2006) studied the network effects between end users and enterprises based on technology platforms and created two scenarios to determine the differences between technology platforms with different degrees of openness. They found that the optimal pricing strategies for proprietary platforms such as Windows and open source platforms such as Linux were different. In addition, Parker et al. (2017) found that the network effects in production activities are different from traditional buyer-supplier network effects and introduced a new mathematical model to study how these new network effects work. Ehret and Wirtz (2017) found that existing business models may not be ideal because the Industrial Internet of Things (IIoT) provides new opportunities and risks, and discussed new IIoT business models. These studies provide us with very constructive opportunities to deepen our research on industrial platforms and the Industrial Internet.

Although many researchers have recognized the importance of industrial platforms and the Industrial Internet, there is still much to be explored in the future. If two-sided platforms regulate the interests of all parties through complex pricing structures, what will the pricing strategy of industry platforms be like? In many cases, the competition landscape of two-sided platforms is "winner takes all". In a more complex industrial Internet, what will the market equilibrium of industrial platforms be like? Since industrial platforms need to develop shared technologies to promote supply chains and balance the advantages of supply chain complementarity, what will the business model of industrial platforms be like? Is the business model of industrial Internet companies still feasible? And in such a complex platform ecosystem, how can industry platforms achieve complementary governance? Will the internationalization of industrial platforms and the emergence of the industrial Internet lead to some interesting phenomena? These research questions have not yet been answered and are in urgent need of further research.

Two-sided platforms and the consumer Internet. On the consumer side, two-sided platforms generally act as intermediaries, connecting different participants and facilitating transactions and exchanges. Two-sided platforms use digital technology to create value on the consumer side, thereby shaping the development of the consumer Internet. Platform users create interactive network effects (Rochet and Tirole, 2003) and generate economic value through transactions or exchanges. Famous examples of two-sided platforms include Amazon, Facebook, Uber, and YouTube.

The development of platformization has brought many new insights into corporate business strategies and mechanisms (Rong Jianjun et al., 2013). Platforms usually adopt pricing strategies that are very different from traditional companies. Due to the importance of cross-network effects, users at different sites are affected by network effects to different degrees; platforms adopt asymmetric pricing structures and even subsidize a site as an incentive mechanism (Armstrong, 2006; Hagiu, 2009;

Rochet and Tirole, 2003). Platforms consider many factors when determining pricing structures, including user preferences for product categories, platform differentiation, and market structure (Armstrong and Wright, 2007; Caillaud and Jullien, 2003; Hagiu, 2009). Since two-sided platforms act as intermediaries between different participants, non-price mechanisms such as control, openness, coordination, and the design of regulatory mechanisms are very important for governance (Parker et al., 2017; Song et al., 2018; Tiwana et al., 2010). Platforms control platform participants through non-price mechanisms, which are mainly divided into two categories of rules: the first category of rules regulates platform access, and the second category of rules regulates platform interaction (Hagiu, 2014).

The development of new digital technologies such as artificial intelligence, big data, and cloud computing is constantly changing the way platforms formulate strategies and improve operational efficiency. The global popularity of TikTok is a good example. Based on a successful recommendation algorithm, TikTok displays content to each user in a highly personalized way, fundamentally changing the way information is transmitted. Therefore, two-sided platforms need to adjust their mechanisms and strategies to adapt to the ever-changing technological and social changes.

Due to their high dynamics and fierce competition, two-sided platforms have also developed unique cross-platform interaction strategies. This leads to different market behaviors from traditional enterprises, including competition and cooperation. Network effects have been shown to play an important role in cross-platform competition. With strong network effects, new market entrants can break the quality advantage of existing suppliers (Zhu and Iansiti, 2012). Technological differentiation is also an important factor in platform cooperation. When the technological difference is large, the existing platform will welcome the entry of new platforms (Saha and Mantena, 2012). At the same time, platforms can also develop cooperative relationships. One example is the competition between Amazon Kindle and Apple iPad in the hardware and e-book markets. Amazon and Apple are clearly developing a friendly relationship (Adner et al., 2020). Due to the low threshold for digital infrastructure construction and strong user integration capabilities, platforms have formed a unique growth mechanism through multi-platform bundling, i.e., integrating multiple platforms into the established platform base (Eisenmann et al., 2006). Established platforms can use their common components or resources (e.g., hardware base, overlapping users, platform rules) to integrate new platforms. Large platforms are better able to achieve multi-platform bundling due to their strong network effects and extensive resources.

This has raised concerns about the consequences of platform expansion and platform monopoly (Bryan and Hovenkamp, 2020; Foerderer et al., 2018; Katz, 2019; Li and Agarwal, 2017). Large technology companies such as Facebook have faced ongoing disputes and even lawsuits for their acquisitions of Instagram and WhatsApp. Due to network effects, traditional definitions and standards of monopoly may no longer apply to platforms (Katz, 2019). In addition, platforms can develop strong market power through cross-platform bundling, while the market share of a single platform remains relatively small (Jia et al., 2019). Therefore, today's platforms are not just facilitators of transactions, but also have the power to formulate rules and shape market dynamics through interaction and integration with multiple platforms, which has attracted widespread attention and supervision from society. For example, since 2021, the Chinese government has continuously strengthened antitrust supervision of large Internet platforms that have taken monopoly measures.

Nowadays, more and more platform companies are expanding their business areas and building platform-based ecosystems, thereby accelerating the popularization of consumer Internet (Gawer and Cusumano, 2014; Rong et al., 2013). The network effect generated by the interaction between supply and demand plays an important role in the growth of the platform. The stronger the network effect, the stronger the competitiveness of the platform (Evans, 2009; Katz and Shapiro, 1985; Zhu and Iansiti, 2012). In addition, the platform can extend the network effect to other complementary stakeholders outside the platform boundary, thereby building a platform ecosystem, a community composed of different stakeholders, including consumers, producers, researchers, governments, etc. (Ceccagnoli et al., 2012;

Moore, 1993). Complementers are crucial to the platform ecosystem. The participation of complementors has a significant positive impact on the growth, innovation and performance of the platform ecosystem (Boudreau and Jeppesen, 2015; Ceccagnoli et al., 2012; Kapoor and Lee, 2013; Parker and Van Alstyne, 2017). Therefore, it is crucial for platform operators to attract, promote and manage these complementors (Gawer and Cusumano, 2014).

But at the same time, issues such as data protection, security, and social welfare have gradually emerged and have attracted widespread public attention (Fransman, 2010). The development of platform ecosystems and their huge social impact require a deeper understanding of the various stakeholders involved in the ecosystem, such as: B. Government and social services. Compared with traditional organizations, the operation of platforms is highly dynamic and diverse, with unclear boundaries, which brings great uncertainty to the scope and context of platform social responsibility and regulation. Important issues include employee welfare and passenger safety in online ride-hailing platforms such as Uber, food safety in food delivery services, and trade fairness and customer data protection in e-commerce platforms (Rong et al., 2021a). Therefore, the definition, context and scope of platform regulation and responsibility need to be redefined.

Data market and data ecosystem. In addition to changes in infrastructure and market structure, the difference between the digital economy and the traditional economy lies in changes in production activities. Resource scarcity is the focus of economics and management research, and how to maximize efficiency by allocating scarce resources is also a fundamental issue of the digital economy. The booming digital economy has made data an important resource (Iansiti, 2021). In 2017, The Economist pointed out that "the world's most valuable resource is no longer oil, but data." Therefore, data markets and data ecosystems have become emerging research areas in the digital economy.

Data has different definitions from different perspectives. From the perspective of information technology, the International Organization for Standardization (ISO) defines data as "a formalized representation of information for the purpose of communication, interpretation or processing". In some economic studies, data is regarded as a type of information (Jones and Tonetti, 2020). Information is an economic asset stored in the form of a sequence of bits. There are two types of information: one represents a set of instructions for producing economic goods (Romer, 1990), and the other refers to data. It is worth noting that data has existed since the Internet era, and its impact on economic activities has always attracted much attention. The amount of data continues to grow and has become an important resource for the digital economy. Science believes that data can be regarded as part of information and does not belong to creativity and knowledge. They cannot be used directly for production, but can promote the formation of creativity and knowledge, thereby guiding the improvement of production.

Data promotes economic growth (Jones and Tonetti, 2020; Cong et al., 2021), especially the growth of the digital economy. Compared with traditional production factors (such as labor, land, capital), data has some different properties. The first characteristic of data is virtuality, which means that data must interact with other factors in production activities, including the integration of data and information technology (O'Leary, 2013) and the integration of data and labor (Jones and Tonetti, 2020). Second, the scale returns increase. As the amount of data increases, the marginal benefits of data will also increase (Veldkamp and Chung, 2019). Third, data is a non-competitive factor. Once data is copied or shared, its productivity will not decrease even if the number of users increases (Jones and Tonetti, 2020; Aquisti et al., 2016; Farboodi and Veldkamp, 2021). Fourth: negative externalities. There is a risk of data leakage when using data (Aquisti et al., 2016; Peukert et al., 2020). The data market is also different from other factor markets. It is based on the data value chain. Miller and Mork (2013) first proposed the concept of the data value chain and believed that the complete data value chain includes three levels: data discovery, data integration, and data use. On the other hand, the OECD (2013) assumes that the data value chain has four levels: collection/access, storage and aggregation, analysis and distribution, and use. In addition, Kornfeld (2019) expanded the data value chain to five levels: collection, storage, processing, distribution, and use. In order to ensure the smooth flow of the data value chain, three issues must be addressed:

- - The first is the definition of data rights. Without the clear definition of rights proposed by Coase (1960), the transaction costs of the data market will remain high, thereby limiting the resource allocation of the data market and damaging social welfare. Data ownership is still under study (Dosis and Sand-Zantman, 2019).
- - The second issue is the structure of the data market. It is not clear whether the data is suitable for over-the-counter transactions or only for stock exchanges. Compared with stocks with a higher degree of standardization, data usually contains a large amount of personal information that is still difficult to standardize.
- - The third issue is the value distribution in the data market. Internet giants benefit from their monopoly position, and many countries have introduced measures to conduct antitrust supervision on platforms. Therefore, how the value of data markets can be distributed more equitably among all stakeholders is an important issue that requires further research.

As data markets develop, another organization that covers more stakeholders outside the value chain deserves our attention. Given the complexity and dynamics of data markets, promoting data ecosystems provides a viable way to better coordinate these stakeholders. The concept of business ecosystem was first proposed by Moore (1993), who defined it as "an economic community that develops collective capabilities around innovation." The rapid development of the digital economy has also driven the development of business ecosystems. The digital background of business ecosystems has further increased the frequency of interaction between stakeholders, and data plays an important role in it. In data ecosystems, governments, R&D institutions, universities, and industry partners jointly build data value networks.

For example, the data ecosystem built by Tencent, each stakeholder promotes the development of the data market in their own way. First, Tencent will launch various applications for C and B markets in the value network to collect data from individual users or producers. Subsequently, Tencent will standardize the data of C-data and store it on its own servers. Companies can also store B-data on their own servers. Once securely stored, Tencent or other affiliated companies can use artificial intelligence algorithms to analyze C data to learn more about consumers. Other platforms hope to enter the C market and even attract advertisers. Similarly, companies can analyze B data to improve their connectivity and increase productivity. In addition to the data value chain, Tencent also promotes the development of community networks. Tencent is making constructive suggestions to the government to implement data market policies, working with universities to cultivate talents needed for the future data market, and working with other companies to develop industry standards to optimize the data market.

Economic background: The digital economy is increasingly becoming an important pillar of economic development in various countries. The latest "White Paper on China's Digital Economy Development" points out that China's digital economy accounted for 38.6% of GDP in 2020, up from 14.2% in 2005 (China Academy of Information and Communications Technology, 2021). At present, scholars agree that the digital transformation of traditional industries helps to increase GDP (Kristoffersen et al., 2020), change the consumption structure, enhance the quality of human capital (Skare and Soriano, 2021), and ultimately make full use of data resources (Bag et al., 2021). The continuous development of the digital economy has many impacts on the macroeconomy, including social distribution, employment, digital currency, finance, etc.

Especially in terms of national resource allocation, digital technology is subverting traditional communications, business and education, as well as the way people operate at work and at home. It makes information acquisition faster and easier, reduces the cost of communication technology, improves productivity, improves efficiency, accelerates innovation and economic growth, promotes government transparency and citizen-government interaction, etc. (Yuan et al., 2021). In such an era, the effective use and application of ICT has greatly promoted digitalization (Pan et al., 2022). From a macroeconomic perspective, the digital economy affects the development of the traditional economy, mainly due to the further adjustment of production input-output efficiency caused by technological progress and revolution (Pan Jianwei et al., 2022). In other words, national resources have been more or less reallocated in a more digital way.

Second, in terms of social employment, the digital revolution has cast doubt on traditional business models and innovative consumption patterns, leading to rapid changes in traditional production systems and value chains. This revolution is the result of the integration and application of new technologies such as cloud computing, the Internet of Things, artificial intelligence, and robots, which has posed new challenges to social employment. Scholars may be concerned about employment issues and how the emergence of digital technologies (such as artificial intelligence and digitally controlled robots) has led to job shortages (e.g. Spence, 2021). Nevertheless, more and more jobs are emerging in emerging markets, which will also create more jobs for some existing occupations. For example, these intermediaries are trying to connect with independent retailers or individual customers through online platforms to transform their previous full-time or long-term employment into on-demand employment. This form of employment will be more flexible and networked due to the increase in human-machine cooperation. New digital technologies have had a significant impact on the field of social employment and promoted the provision of new employment solutions. Third, the booming digital economy will also promote the continuous development of the financial sector (i.e., digital currency). The potential widespread use of digital currency will be largely driven by the development of the digital payment industry and the advancement of digital security technology. Currently, the digital economy is changing the business model of many industries. For example, in the retail industry, it supports online ordering from local retailers. At the same time, retailers can easily collect and analyze customer data to provide personalized services and relevant marketing information. In particular, China, as one of the world's largest digital payment markets, has become an international pioneer in the field of financial technology and fintech. Therefore, in the era of digital economy, the use of digital currency is increasingly promoted in China.

According to the United Nations Conference on Trade and Development's Digital Economy Report, data is regarded as an important asset that can be used to create more personal and social value (United Nations Conference on Trade and Development, 2021). However, there is still no scientific consensus on the definition of data, which leads to confusion and contradictory results in existing analysis and policy reports (UNCTAD, 2021). A global approach to data governance is needed because it can promote cross-border data sharing and help address global development challenges (such as health, climate change, etc.). For example, the digital economy also poses challenges to national security and labor market instability (Spence, 2021). Specifically, government officials should take restrictive measures on the flow of information, prevent spam, and ensure data protection to protect national security and important infrastructure in the economic system. Therefore, it is becoming increasingly difficult to strengthen global cooperation on cross-border data flows. This requires countries to actively formulate and implement appropriate data governance rules. Aaronson (2019) advocates the establishment of an international organization to develop common standards and rules to support international data flows. In this case, a global data governance organization may be needed to work with countries around the world to provide common standards and guidelines for managing cross-border data transactions, ensuring data protection, and strengthening data security.

1.2. THE ROLE OF IT COMPANIES IN THE DEVELOPMENT OF THE DIGITAL ECONOMY

The evolution of approaches to defining the digital economy can be traced in the works of D. Tapscott [2], experts from the World Bank [3] and the United Nations Environment Program [4], S. Brenner and D. Kreis [5], M. Ardolino, N. Saccani and M. Perona [6], P. Singh [7], R. Bukta and R. Hicks [8] (see Fig. 1.2).

In their fundamental monograph on the digital transformation of the economy, K. Kraus and N. Kraus [9] identified opportunities for innovative entrepreneurial activity in many areas of the economy and predicted that the dialogue between governments, cross-sector organizations and the business community will continue to deepen in order to implement large-scale projects based on “deep” digitalization. D. Edgerton [10] and S. Montresor [11] noted that economic digitalization is accompanied by a process of technological globalization or technological globalization, which develops the possibility of international cooperation and sharing of resources, thus giving rise to the sharing economy [12] and the access economy [13]. According to S. Ostry and R. Nelson [14], T. Elkier and I. Damgaard [15], technological globalization affects both the macro and micro levels - from the nature of relations between national economies and the quality of interaction to the coordination of business relations, especially the coordination of business and information technology.

The conceptual framework describing the process of digital transformation of the economy is still in its infancy. Therefore, we recommend focusing on the main concepts that characterize them, which will avoid conflicts in the perception of the outlined phenomena. The most common is the erroneous use of the terms "digitization" and "digitization" as synonyms. “Digitization” refers to a technological process, namely “the integration of digital technologies into everyday life”[16]. In terms of information technology coding and programming, “digitization” describes the transformation of analog information into a digital format, for example by creating programmable and transferable physical products [17]. Rather, digitalization is a socio-technical process that applies digital methods in a broader social and institutional context, thus reproducing the infrastructure of digital technologies[18]. The industry classification method identifies digital enterprises as part of knowledge-intensive enterprises [19; 20], focusing on the chemical industry, the electronics industry and related industries, whose development has benefited from recent progress in the integration of platform knowledge [21]. However, A. Ganelt, E. Piccinini, R.-V. Gregory, B. Hildebrandt and L. Kolbe [22] did not distinguish between digitalization processes at the industry level. The authors argue that “digitization” should be analyzed only at the product level, so they distinguish between the industry itself and how it operates. This allowed them to identify three archetypes based on their level of digitalization (from no digitalization to full digitalization): (1) Purely physical products, (2) Digitally enhanced physical products, and (3) Fully digital products.

"Digitalization" is a complex concept. Almost all economic processes directly or indirectly depend on digital technologies. R. Bukt and R. Hicks [8] proposed the author's concept of the digital economy, describing it as the part of the economy most directly related to digital technologies and the digital sector. By "digital sector" the authors mean the IT/ICT sector, which produces mainly digital products and services. "Digital economy" includes the "digital sector", as well as digital services and digital platform services, which are defined as "the part of the economic result obtained entirely or mainly through the implementation of business models based on digital goods or services that rely exclusively or mainly on digital technologies" (Figure 1.2). Therefore, the part of the economy that is directly or indirectly related to digital technologies is defined as the "digital economy". The approach of R. Bukt and R. Hicks was reconsidered by Ukrainian scientists A. Kuznetsova and G. Chmeruk [23, p. 38-39] propose an author's definition of the digital economy as that part of economic activity that is carried out by enterprises through the intensive use of information and communication and new digital technologies. A. Kuznetsova and G. Chmeruk define the digital economy as economic activity that is generated only with the help of new digital technologies, based on the use of new digital business models, the main means of production (factors) of which are digital (electronic, virtual) data, both digital and textual.

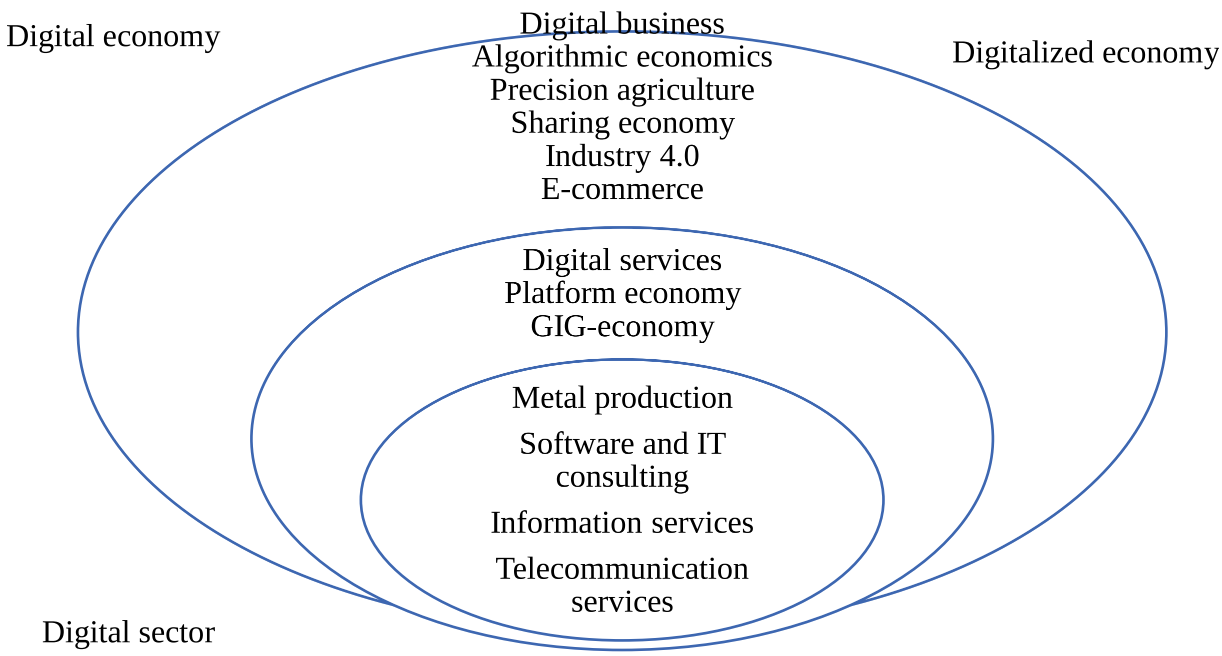


Figure 1.2 – The place of the digital economy in the digitized economy

Source: [8].

Digital transformation is not only the result of the interaction between digital technologies, digital business models and digital innovations, but also depends on the structure and position of the company in the market, its digital readiness and the nature of external collaboration that facilitates digital transformation (Fig. 1.3).

Types of digital economy products

- public, without an exchange for consumption
- long-term use
- products whose usefulness cannot be determined until the moment of purchase

Digital products

- products produced electronically and without a material prototype
- digital copies of real products
- digital copies of real objects

Types of digital trade

- digital enabled – covers transnational trade
- digital delivered - products are transferred via web-streaming channels
- platform-enabled – implemented with the help of intermediary companies operating on the basis of platforms
- trade indicators: trade in classic information and communication services; trade in ICT-based services; cross-border supply of goods and services via e-commerce channels in B2C format

Digital product

- digital model of a real object
- result of intellectual work
- virtual
- accessible for visual and auditory perception
- the cycle of movement of a digital product from all stages to one stage cycle
- non-cash payment is the only possible
- production costs do not include the cost of raw materials
- the price of a digital product is lower than the price of a real prototype, the profitability of production of each copy is higher

Figure 1.3. Characteristics of key concepts that reveal the meaning of the digital transformation of the economy

Source: developed by the authors based on [24; 25; 26]

There are different views on how to identify the presence of “digital technologies” in a firm’s operations, which raises the question of whether they are part of the firm’s underlying business model or specifically a component of a digital business model (Figure 1.4).

Six stages of digital transformatiom	traditional business
	excisting and active
	formalized
	strategic
	convergent
	innovative and adaptive

Figure 1.4. Stages of digital transformation of the economy

Source: constructed by the author

External collaboration is a key factor in managing digital transformation. Without digital readiness, it is impossible to implement digital technologies, digital business models or master digital transformation. The "know-how" factor that affects digital technologies depends on speed, which in turn depends on stability and speed to market, which ultimately affects the success of digital technologies. Transparency is an important component of the success of intermediaries in the field of digital technologies and innovations.

If we consider digital innovations as a driver of digital transformation, the question arises of identifying the drivers of the development of digital innovations themselves (Figure 1.5). Potentially important factors mentioned in the literature include certain characteristics of digital technologies that can influence the processes associated with digital innovations [28]; 29; 30].

Features of digital technology	Reprogrammable
	Self-referential (refers to itself)
	Multi-level architecture modules
Features of digital innovations	Combinatorial
	Open
	Distributed
	Distributed

Fig. 1.5. Characteristics of digital technology and digital innovation

Source: constructed by the author

These characteristics of digital technologies include the ability to be reprogrammed over time by separating form from function, for example, a smartphone can be replaced at any time by installing new software. Second, digital technologies are considered self-referential, as they are an important incentive for the creation of more similar technologies [30]. In essence, a “vicious circle of technological globalization” develops, in which the increase in productivity, diversity and accessibility of digital resources leads to the creation of additional resources. Digital technologies provide openness to the process and results of digital innovation, which is reflected in the fact that the addition of new modules allows the functionality of digital products or services to change over time. Although modular architectures often allow for the addition of modules after the sale, they must first be aligned with the core functionality of a particular product.

“Digital transformation” goes beyond the concept of “digitization” as it involves constant change and its management. “Digital transformation” is characterized by the implementation of innovative, operational and flexible business models based on the latest technologies, digital processes and digital business analytics. Since digital transformation manifests itself differently depending on the stage of the business, there is no single definition that applies to everyone. But in general, digital transformation is seen as the integration of digital technologies and innovations into all areas of business, which leads to fundamental changes in international markets for goods and services, labor markets and innovation ecosystems. Digital transformation is a civilizational change that requires companies to constantly change the status quo and revise their perception of the concepts of “sustainability” and “risk”, as it essentially makes the implementation of digital innovations indispensable at all stages of the product life cycle, leading to an increase in the level of service-oriented international trade.

Technological developments have fundamentally changed business processes around the world. This means that companies need to adapt and implement new solutions to remain competitive and improve operational efficiency (Kuzior et al. 2023).

In recent years, the intersection between digital transformation and business model innovation and sustainable industry practices has been intensively studied. The important role of technological progress in reshaping the operational and strategic activities of companies has been emphasized. Digitalization is seen as a means to initiate business model innovation and ensure industry sustainability (Parida, Sjödin, and Reim 2019). This has given a preliminary understanding of the importance of these transformations for future business success. For example, Urbinati et al. (2020) used case studies from different industries to understand how digital technologies can support open innovation processes by bridging the gap between technology adoption and innovation capabilities.

In this direction, Fan Wenbin, Wang Wenbin, and Lu Wenbin (2023) continued this discussion and specifically examined how digital transformation promotes sustainable innovation in manufacturing companies from the perspective of digital technologies as a means to enhance innovation capabilities. Ponsignon, Kleinhans, and Bressolles (2019) studied the integration of quality management practices in the digital transformation process. They emphasize that quality management plays a key role in supporting companies to successfully achieve digital transformation. In addition, Zhang et al. (2023) studied digital transformation from the perspective of innovation portfolio, by studying the digital technologies that mature companies can integrate to ensure their competitive advantage through strategic innovation.

Yaqub and Alsabban (2023) introduced the prospects and challenges of digital transformation in the context of Industry 4.0, which also provided a perspective on the factors that affect the potential success of digital transformation of enterprises. For the same reason, Hughes et al. (2022) proposed a view on the future of manufacturing in the era of Industry 4.0 by studying how digital technologies redefine manufacturing processes and business models.

In their study, Sánchez Ramírezet et al. (2022) analyzed the impact of digitalization on innovation capabilities and advocated the use of knowledge management strategies. Only when these strategies are skillfully applied and implemented can they promote digital transformation. In a systematic review, Di Vaio et al. (2021) reviewed the literature on the role of digital innovation in knowledge management systems. They studied how digital tools improve organizational knowledge and promote innovation. Finally, Lynn et al. (2022) studied the impact of the digital economy on regional economies by studying how digital business models and the digitalization of business activities promote regional economic growth and innovation.

Ukrainian scientists studied the role of technological innovation in strengthening IT operations in Ukrainian enterprises based on empirical data from ten companies in various industries for the period 2019-2023. This article uses econometric models and panel data analysis methods to explore the relationship between technological innovation, investment expenditures, training personnel, enterprise size and industry characteristics.

They selected a sample of 10 Ukrainian companies from the above-mentioned companies in the IT services, manufacturing, logistics and retail industries. The authors selected these companies based on reliable data on active technological innovation. The authors collected annual data on IT operational performance, technological innovation, capital investment, employee training, company size, and industry over a five-year period from 2019 to 2023.

The results show that the boom in technology adoption among Ukrainian companies highlights the role of technological innovation in strengthening IT operations (Parida, Sjödin, and Reim 2019). Over the past decade, advances in IT have helped companies improve efficiency, reduce costs, and gain competitive advantage. In this study, technological innovation played an important role in improving the IT operational performance of 10 Ukrainian organizations during the period from 2019 to 2023.

Technological innovation to improve IT operations has now become a ubiquitous component of modern corporate strategy. This is never more important than in today’s dynamic and changing markets, such as Ukraine. Over the past five years (2019-2023), an increasing number of Ukrainian companies have sought to integrate modern technological advances into their operational structures in order to remain creatively competitive not only in a changing economic environment but also in the field of technology that complements and develops the economy. This study focuses on analyzing the relationship between technological innovation, capital investment, human resource development, company size and its industry-specific aspects and operational IT performance of Ukrainian companies through ten focus companies as case studies. Using a fixed-effects econometric model, the authors examined how these variables affect IT operational outcomes over a five-year period, providing actionable findings for industry stakeholders and policymakers.

The econometric analysis shows that technological innovation, coupled with factors such as capital investment and skills development, has made a significant contribution to improving operational IT performance.

The researchers concluded the following:

1. Technological innovation. It turns out that there is a significant and robust relationship between technological innovation and IT operational performance. This result highlights the transformative potential of adopting cutting-edge technologies such as automation, cloud computing, and advanced analytics.

2. IT infrastructure investment has a measurable but moderate impact on business performance. This result highlights the importance of financial resources in creating a foundation for technological innovation, while also suggesting that when investment is not accompanied by strategic implementation, there are diminishing returns.

3. Capability development. Training and development of the workforce is another key factor. Companies that focus on skill development have achieved significant improvements in IT operations. This emphasizes the need for human capital to adapt to technological advances.

4. Company size. The results show that larger companies benefit from economies of scale, which enables them to better integrate and implement technological innovations. This result suggests that smaller companies may need tailored strategies or external support to reap comparable benefits.

5. Industry type. Industry-specific factors influence the effectiveness of technological innovation. Among them, IT and manufacturing industries show stronger adaptability and higher returns on innovation investments than other industries.

Almost everything that can be described as advanced technology and IT infrastructure investments can significantly improve operational efficiency. Investments in further training of the workforce act as a catalyst. Large companies benefit more because these innovations are scalable and can quickly scale up their investments. However, smaller companies should focus on high-leverage strategic initiatives to maximize returns.

Policymakers and industry leaders must focus on incentives for R&D and skills development in the IT sector that drive Ukraine's economic vitality. Companies must ensure that their innovation strategies are aligned with the company's capabilities and industry-specific requirements to achieve sustainable growth. Future research can build on this analysis to examine the long-term consequences of industry differences or digitalization initiatives.

Ukrainian companies can overcome operational challenges and seize cross-border opportunities offered by the digital economy by integrating technological innovation into their strategic priorities.

Among the ten companies, technological innovation was ranked as the most important factor in improving IT operational performance, followed by product differentiation. However, companies that invested in advanced technologies such as automation, artificial intelligence, and cloud solutions consistently achieved greater efficiency and scalability. In one example, an IT service provider reduced system downtime by 40% after implementing a predictive maintenance tool that leveraged machine learning algorithms. For example, one manufacturing company integrated IoT devices into its production lines, increasing production efficiency by 25%. These examples illustrate the dramatic impact that technology adoption can have on a company’s success.

The second important success factor is investment in IT infrastructure. Building on the success of the ASCO commissioning tool, large companies, including leading retail chains and manufacturing giants, have led by example and invested heavily to update their IT systems, resulting in sustained operational improvements. On the other hand, smaller companies have struggled to sustain similar levels of investment, and resource availability is clearly lacking at smaller companies. Nonetheless, targeted and efficient use of resources by smaller companies has yielded positive results, including improved supply chain transparency through the cost-effective implementation of a digital tracking system by a mid-sized logistics company.

Skill-building initiatives have proven to be extremely important across all companies. Companies that focus on training their employees have better results in implementing and using technological innovations. For example, a financial services provider provided a holistic training program in data analytics and cybersecurity, resulting in a 30% improvement in system reliability and decision-making capabilities. However, companies that did not invest in employee training were unable to fully reap the return on their technology investments, highlighting the interdependence of human and technological capital.

Company size and industry also had a significant impact on the results. Companies with economies of scale benefit from their ability to adopt technology on a large scale and integrate it more deeply into their operations. However, smaller companies have shown agility in testing new technological solutions, especially because the IT industry is characterized by rapid technological change and low barriers to market entry. In the manufacturing sector, the authors observed strong industry-specific factors, as companies that successfully implemented industry-specific innovations (such as process automation and quality control systems) outperformed other companies.

In short, the right balance between technological innovation, capital investment, and skills development is key to a business' success compared to its competitors.

Overall, the analysis shows that while technological innovation is key to improving IT operations, success ultimately depends on additional investments in infrastructure and human resource development. A strategic, targeted approach can bring significant improvements to both large and small companies in adaptive industries. The findings highlight the need for Ukrainian businesses to take a comprehensive approach to promoting technological advancement and developing operational excellence.

These results are closely related to many recent studies that have examined the relationship between technological innovation and business performance.

Investments in cutting-edge technologies, IT infrastructure modernization, and workforce development have been shown to improve operational efficiency and system reliability. Companies that actively adopt technological innovations have significantly outperformed their competitors that typically do not invest in such measures. Clearly, company size, capital investment, and successful technology implementation are correlated. Companies that can afford it have access to more resources to modernize their IT infrastructure and workforce, and thus benefit more from innovation. On the other hand, small and medium-sized enterprises are largely constrained by limited capital and an underqualified workforce.

Conclisions for the first section

The first section analyzed the sources of formation of the digital economy. A comparative analysis of industrial and digital economies was conducted. It was established that the main element in the digital economy is information. Considered business models of the digital economy. We have provided analyses of IBCDE framework and described its elements.

The analysis of the components of the data market and their ecosystem was carried out. It was determined that the existing platforms and models in the digital economy, unlike the industrial one, have certain differences due to the characteristic features of the information itself, so there is an opportunity for further development of both the digital economy itself and the threats that these opportunities carry. So the dissemination of information in general does not require additional costs, which poses a threat of its receipt by fraudsters. The next threat follows from the first one - the possession and use of information. Thus, a material product can be used by the end consumer, and the intermediary does not have the opportunity to use it when trading through an indirect distribution channel. In the case of information, such use is extremely difficult to limit.

At the same time, the digital economy makes its contribution to the development of national and global economies, namely, quick access to information, new employment opportunities (teleworking), industry 4.0 appears, the financial sector is developing. IT companies are the conductor of digitalization and the development of the digital economy, and first of all, innovations of IT companies play an important role in the development of the digital economy.

We considered the concept of the digital economy, digitalization and digital transformation. The stages of digital transformation of the economy are defined, and the characteristics of digital technology and digital innovation are given. Overall, this analysis suggests that although technical innovations are the key to enhanced IT operations, ultimately, their success depends on additional investments in infrastructure and workforce development. Strategic, targeted approaches can yield substantial improvements for smaller firms as well as larger ones in adaptive industries. The findings underscore the necessity of comprehensive approach of technology progress and operational excellence development in the sphere of business.

And IT companies can and should be the conductors and embodiments of such innovations.

SECTION 2. THE STATE OF INTERNATIONAL BUSINESS OF IT COMPANIES IN DIGITAL ECONOMICS

2.1. STATISTICAL ANALYSIS OF THE DIGITAL ECONOMY

The world is undergoing a digital revolution, with significant impacts on the global economy and people's livelihoods. Like previous waves of technological innovation, such as the development of the internal combustion engine and electrification, digital technologies are transforming economies and societies. Digitalization is spreading and democratizing knowledge, education, and entertainment at an unprecedented rate around the world. The rise of digital imaging and advances in artificial intelligence are helping doctors diagnose and treat diseases. The advent of the Internet of Things (IoT)1 has the potential to make workplaces and transportation systems safer, cities more livable, and homes easier. Broadband networks and the applications they support are changing the way people communicate, socialize, shop, travel, and work, creating entirely new business models and markets. At the same time, digitalization is transforming many consumers into "prosumers" by producing content on digital platforms and participating in peer-to-peer (P2P) networks and the sharing economy.

The digital economy promotes growth and productivity and supports inclusive development. This growth is reflected in the use of digital technologies by a large number of consumers, businesses, and governments, although the extent of use varies across industries and countries. The introduction and use of digital technologies has increased the productivity of capital and labor and enabled them to participate in global value chains (Miller and Atkinson, 2014). The digital economy promotes greater inclusion by reducing transaction costs, balancing information asymmetries, and leveraging economies of scale and network effects (World Bank, 2016a). Through these mechanisms, the digital economy improves access to a range of markets and services for previously marginalized groups—education (edX, Coursera), peer-to-peer lending (Lending Club, Grid Finance), the sharing economy (AirBnb, Uber), crowdfunding (Indiegogo, Kickstarter), and online job search platforms (Taskrabbit, Souktel).

The digital revolution is too important for any country to ignore. Leveraging the advantages of the global digital ecosystem is of great significance to both developed and developing countries. Many industrialized countries already have mature digital economies and are making full use of the advantages of digitalization to promote economic prosperity and improve and facilitate people's lives. Regardless of a country's stage of development, developing a digital economy can promote inclusive growth. For example, in less developed economies, the adoption and use of mobile technology can provide basic financial services to everyone or help farmers sell agricultural products at reasonable prices. With the right infrastructure, countries at all stages of development can use digital technology to accelerate the provision of broad, high-quality health care, education, and government services. The more countries develop and expand their digital economic base, the more they can enter the field of becoming providers of digital products and services in the competitive global digital ecosystem.

However, the rise of the digital economy is not without challenges. Digitalization has created new jobs, destroyed old jobs, and changed the composition of existing jobs. It has promoted skill-based technological change, which is the main reason for the increase in labor income inequality (OECD, 2011). These turmoil in the labor market has raised concerns that digitalization may lead to jobless growth and exacerbate existing income distribution inequality (Cowen, 2015). The key factors that make the digital economy successful—its ubiquity, decentralization, network effects, and the speed of technology diffusion—pose new challenges to policymakers. The “placeless” digital economy, characterized by the cross-border production and use of digital goods and services, challenges government tax and trade policies that have traditionally been oriented toward location. The rise of the gig economy and digital platforms such as Uber and Mechanical Turk challenges the labor and social policies (such as health insurance, training, and working conditions) that companies and organizations in many countries are expected to implement. Digital platforms also raise debates about market concentration, equal access, and fair competition—issues that are not new across the communications industry. Transnational data flows that cross national legal systems raise questions about data ownership and data protection. Increasing reliance on digital systems also makes governments and businesses more vulnerable to attack: the threat of cyberterrorism is real. Finally, policymakers must also promote IT standardization and device interoperability to fully realize the benefits of various digital technologies such as the Internet of Things.

Digitalization poses particular challenges for developing countries. Making the most of the digital economy depends on basic ICT infrastructure that many emerging economies still lack. Moreover, OECD countries are significantly more digitalized: many developing countries will adopt technological and regulatory developments from other parts of the world. However, this is no reason for pessimism. Emerging countries have the greatest advantages in digitalization, but also face the greatest disadvantages, as they are often more technologically backward than OECD countries. Developing countries therefore need to plan strategically to maximize the development impact of digitalization. Countries that fail to do so risk losing international competitiveness and may find it increasingly difficult to improve the welfare of their people.

Despite widespread broadband coverage in the EU, only 70% of households have access to very high capacity fixed lines (VHCNs) that can deliver gigabit speeds. In the DESI report, fixed VHCNs include FTTP (fiber to the premises) and cable DOCSIS 3.1 (cable data service interface specification) technologies. FTTP coverage increased from 43% in 2020 to 50% in 2021, and DOCSIS 3.1 coverage increased from 28% in 2020 to 32% in 2021. Fixed VHCN coverage in rural areas also increased from 29% in 2020 to 37% in 2021. However, there is still a large gap between rural data and national data. Malta, Luxembourg, Denmark, Spain, Latvia, the Netherlands and Portugal are the Member States with the highest fixed VHCN coverage (covering more than 90% of households). However, in Greece, only one in five households has access to fixed VHCN. The Digital Decade proposal sets the goal of achieving gigabit coverage for all households by 2030.

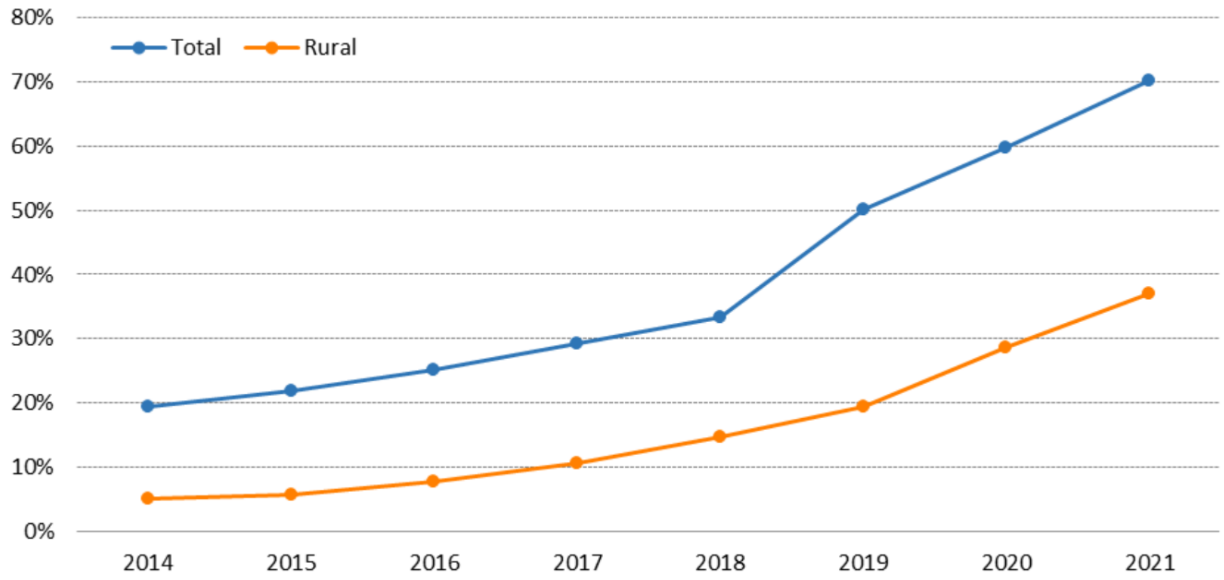


Figure 2.1 – Fixed very high capacity network (VHCN) coverage (% of households) in the EU, 2014-2021

Source: constructed by the author

Last year, 5G coverage also increased to 66% of densely populated areas in the EU. However, frequency allocation, an important prerequisite for the commercialization of 5G, has not yet been completed: only 56% of the total harmonized spectrum for 5G has been allocated. The very low coverage in some Member States is also due to operators sharing frequencies based on 4G frequencies or 5G low-band spectrum (700 MHz), which does not yet allow the full deployment of advanced applications. Closing these gaps is essential to realize the potential of 5G and enable new services with high economic and social value, such as connected and automated mobility, advanced manufacturing, smart energy systems and e-health.

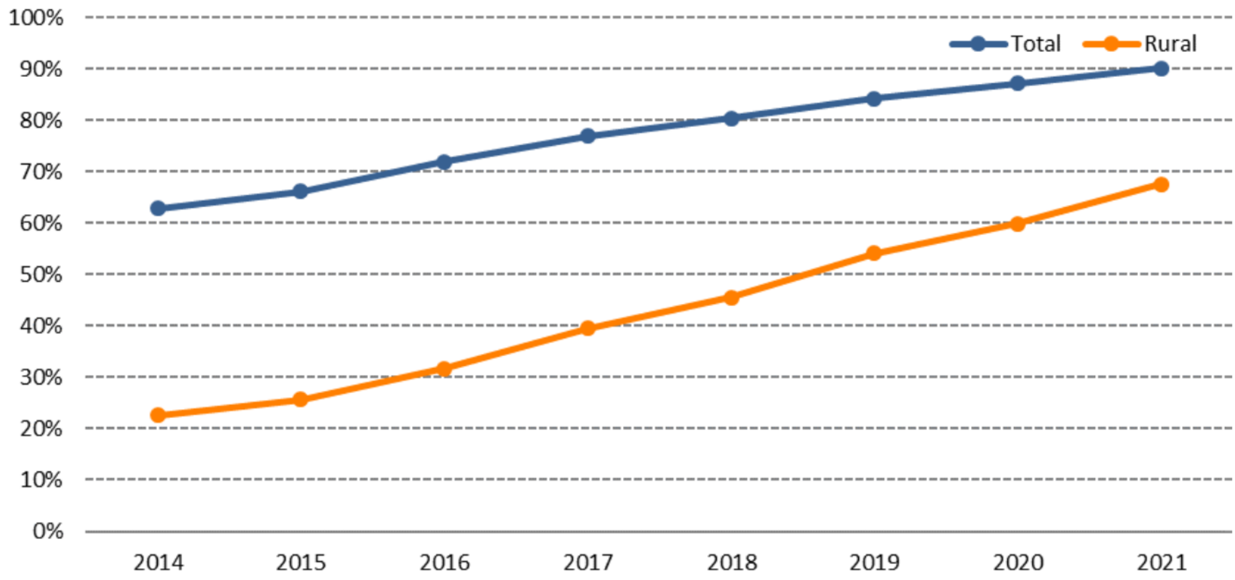


Figure 2.2 – Next generation access (NGA) broadband coverage in the EU (% of households), 2014-2021

Source: constructed by the author

Broadband coverage in rural areas remains a challenge, as 8.5% of households are not connected to fixed networks and 32.5% are not connected to NGA technologies. However, 4G networks are also available in rural areas (99.6%). Regarding fixed-line technologies, FTTP coverage in rural areas has increased significantly (from 26% in 2010 to 34% in 2021), see Figure 2.2.

In Cyprus, Malta, Luxembourg, the Netherlands and Belgium, more than 99% of households have access to NGA. The situation remains difficult in France (74%), Finland (75%) and Poland (78%).

Between 2014 and 2020, VHCN coverage has increased significantly, from 19.5% to 70%. Coverage has more than doubled in the last three years, thanks to cable network upgrades to DOCSIS 3.1 (e.g. Malta, Luxembourg, the Netherlands, Belgium, Denmark and Germany) and accelerated FTTP rollouts (e.g. Ireland, Cyprus, Bulgaria, Hungary, France and Romania).

The growth rate was lower in rural areas, but still significant (from 4% to 37%). The large gap between overall and rural VHCN coverage highlights regional differences in digital capabilities and confirms that more investment is needed to help rural areas catch up.

To close the digital divide in rural and remote areas, the EU is supporting an unprecedented scale of investment. Around €16 billion has been approved for reforms and investments under the Recovery and Resilience Facility (RRF) to build digital connectivity networks over the next four years, especially in rural areas. In addition, the EU will mobilize connectivity investments through the new Cohesion Fund, East African Department of Economics and Development (EAFRD), InvestEU and European Investment Bank (EIB) loans, and CEF Digital. CEF Digital is a project managed directly by the Commission through its agency HADEA, which provides €2 billion over seven years for high-performance connectivity infrastructure. The goal is to mobilize targeted investments of €3 billion to €6 billion to achieve the 2030 digital connectivity goals.

Human capital – digital skills. Although 87% of people (aged 16 to 74) regularly use the internet in 2021, only 54% have at least basic digital skills. The Netherlands and Finland lead the way in the EU, while Romania and Bulgaria lag behind. Although most jobs require basic digital skills, a large part of the EU population still lacks such skills. The 2030 target set by the "Towards a Digital Decade" is that at least 80% of citizens have basic digital skills.

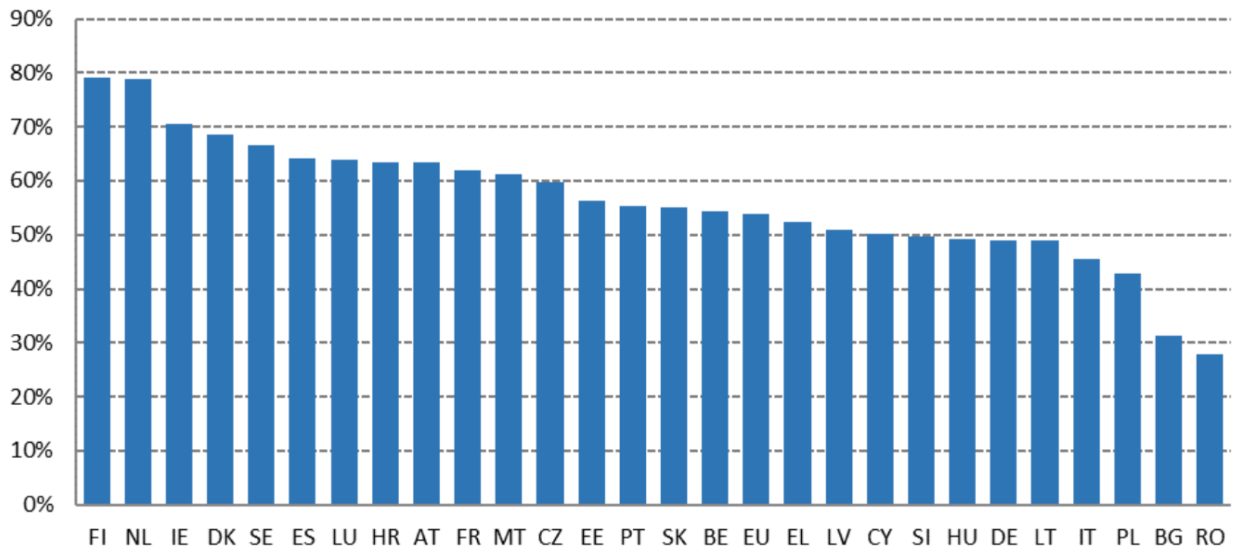


Figure 2.3 – At least basic digital skills (% of individuals), 2021

Source: constructed by the author

There remains a general shortage of ICT experts in the EU labour market, and the number of vacancies continues to rise as new jobs are created. In 2020, 55% of companies that employed or attempted to employ ICT professionals reported difficulties filling these positions.

There are also serious problems with gender balance: only 19% of ICT professionals and a third of science, technology, engineering and/or mathematics (STEM) graduates are women. The Road to a Digital Decade proposal sets a target for gender inclusion of ICT professionals.

The Road to a Digital Decade proposal aims to increase the number of ICT experts employed in the EU to at least 20 million by 2030, compared to 8.9 million in 2021 (equivalent to 4.5% of the working population). Although there has been steady growth since 2013, acceleration is needed to achieve the target. In 2021, Sweden (8%) and Finland (7.4%) had the highest proportion of ICT experts in their workforce.

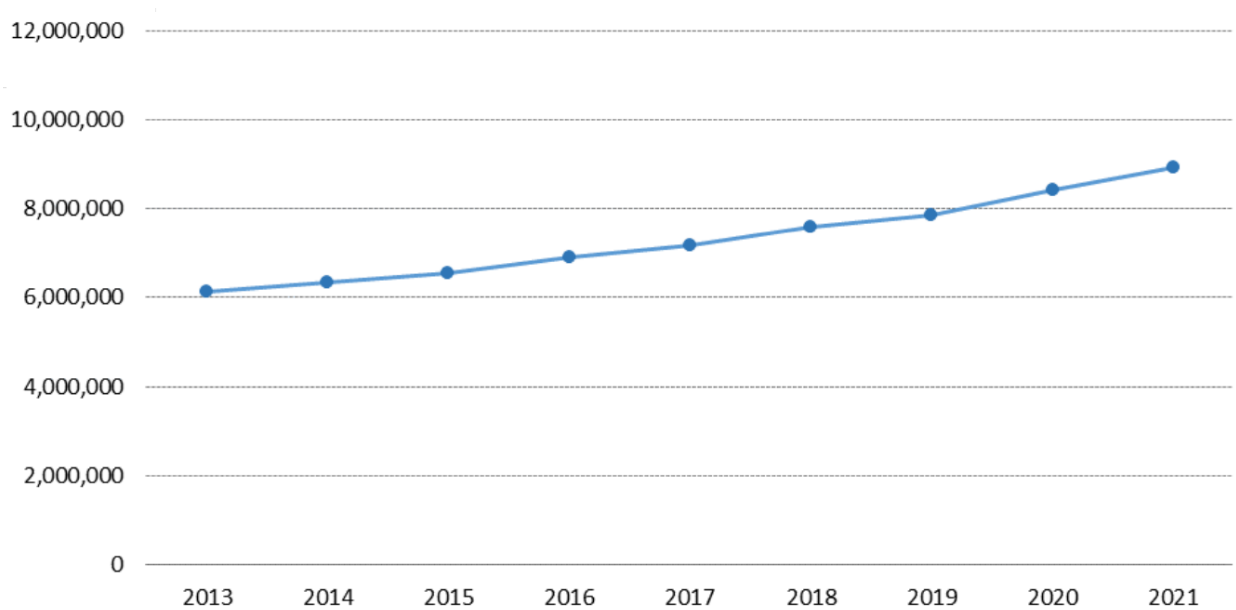


Figure 2.4 – ICT specialists, 2013-2021

Source: constructed by the author

Integration of digital technologies by companies. In 2021, only 55% of small and medium-sized enterprises (SMEs) achieved at least a basic level of digital technology adoption. SMEs in Sweden and Finland are the most digitally oriented

(86% and 82% basic digital intensity, respectively), while Romania and Bulgaria have the lowest rates. To achieve the goals of the Digital Decade, at least 90% of SMEs in the EU should have a basic digital intensity by 2030.

Companies are increasingly digitalized, but the use of advanced digital technologies remains low. While 34% of companies already rely on cloud computing (2021), only 8% use artificial intelligence (2021) and 14% use big data (2020). According to the proposals of the Road to the Digital Decade, at least 75% of companies should use artificial intelligence, cloud computing and big data technologies by 2030.

There is a significant gap between large companies and SMEs, not only in the use of advanced technologies, but also in basic digital solutions, such as the use of ERP (Enterprise Resource Planning) packages and participation in e-commerce.

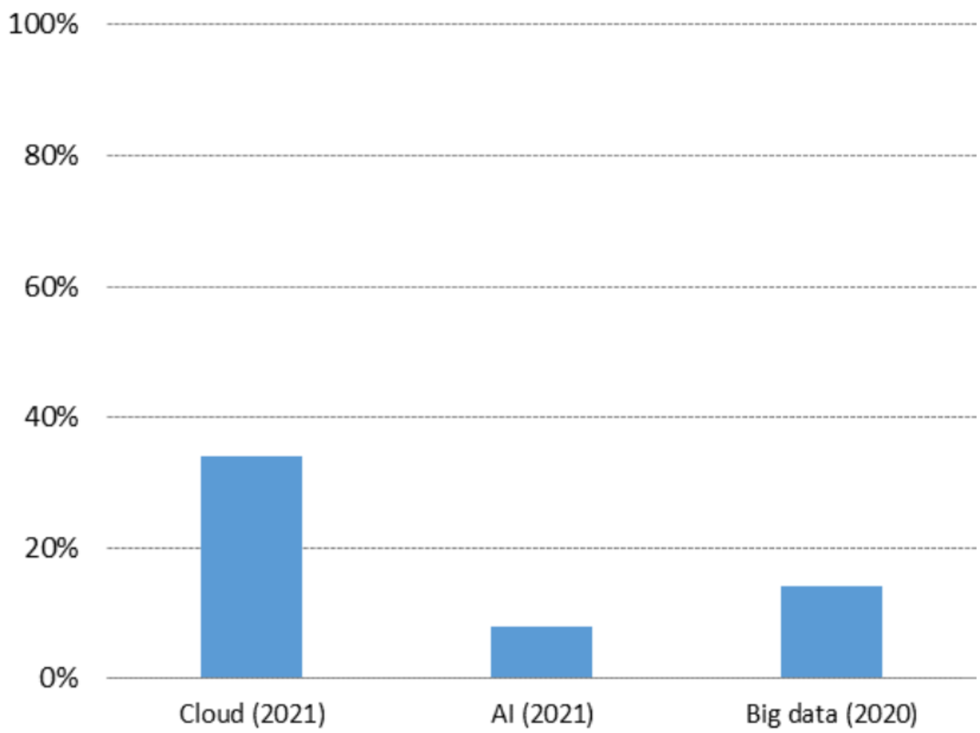


Figure 2.5 – Adoption of advanced technologies (% of enterprises) in the EU, 2020/2021

Source: constructed by the author

Large companies are more likely to use new technologies. For example, electronic information exchange through enterprise resource planning (ERP) software is more common among large companies (81%) than among SMEs (37%) (Figure 2.6). More than twice as many large companies (61%) as SMEs (28%) use social media. SMEs have limited use of e-commerce opportunities: only 18% sell online (compared to 38% of large companies) and only 9% sell online cross-border (compared to 24% of large companies). There are many other technological opportunities that SMEs have not yet taken advantage of, such as cloud services, artificial intelligence and big data. The ability to extract insights from data using advanced data analytics is essential for the competitiveness of the EU economy. If 75% of companies across all industries use advanced big data analytics, European companies will be able to keep pace with global data growth and take full advantage of the new data analysis and interpretation opportunities brought about by artificial intelligence, natural language processing and augmented reality technologies.

There are some common key factors for enabling and promoting the use of cloud services, big data and artificial intelligence, such as employees with advanced digital skills. Furthermore, ensuring legal certainty and considering data protection and liability issues are essential for using data and minimizing the risk of security and data protection breaches.

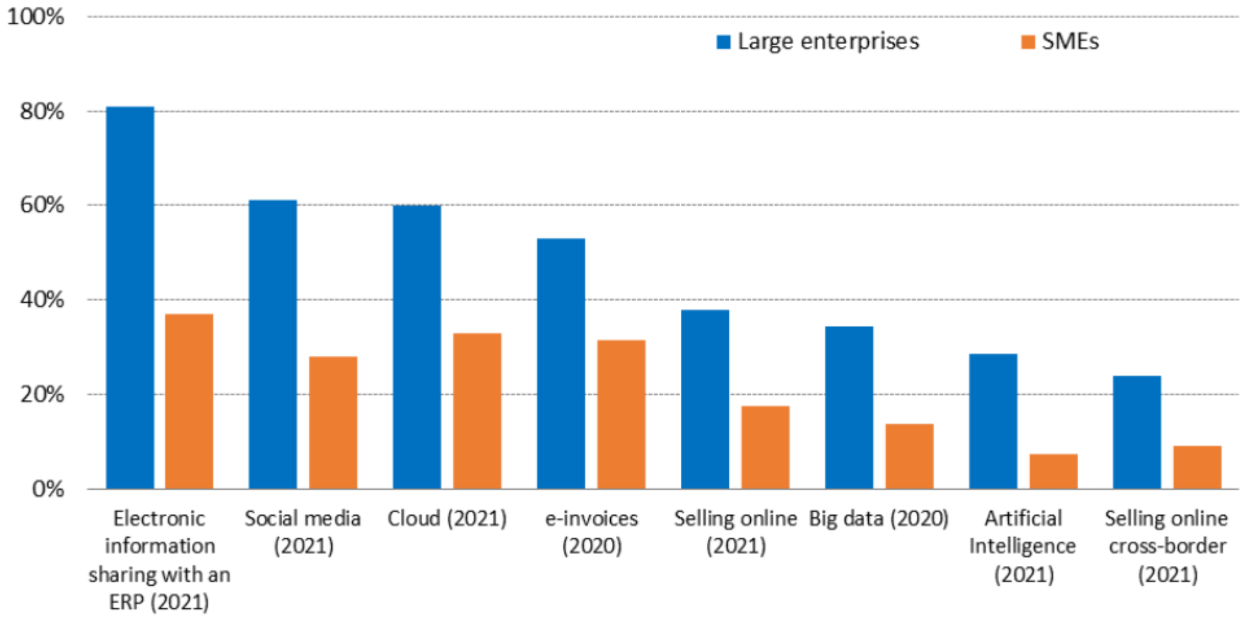


Figure 2.6 – Adoption of digital technologies (% entreprises), 2020, 202153

Source: constructed by the author

We should also analyze successful IT companies. A unicorn is a privately held startup with a valuation of more than $1 billion. This stage of a startup's financial development reflects its maturity and success in the global market. For the current analysis, we consider technology companies founded since 1990 and currently valued at more than $1 billion. Companies with subsidiaries valued at more than $1 billion are not included. Companies currently valued at less than $1 billion but valued at more than $1 billion at the time of exit are also considered.

The proposed Digital Decade aims to double the number of unicorns in the EU27 by 2030.

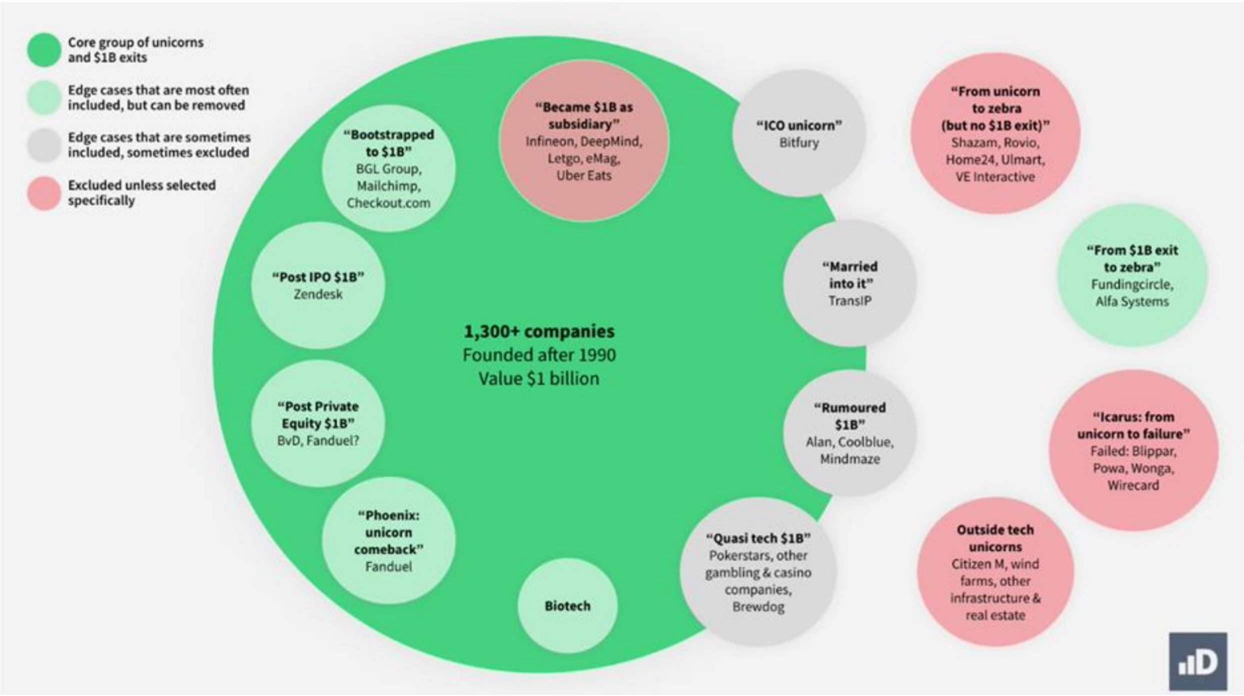


Figure 2.7 – The definition of unicorns included in the analysis

Source: constructed by the author

According to Dealroom, there were 2,282 unicorns worldwide in March 2022, of which only 222 were in the EU (up 143 from summer 2021), while there were 1,243 in the United States (up 889), 530 in Asia (up 414) (including 306 in China (up 272) and 119 in the United Kingdom (up 101). Therefore, there is a great need for improvement. The top EU countries are Germany (58th out of 44 countries), France (35th out of 23 countries), Sweden (30th out of 20 countries) and the Netherlands (24th out of 19 countries). Eight EU member states do not have a single unicorn. Some countries have made significant progress. Poland has more than quintupled its number of unicorns (from 2 to 11), and the Czech Republic has 500 in 2021. It started from scratch in 2017 and now owns 4 unicorns.

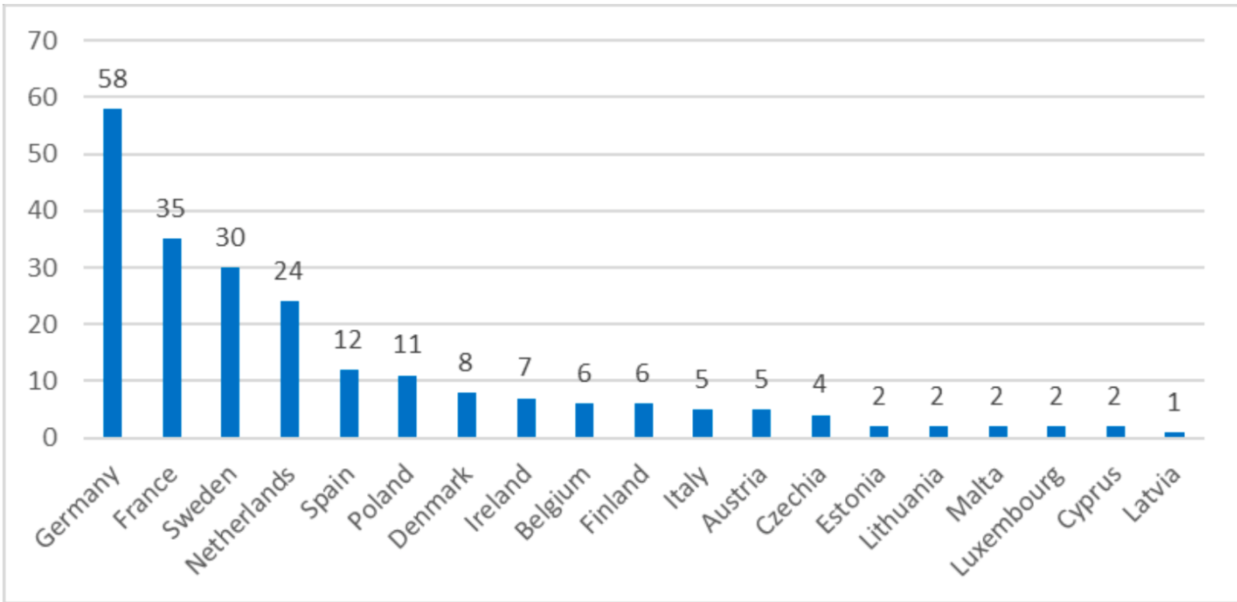


Figure 2.8 – Number of unicorns per EU Member States

Source: constructed by the author

To become a unicorn, a company must steadily and dynamically advance through all stages of development with the help of a startup ecosystem. According to Startup Genome, the best startup ecosystems in the world in 2021 are similar to the previous year, namely Silicon Valley (1st), New York City (2nd) and London (3rd). There is not a single EU ecosystem in the top ten, and the best EU ecosystem - the Amsterdam Delta - ranks only 14th globally, followed by Berlin (15th), Paris (21st) and Stockholm (24th). While half of the top 30 ecosystems are located in North America (as are half of the top 10), only 4 of them are in the EU. Asia is catching up, with 8 ecosystems in the top 30, see Figure 2.9.

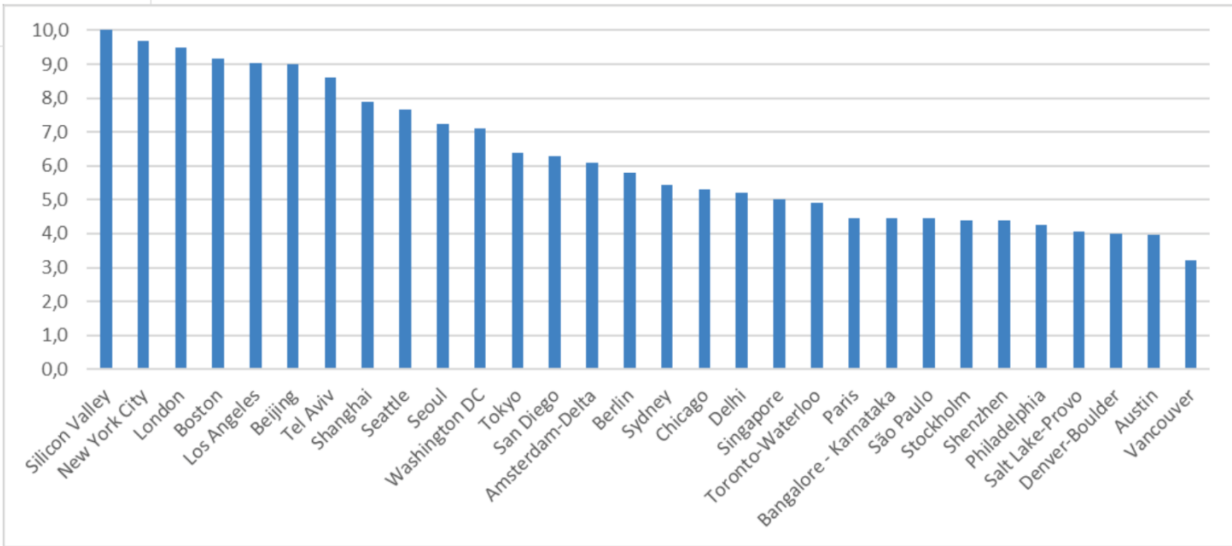


Figure 2.9 – Global start-up ecosystem ranking 2021

Source: constructed by the author

Of the twelve most valuable unicorns in the world, the five largest are based in the United States, followed by four in China, and none in the European Union. Google surpassed Amazon (currently valued at $1.7 trillion) with a market value of $1.9 trillion to take first place (Table 2.1).

Table 2.1

Most valuable unicorns worldwide as of 2022.03.01

#	Name	Market	Type	Valuation (billion USD)	Location
1	Google	B2C	Deep tech Artificial intelligence	1 900	Mountain View United States
2	Amazon	B2C Home living Transportation Logistics & delivery	Marketplace & Commerce	1700	Seattle United States
3	Tesla Motors	B2C Energy Transportation Autonomous & sensor tech Clean energy Energy Storage	Artificial intelligence Autonomous & sensor tech Deep tech Selling own inventory Manufacturing	808.6	Palo Alto United States
4	Nvidia	B2B, B2C Gaming Console & PC gaming	Machine learning Deep learning Artificial intelligence Deep tech Hardware	601.9	Santa Clara United States
5	Meta (Facebook)	B2C Media Social Media	Big data Artificial intelligence Advertising Saas	510.2	Menlo Park United States
6	ByteDance	B2C Media Telecom	Natural language processing	400.0	Beijing China

		Content production	Big data Deep tech Subscription		
7	Meituan	B2C Telecom Marketing Ecommerce solutions	Artificial intelligence Commission Marketplace & Commerce	360.3	Beijing China
8	Alibaba	B2B Enterprise software	Marketplace & Commerce Saas	283.0	Huangzhou China
9	Kuaishou	B2C Media Enterprise software Content production	Machine learning Artificial intelligence Advertising	214.0	Beijing China
10	Salesforce	B2B Marketing Enterprise software CRM & sales	Artificial intelligence Subscription Saas	202.2	San Franciso United States

Source: constructed by the author

By comparison, the most valuable EU unicorn, Adyen (based in Amsterdam), is valued at €56.8 billion (see Table 2.2). In the EU, Adyen is followed by Spotify and Klarna (both based in Stockholm). Of the twelve most valuable EU unicorns, five are based in Germany, three in Sweden, and one each in the Netherlands, Ireland, Denmark, and Belgium.

Table 2.2

Most valuable unicorns in the EU as of 01.03.2022

#	Name	Market	Type	Valuation (billion USD)	Location
1	Adyen	B2B Fintech Payments	Machine learning Artificial intelligence Commission Saas	56.8	Amsterdam Netherlands
2	Spotify	B2C Music Media Streaming	Machine learning Artificial intelligence Subscription	52.0	Stockholm Sweden
3	Klarna	B2B, B2C Fintech Payments	Commission	45.6	Stockholm Sweden
4	BioNTech	B2B Health Biotechnology	Machine learning Artificial intelligence Deep tech	36.4	Mainz Germany
5	Flutter Entertainment	B2C Gaming Betting & Gabling	Commission	29.4	Dublin Ireland
6	Genmab	B2B Health Biotechnology	Deep tech Machine learning Artificial intelligence	17.4	Copenhagen Denmark
7	Delivery	B2C	Commission	15.2	Berlin

	Hero	Food Food logistics and delivery	Marketplace & Commerce		Germany
8	Zalando	B2C Fashion Footwear	Artificial intelligence Marketplace & Commerce	13.7	Berlin Germany
9	ARGEN-X	B2B Health Biotechnology	Commission	13.0	Ghent Belgium
10	Oatly	B2C Food Innovative food	Selling own inventory Manufacturing	13.0	Malmo Sweden
11	AUTO1 Group	B2C Transportation Search, buy & rent	Marketplace & Commerce	12.9	Berlin Germany
12	CureVac	B2B Health Biotechnology	Manufacturing	12.8	Tubingen Germany

Source: constructed by the author

Table 2.2 shows that EU unicorns are most active in fintech (20.3%)58, enterprise software (12.6%) and health (12.2%), in line with worldwide trends, but it is clear that they exist in almost every sector.

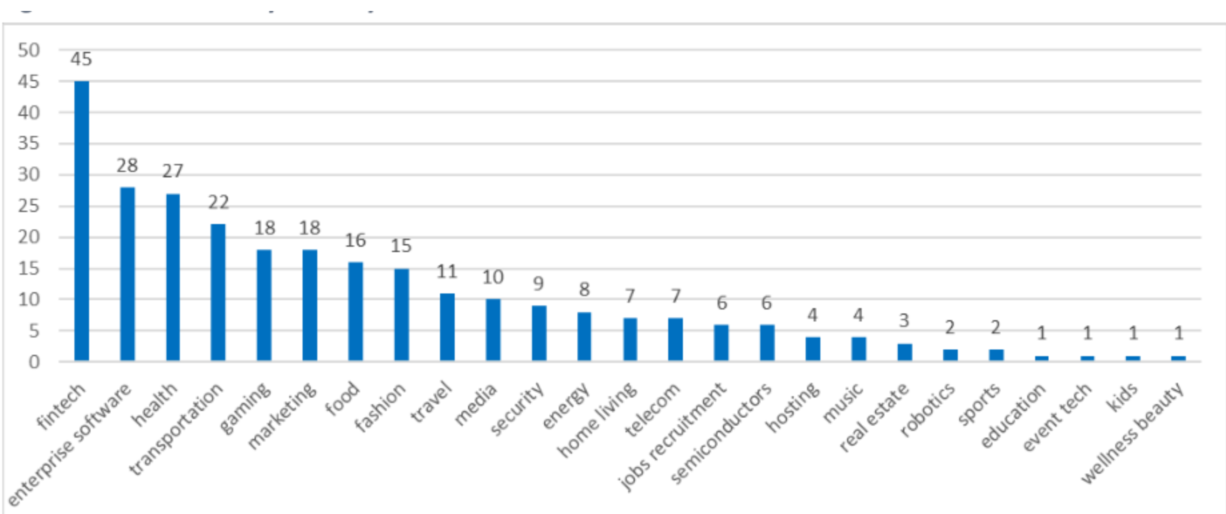


Figure 2.10 – EU unicorns by industry as of 2022.03.01

Source: constructed by the author

Figure 2.10 shows that the startup ecosystem is the cradle and key development factor for unicorns. The more companies there are in the ecosystem, the higher the probability that some of them will reach a valuation of $1 billion. The only outlier in the chart is China, where venture capital is generally controlled by the state and many policies have been enacted to strengthen control over the Internet industry. Industries such as fintech, social media, gaming, e-commerce and even live streaming are increasingly criticized by regulators for their unbridled growth and their associated social problems. The United States is currently the clear champion (not shown to scale in the figure, but it is four times smaller), but other countries are also on a growth trajectory. From this perspective, fully tapping the potential of the EU internal market and overcoming the legal and economic barriers that persist between EU member states is an important factor.

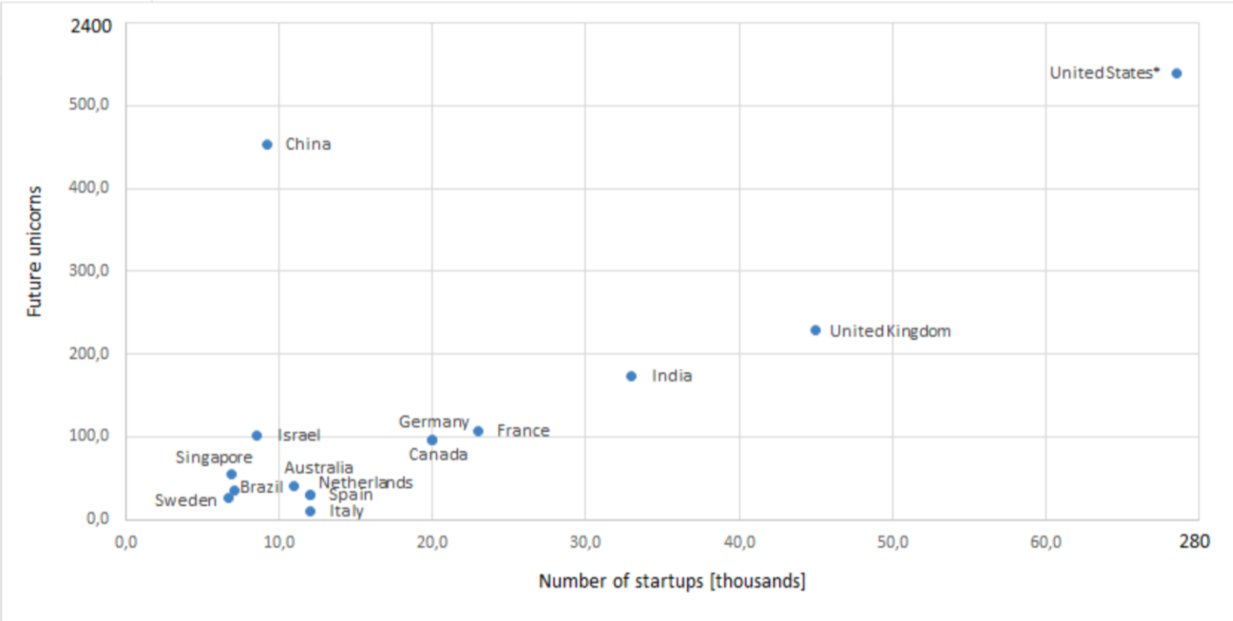


Figure 2.11 – Future unicorns vs number of start-ups (in thousands)

Source: constructed by the author

Figure 2.11 shows that most start-ups are active in the fields of artificial intelligence and big data, and their number is likely to grow more dynamically in the future. Three other fields are also likely to catch up: (1) advanced manufacturing and robotics; (2) blockchain; and (3) agricultural technology (AgTech) and new foods, as investment in these technologies continues to increase. However, investment in advertising technology (AdTech) and digital media is declining.

Digital public services. DESI monitors online public services by assessing whether each step of a member state's key services can be fully delivered online. In 2021, the quality rating of digital public services for citizens reached 75 points (out of 100) and the quality rating of digital public services for enterprises reached 82 points (out of 100). Estonia, Finland, Malta and the Netherlands scored the highest in DESI's digital public services, while Romania and Greece scored the lowest. The

Towards a Digital Decade proposal sets the goal that all important public services for citizens and enterprises should be fully delivered online by 2030.

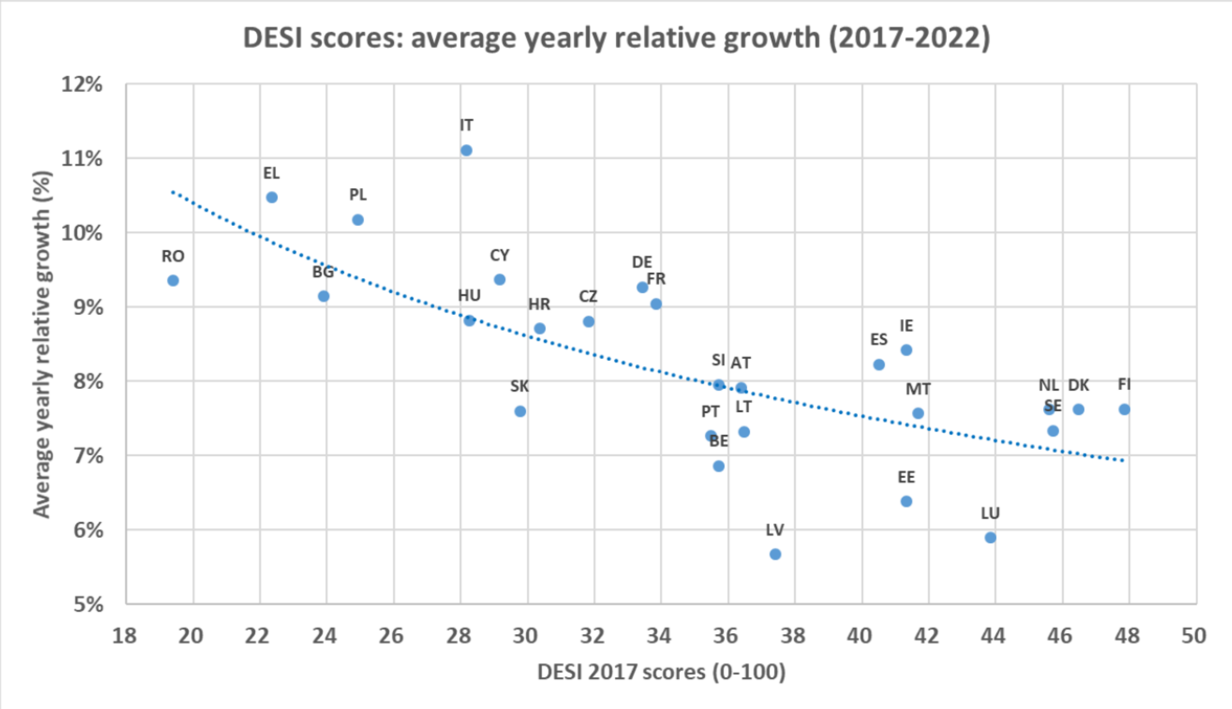


Figure 2.12 – Digital Economy and Society Index – Member States' relative progress in the period 2017-2022

Source: constructed by the author

Figure 2.12 shows the progress made in the overall digitalization of the Member States' economies and societies over the past five years. For each country, the figure shows the relationship between its 2017 DESI value (horizontal axis) and the average annual growth rate of DESI between 2017 and 2022 (vertical axis). As in classical economic growth theory, general convergence occurs when countries with lower levels of digital development grow faster (left side of the graph). The DESI values clearly show the general convergence pattern in the EU between 2017 and 2022. The blue line in the figure represents the estimated convergence pattern. Countries above the blue line have stronger growth momentum than the convergence curve would predict, thus achieving "overperformance". The opposite is true for countries below the blue line.

2.2. THE STATE OF E-COMMERCE IN EUROPE AND THE WORLD

Digital commerce can be understood as a modern interpretation of the WTO definition of e-commerce: “the production, distribution, marketing, sale or delivery of goods and services by electronic means”. However, the term is often used to describe a combination of facts.

For measurement purposes, it is defined as “all international trade that is ordered and/or delivered digitally” (OECD, WTO, IMF, 2020), (IMF et al., 2023). It therefore includes part of the trade in goods that is ordered digitally, often through digital platforms, such as mobile phones delivered to your door in the form of a package. Digital commerce also includes part of the trade in services when these services are ordered and/or provided digitally, such as online communications and internet access services or content streaming services.

In political discussions, the term “digital commerce” is widely used to refer to commerce in the digital age. In addition to goods and services ordered and/or delivered digitally, it also includes:

1) increased trade in all economic sectors due to lower trade costs caused by increased digital connectivity;

2) the digitization of trade documents and processes, including border trade;

3) increased cross-border data flows to support international trade transactions.

The impact of digitalization on trade is revolutionary. It has increased the scale, scope, and speed of commerce, allowing companies to offer new products and services to more digitally connected customers around the world. It has enabled companies, especially small ones, to use new and innovative digital tools to overcome barriers to growth.

Digitalization is changing the way we trade goods. For example, the growth of online platforms has led to an increasing number of small parcels crossing international borders (López González and Sorescu, 2021). This raises a range of issues for policymakers, including at borders, including the physical management of parcel trade, the impact on risk management (e.g., with respect to counterfeit goods or biosecurity standards), and the impact on revenues associated with the collection of taxes and tariffs (Andrenelli and López González, 2019).

In addition, digital technologies can help reduce trade costs at all stages of the supply chain. The continued implementation of the WTO Trade Facilitation Agreement (TFA) has enabled more comprehensive digitalization of trade processes through the electronic filing and processing of trade documents, the use of digital certificates and signatures, and the introduction of a single electronic trading window (OECD, 2023). In agricultural and food trade, digital technologies can enable the exchange of electronic sanitary and phytosanitary certificates (e-certification) for animal and plant products, conformity assessment platforms, traceability and supply chain integrity technologies, remote pest screening, and enhanced shipment declaration and control (OECD, 2021).

Meeting new regulatory requirements, product standards, and sustainability needs requires the ability to track, report, and monitor information between supply chain participants, including environmental impacts during the product life cycle (e.g. tracking carbon footprints). In this context, digital technologies are also playing an increasingly important role in the exchange of information (and related data or documentation requirements) at different stages of the supply chain.

Rapid technological developments have also contributed to the growth of international trade in services. Information and communications technology services form the backbone of digital commerce, providing the necessary network infrastructure and supporting the digitization of other types of services (Benz, Jaax, and Yotov, 2022[10]). At the same time, digitization makes more existing services tradable and enables new services (such as cloud computing or electronic payments). In addition, new technologies and business models are blurring the already blurred boundaries between goods and services and between delivery methods, resulting in new combinations of goods and services (Aoki et al., 2023).

Digital connectivity has made a significant contribution to reducing domestic and international trade costs. It is estimated that a 1% increase in digital connectivity is associated with a 0.3% reduction in domestic trade costs and a 0.1% reduction in international trade costs. Thus, improving digital connectivity has a dual benefit: it reduces both domestic and international trade costs. Importantly, the impact of digital connectivity on international trade costs was three times greater in 2018 than in 1995 (López-Gonzalez, Sorescu, and Kaynak, 2023[12]) (Figure 2.13).

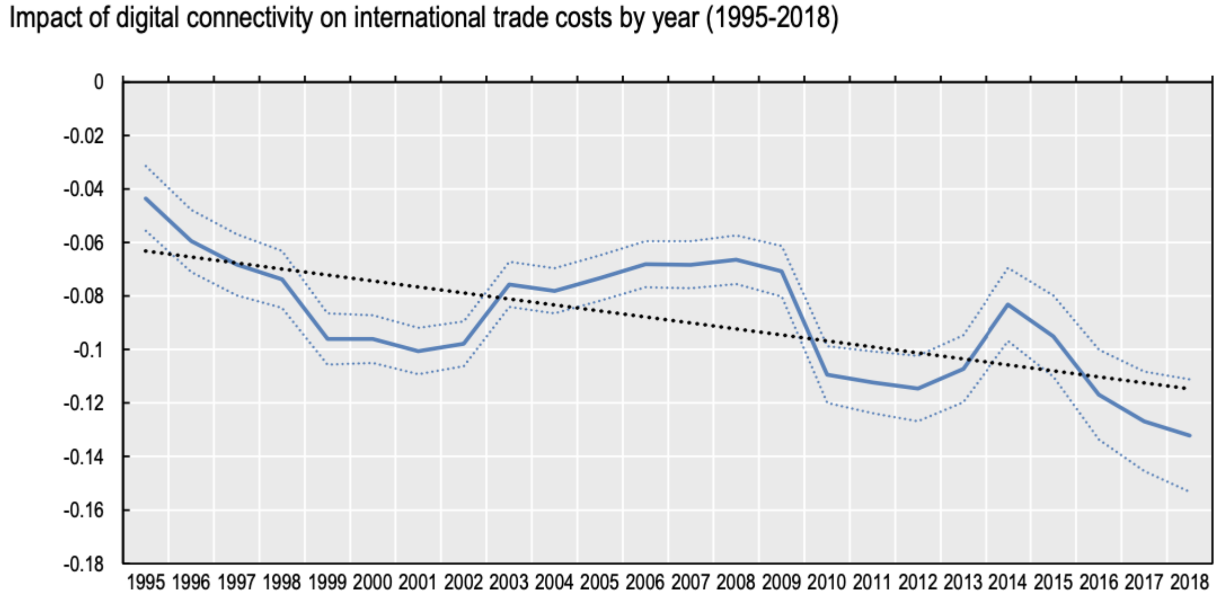
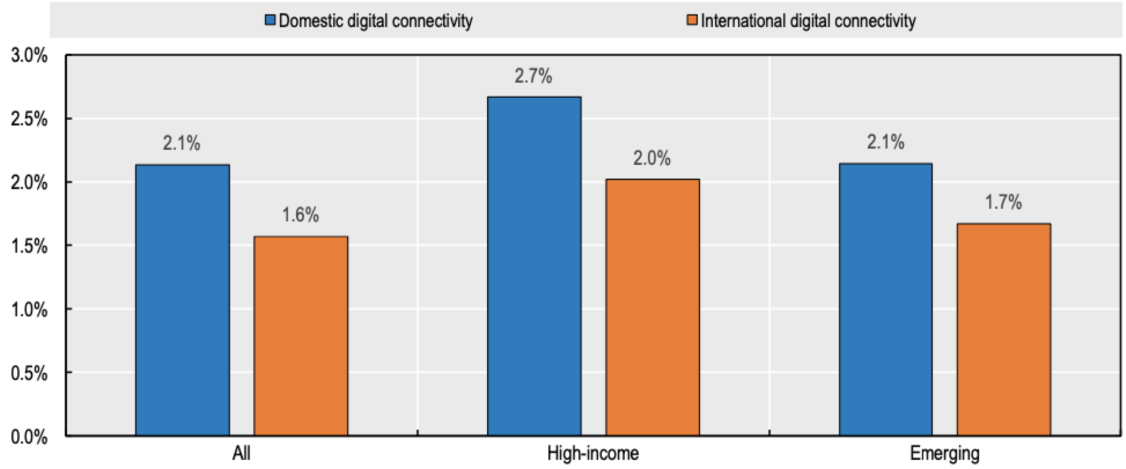


Figure 2.13 – The trade cost reducing impact of digital connectivity is three times higher today than in 1995

Source: constructed by the author

The trade cost-reducing effects of digital connectivity have significant trade-enhancing effects. On average, a 1% increase in domestic digital connectivity is associated with a 2.1% increase in domestic trade and a 1.5% increase in international trade (Figure 2.14, Panel A). The impact of digital connectivity on trade is slightly larger in high-income countries than in emerging markets. Digital connectivity is also important for low-income countries, as these countries benefit more from improved digital connectivity in terms of international trade than do middle- and high-income countries (López-Gonzalez, Sorescu, and Kaynak 2023).

A. Impact of a 1% improvement in bilateral digital connectivity on domestic and international trade by income level



B. Impact of a 1% improvement in bilateral digital connectivity on domestic and international trade by sector

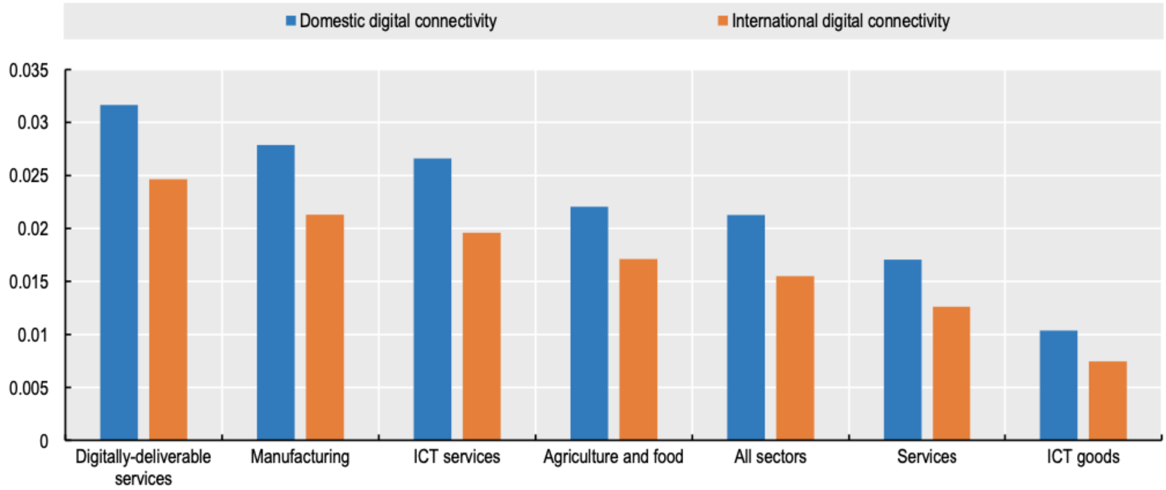


Figure 2.14 – Growing digital connectivity delivers a double dividend

Source: constructed by the author

The benefits of enhanced digital connectivity extend beyond the digital sector. As expected, they perform best in digitally delivered services, but also have a strong presence in manufacturing, agriculture, and food production (Figure 2.14, Panel B). Digital transformation is critical for traditional industries.

Digitalization leads to more inclusive outcomes. By using digital tools to sell goods across borders, including digital platforms or websites, micro, small, and medium enterprises (MSMEs) and women entrepreneurs can internationalize more cost-effectively. Better and faster access to vital knowledge and information helps small businesses overcome information disadvantages (especially compared to large companies) and compete on equal terms. Digital platforms also increasingly offer new transaction ecosystems, giving small businesses better access to warehousing, logistics, electronic payments, credit, and insurance services.

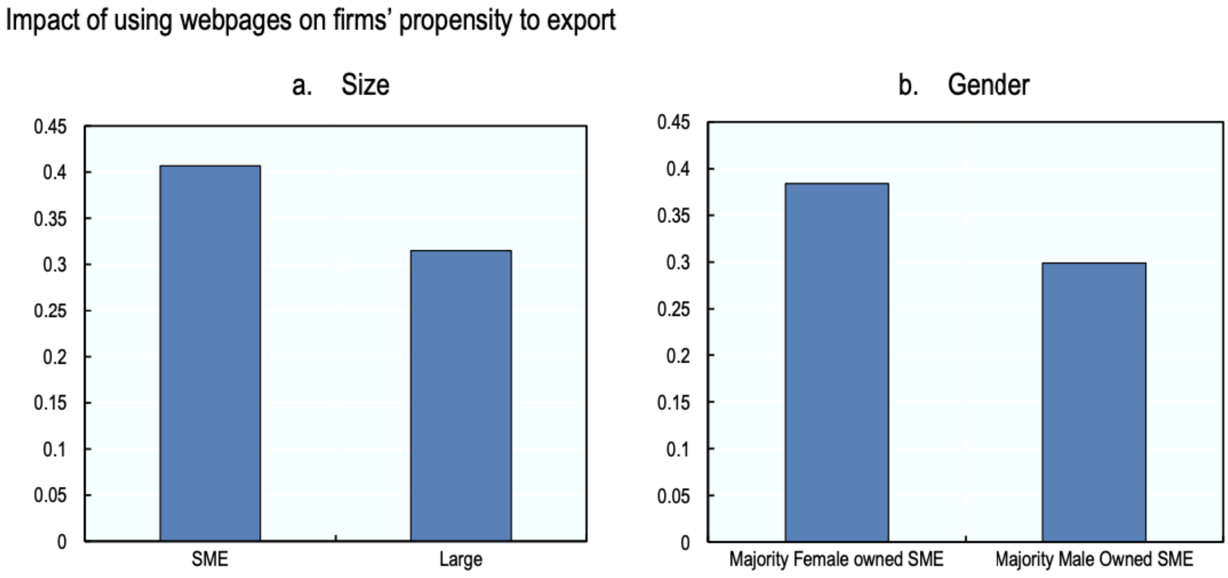


Figure 2.15 – The use of digital tools enables more inclusive outcomes

Source: constructed by the author

There is evidence that the use of digital tools such as websites is associated with a higher propensity to export among MSMEs and women-owned businesses (Andrenelli and López González, forthcoming) (Figure 2.15). Moreover, automating border processes can help MSMEs in both developed and developing countries participate in international trade and increase their exports and imports by 4.5% to 6.5% (López González and Sorescu, 2021).

Measuring digital trade is not easy, but a multi-agency process is underway to better capture it in trade statistics (OECD, WTO, IMF, 2020[4]) (IMF et al., 2023[5]). This research suggests that existing trade statistics do not significantly underestimate digital trade; the challenge is to make digital commerce visible. This means that a book ordered digitally is recorded in trade statistics under the corresponding customs code, but the statistics do not distinguish whether the book was ordered digitally. Similarly, measuring cross-border services transactions has always been difficult, but in digital trade the challenge is exacerbated by the need to identify digitally ordered and digitally provided services. In the absence of comprehensive and comparable (official) digital trade statistics, proxy indicators can be used to understand the nature and development of digital trade (López-Gonzalez, Sorescu, and Kaynak, 2023).

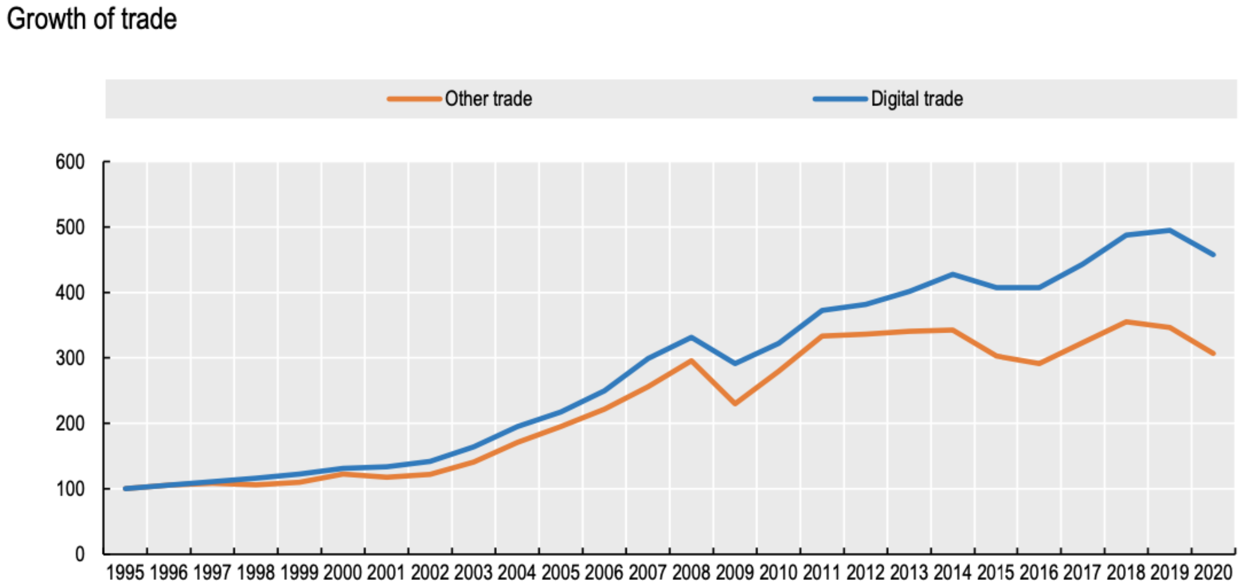


Figure 2.16 – Digital trade is growing faster than non-digital trade

Source: constructed by the author

Digital transformation has been underway for decades, but since 2011, the growth of global digital trade has clearly decoupled from the growth of other trade (Figure 2.16). By 2020, digital trade will account for 25% of global trade, or nearly $5 trillion.

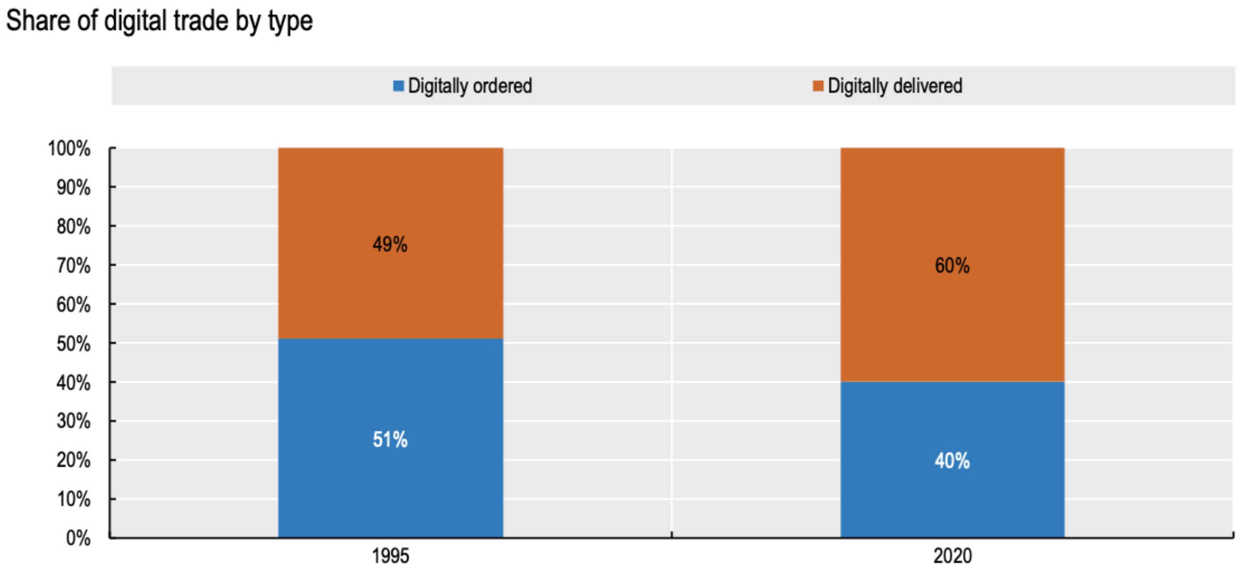


Figure 2.17 – Digitally delivered trade is increasingly important

Source: constructed by the author

The structure of digital commerce has also changed. In 1995, digital commerce accounted for about 49% of projected digital commerce. By 2020, this share had risen to 60% (Figure 2.17). This was due to the increase in ICT services, which accounted for 14.2% of projected digital commerce in 2020 (compared to 6.9% in 1995). Overall, these changes are relatively small, but suggest that digital commerce is becoming increasingly digital (and thus service-oriented).

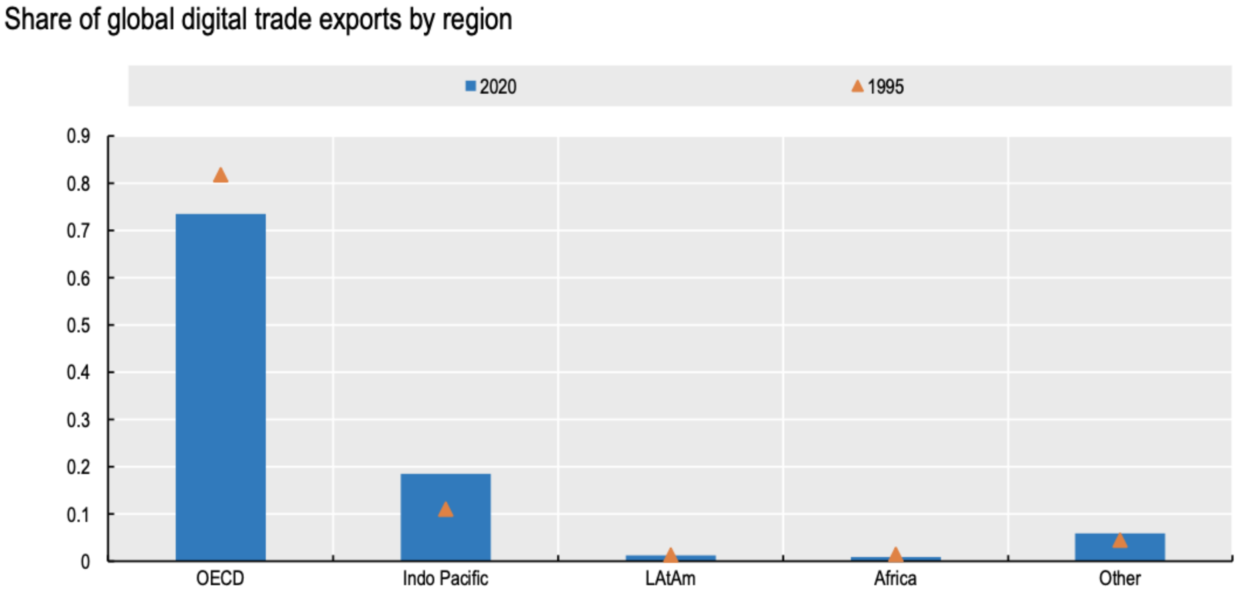


Figure 2.18 – The geography of digital trade is shifting, particularly to the Indo-Pacific region

Source: constructed by the author

In 1995 (Figure 2.18), OECD countries accounted for 82% of global digital trade exports. By 2020, this share had fallen to 73%. The Indo-Pacific region has grown fastest, accounting for 18% of global digital trade (11% in 1995).

The European Commission has proposed two legislative proposals to improve the EU’s digital services rules: the Digital Services Act (DSA) and the Digital Markets Act (DMA). They form a unified set of EU-wide rules to create a safer and more open digital space.

The DSA and DMA have two main objectives: (i) create a safer digital space that protects the fundamental rights of all users of digital services; and (ii) create a level playing field to promote innovation, growth and competitiveness in the internal market and globally. 60

In 2021, about one in five small and medium-sized enterprises (SMEs) in the EU sold online, accounting for 12% of total sales. Between 2015 and 2021, the share of SMEs selling online increased by 3 percentage points and the share of SMEs selling online increased by 2 percentage points.

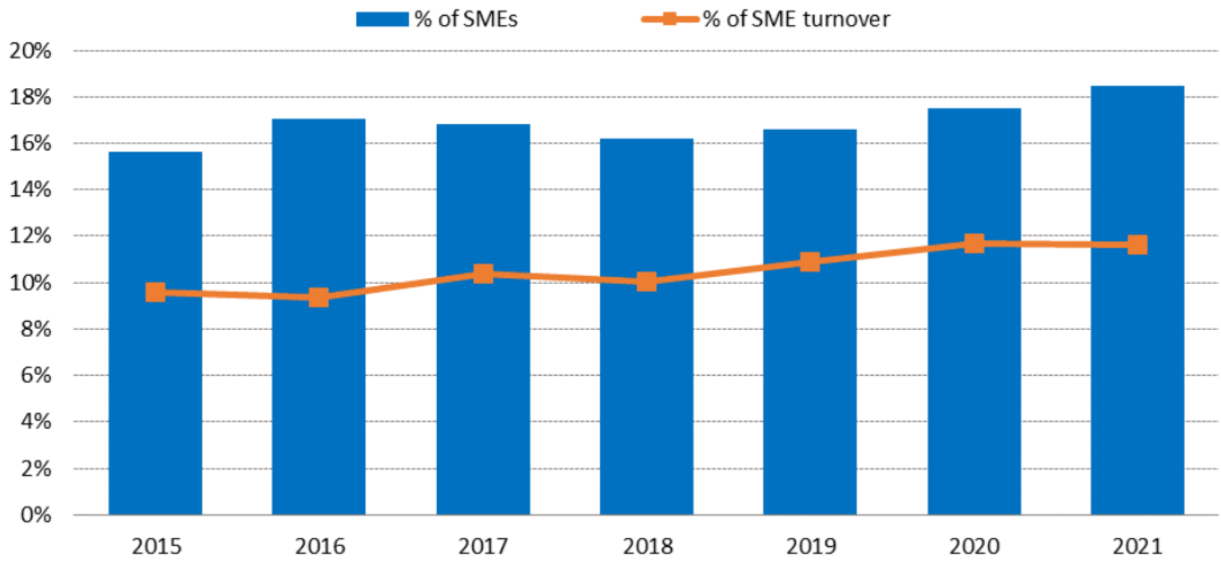


Figure 2.19 – Trends in e-commerce (% of SMEs, % of SME turnover), 2015-2021

Source: constructed by the author

Companies benefit from cross-border e-commerce by leveraging economies of scale. This helps reduce costs, improve efficiency, enhance competitiveness and increase productivity. Cross-border e-commerce is even more important for companies that are limited to a small domestic market, especially SMEs. However, in 2021, only 9% of SMEs sold online to customers in other EU countries. SMEs in Denmark, Sweden, Ireland, Lithuania and Belgium have the largest share of online sales (30% or more). Austria leads in cross-border e-commerce (16% of Austrian companies sell online cross-border to other EU countries), followed by Belgium, Denmark, Malta and Slovenia (all over 13%).

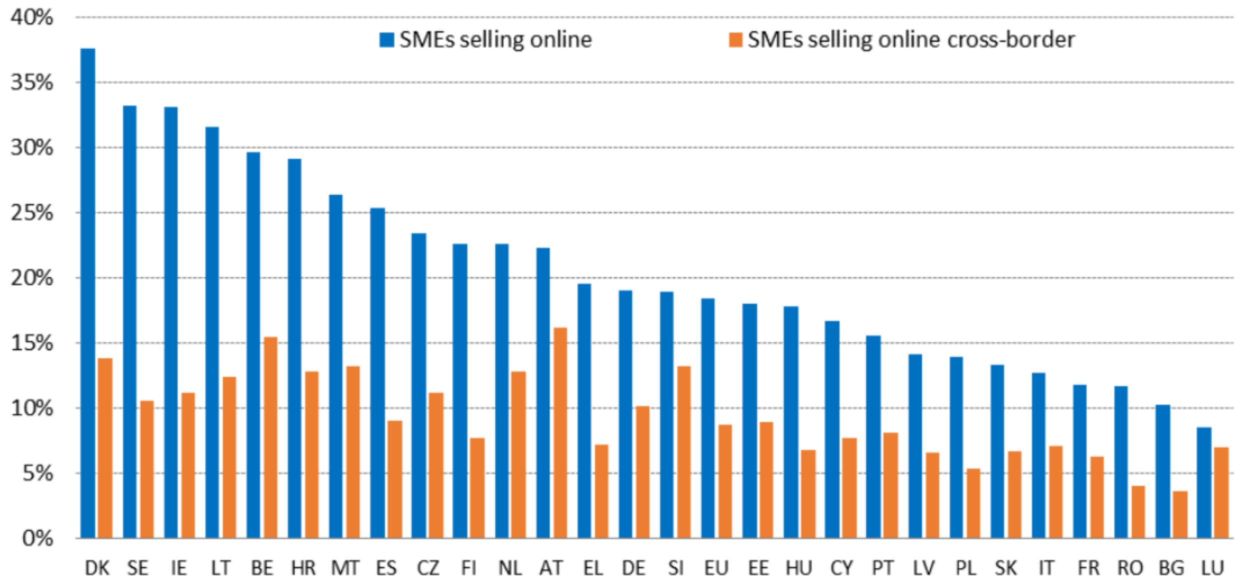


Figure 2.20 – SMEs selling online and selling online cross-border (2021) (% of SMEs)

Source: constructed by the author

The majority (56%) of SMEs selling online to other EU countries do not experience difficulties selling to customers in other EU countries. However, 43% of SMEs say that at least one obstacle is primarily due to economic factors (e.g., 28% cite high costs for shipping or returning products). Problems with resolving complaints and disputes (13%) and lack of foreign language skills (10%) are also cited by SMEs as difficulties in selling online to other EU countries.

Conclusion for the seconf section.

In the second section we provided a statistical analyses of digital economy development.

The digital economy fosters growth and productivity and supports inclusive development. This growth is demonstrated by the adoption of digital technologies by a large number of consumers, firms and governments albeit at varying rates across sectors and countries.

The rise of the digital economy is not without its challenges, however. Digitalisation creates new jobs, destroys old ones, and alters the composition of existing jobs. It contributes to skill- biased technological change, a major cause of rising inequality in labour income.

Digitalisation poses particular challenges for developing countries. Maximising the benefits of the digital economy depend on a basic level of ICT infrastructure that many emerging economies still lack. Developing countries need to engage in strategic planning to maximise the development impact of digitalization. Firstly it concerns internet coverage of households. Also we have challenges in diversity between rural and city.

The next challenge is human capital. The issue of developing the skills needed for the digital economy is becoming increasingly important. It is necessary to include digital skills in specialist training programs, as well as the need for retraining and advanced training courses for personnel. Also, the disproportion between men and women.

There is also a severe gender balance issue, with only 19% of ICT specialists and one in three science, technology, engineering and/or mathematics (STEM) graduates being women.

There is a substantial gap between large companies and SMEs, not only in the use of advanced technologies, but also of basic digital solutions, such as having an enterprise resource planning (ERP) software package and engaging in e-Commerce.

It is also worth noting the growth of IT companies themselves, which not only play a secondary role in the production of digitalization, but also create new digital products themselves. As a result, large IT companies appear, the number of which will grow. As for the state of e-commerce in Europe and the world, we can say that it is growing, but this process does not happen without challenges.

Beyond digitally ordered and/or delivered goods and services this includes:

1) rising trade across all sectors of the economy due to lower trade costs spurred by rising digital connectivity;

2) digitalisation of trade documents and processes, including at the border;

3) increased flows of data across international borders in support of international trade transactions.

The trade cost reducing impact of digital connectivity is three times higher today than in 1995

The benefits of growing digital connectivity extend beyond ‘digital’ sectors. They are, as expected, largest for digitally deliverable services, but they are also important for manufacturing and for agriculture and food produce (Figure 2.14, Panel B). The digital transformation is key for traditional sectors.

Digitalization leads to more inclusive outcomes, the use of digital tools like webpages is linked with greater export propensities for MSMEs and for women-owned firms.

Digital trade is growing faster than non-digital trade and digitally delivered trade is increasingly important. A majority (56%) of SMEs with web sales to other EU countries have no difficulties when selling to customers in other EU countries.

SECTION 3. PERSPECTIVES OF INTERNATIONAL BUSINESS OF IT COMPANIES IN DIGITAL ECONOMICS

3.1. TRENDS OF DEVELOPMENT OF IT BUSINESS IN DIGITAL ECONOMICS

Several trends are emerging in the IT market right now. The McKinsey Technology Council has identified the most important current technology trends. The analysis assesses the momentum of each trend by looking at quantitative indicators such as interest, innovation, investment, and talent. Given the long-term and interdependent nature of these trends, we also discuss the underlying technologies, uncertainties, and issues that accompany each trend.

Two standout trends for 2023 are next-generation artificial intelligence and electrification and renewable energy. Next-generation artificial intelligence grew nearly 700% in Google searches from 2022 to 2023, accompanied by a significant increase in job postings and investment. The pace of technology innovation is impressive. Between 2023 and 2024, the size of prompts that large language models (LLMs) can handle (the so-called “context window”) increased from 100,000 tokens to 2 million tokens. This is roughly the difference between adding a research paper to the model specification and adding about 20 novels. Generative AI continues to advance in processing power, moving from text summarization and image generation to advanced capabilities for video, images, audio, and text. This has triggered a dramatic increase in investment and innovation in developing more powerful and efficient computer systems.

The large-scale underlying models that drive generative AI, such as B. LLM, are integrated into a variety of enterprise software tools and used for a variety of purposes, such as customer-facing chatbots, creating advertising campaigns, accelerating drug discovery, and more. We expect this expansion to continue and push the boundaries of AI capabilities. Executive awareness of generative AI innovation has increased interest, investment, and innovation in other trends such as AI technology and robotics, which is a new addition to our trend analysis this year.

Advances in AI are ushering in a new era of more powerful robots, driving greater innovation and wider applications.

Electrification and renewable energy are other trends that are resilient to economic headwinds, and they have received the highest levels of investment and attention of all the trends we evaluated. Hiring in this industry has also increased slightly.

Despite the decline in investment and hiring for many trends in 2023, the long-term outlook remains positive. This optimism is supported by the long-term continued growth in the number of job openings for the analyzed trends (an increase of 8% between 2021 and 2023), as well as the continued innovation and growing interest of companies in these technologies, especially for future growth.

Technology equity investment fell 30% to 40% to about $570 billion in 2023, driven by rising financing costs and caution about short-term growth prospects. This has led investors to favor technologies with high revenue and high profit potential. This approach reflects the strategic view of leading companies, who recognize that the full adoption and expansion of cutting-edge technologies is a long-term undertaking. This insight is reflected in the company's diversified investment in different technology fields and its focus on those with the greatest potential to push the boundaries of technology. While many technologies maintained a cautious investment posture last year, investment in artificial intelligence increased sevenfold, driven by major advances in text, image and video generation.

Despite the general decline in private equity investment, the pace of innovation has not slowed down. The three major trends of the "AI revolution" - generative AI, applied AI and the industrialization of machine learning - have accelerated innovation. The new generation of AI creates new content from unstructured data (such as text and images), applied AI uses machine learning models for analysis and prediction tasks, and the industrialization of machine learning accelerates and reduces the risk of developing machine learning solutions. Industrialization with applied AI and machine learning saw the strongest innovation growth, driven by growing interest in generational AI, as reflected in the growth in publications and patents from

2022 to 2023. Meanwhile, electrification and renewable energy continue to attract significant interest, as reflected in news mentions and web searches. Their popularity is driven by the increase in global renewable energy capacity, their key role in global decarbonization efforts, and the growing need for energy security in the face of geopolitical tensions and energy crises.

The talent landscape largely reflects the investment outlook for the technology trends in 2023. The technology industry faces massive layoffs, especially at large technology companies. Job postings related to the technology trends we studied fell by 26%, a larger drop than the 17% drop in global job postings. The sharp decline in demand for skilled workers in the technology trends is likely due to technology companies' efforts to cut costs in the face of falling revenue growth forecasts. Despite this decline, positions in trends with strong investment and innovation, such as generational AI, not only maintained their levels but even increased, reflecting strong demand for emerging and advanced skills. Electrification and renewable energy are other trends with positive job growth, driven in part by public support for infrastructure spending.

While demand for skilled workers fluctuates in the short term, our analysis of 4.3 million job postings across 15 technology trends highlights significant skills gaps. Compared to the global average, less than half of potential candidates have the high-demand technology skills listed in job postings. While job postings for many trends decline from 2022 to 2023 compared to the previous year, the number of technology-related job postings in 2023 is still 8% higher than in 2021. This suggests long-term growth potential (Appendix A).

The evolution of enterprise technology adoption is often described as an S-curve, following the following pattern: technology innovation and exploration, technology experimentation, initial pilot projects within the organization, scaling up of impact across the organization, and ultimately full adoption (Figure 3.1).

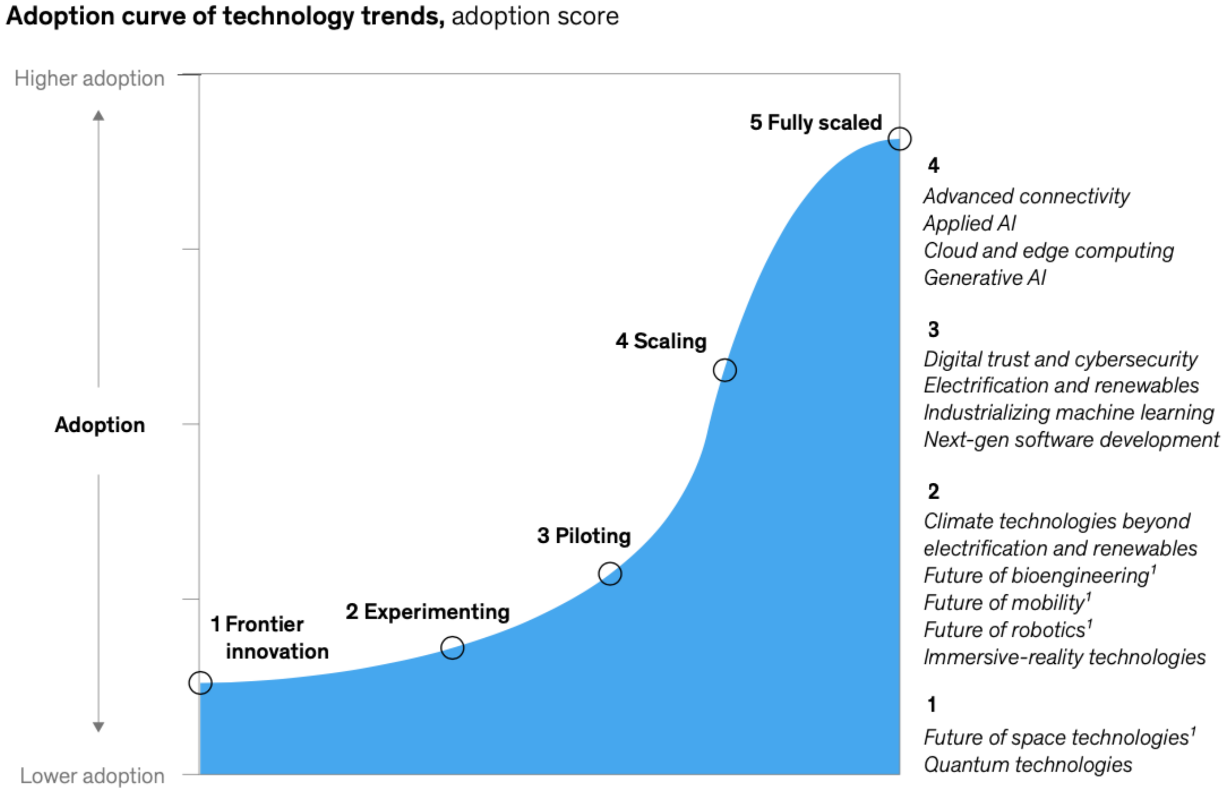


Figure 3.1 – Technologies progress through different stages, with some at the leading edge of innovation and others approaching large-scale adoption.

Source: constructed by the author

This pattern is evident in this year's survey of enterprise adoption of our 15 technologies. Adoption rates vary by industry and company size, as does perceived progress.

We see that technologies in the early innovation and experimentation stages of the S-curve are either at the forefront of progress, such as quantum technology and robotics, or are more relevant to specific industries, such as bioengineering and aerospace. Factors that may influence the adoption of these technologies include high costs, specialized applications, and the trade-off between broad technology investments and focusing on a few technologies that may provide significant first-mover advantages.

As adoption increases and companies move beyond the experimental stage, adoption accelerates, with companies investing more in pilot projects and expansion. We see this shift happening for many trends, such as next-generation software development and electrification. The rapid development of next-generation artificial intelligence leads the trends analyzed: about a quarter of respondents say they are expanding its use. More mature technologies, such as cloud computing, edge computing, and advanced connectivity, continue to be adopted rapidly and serve as drivers of adoption for other new technologies (Figure 3.2).

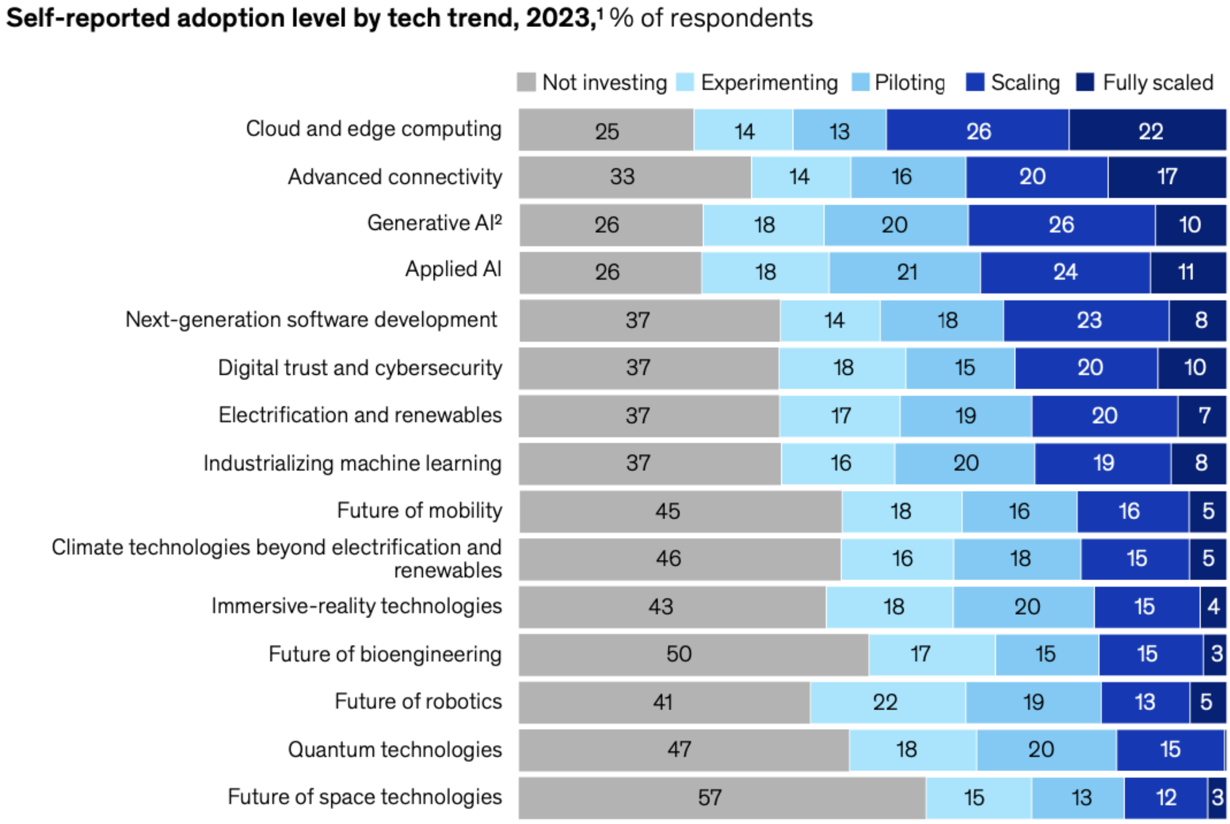


Figure 3.2 – More-mature technologies are more widely adopted, often serving as enablers for more-nascent technologies.

Source: constructed by the author

Scaling technology adoption also requires a supportive external ecosystem, where user trust and willingness, economic viability of business models, regulatory frameworks, and availability of skilled workers play critical roles. Because these ecosystem factors vary by region and industry, we observe different adoption scenarios. For example, while leading banks in Latin America are on par with their North American counterparts in implementing next-generation AI use cases, adoption of robotics in the manufacturing industry varies widely, as different labor costs affect the business case for automation.

Leaders should manage this complexity and align their long-term technology adoption strategy with their internal capabilities and the conditions of the external ecosystem to ensure that new technologies are successfully integrated into their business models. Executives should monitor ecosystem conditions that may affect their priority use cases to decide on the appropriate level of investment while managing uncertainty and budget constraints on the path to full adoption (see the “Global Adoption Developments” section within each trend for examples of adoption dimensions or specific use cases within the trend that executives should monitor). Leaders who take a long-term view—that is, develop their talents, test and learn where they can make an impact, and redesign their companies for the future—can become leaders in each category.

Innovation, interest, investment, and adoption, by technology trend, 2023

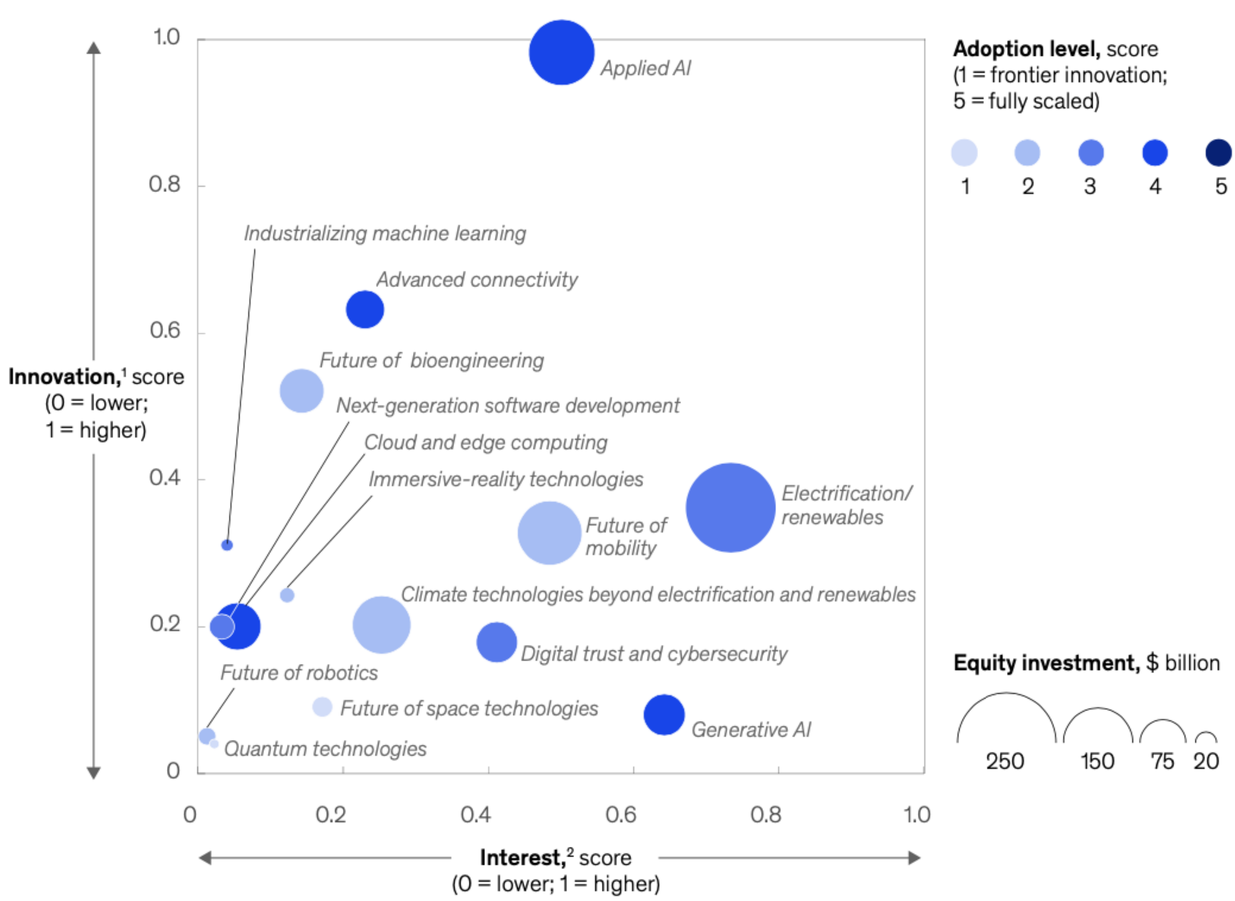


Figure 3.3 – Each trend is scored based on its level of innovation, interest, investment, and adoption

Source: constructed by the author

The scientists reflected on all 15 technology trends. These trends are divided into five categories: the AI revolution, the digital future, the computing and connectivity frontier, cutting-edge technology, and the world of sustainable development. Of course, looking at these groupings offers considerable potential when considering combinations of trends (Figure 3.3).

Therefore, this study should be analyzed in detail:

1. Gen-AI has attracted widespread interest, and individuals and organizations in different regions and industries are exploring its potential. According to McKinsey's latest global AI status survey, 65% of respondents said that their organizations regularly use Gen AI in at least one business function (up from a third last year). 1Gen AI use cases have the potential to create $2.6 to $4.4 trillion in value per year.

AI is emerging as a leader in the trend space, tied for first place with electrification and renewable energy, and has the highest percentage of respondents expanding its implementation. This highlights the importance of AI as a key growth trend that needs to be closely monitored throughout the year.

Many companies have made progress in adopting next-generation AI in the past year and are now working to promote it across the enterprise. While the use of next-generation AI has increased significantly across sectors, the technology, media, and telecommunications industry has emerged as a leader in adoption.

Lack of support for local languages poses a challenge to global adoption. Countries such as India, Japan, and the Middle East have also advanced their LLM programs. In Africa, the priority given to data locality and proximity has hampered the development of LLMs.

Significant progress has been made recently in the development of multilingual models. Multilingual capabilities are essential for any LLM, with an emphasis on localization, including the use of colloquial language, technical terminology, and other nuances.

The spread of advanced technology depends on both the technology itself and how it is used. Advances in the following areas can drive AI adoption to the next level:

- – Clearly defined return on investment (ROI) for a wide range of horizontal and vertical use cases across the industry, and a proven ability to manage risk and ensure security when developing and deploying new AI solutions.
- Lowering computational costs while improving overall AI efficiency (e.g., by improving latency).

2. Applied AI. In 2024, the impact of analytical AI technologies, including applications of machine learning (ML), computer vision, and natural language processing (NLP), will continue to grow across industries. Companies use data to gain insights, automate processes, transform their businesses, and make better decisions. McKinsey Research estimates that AI applications could unlock $11 to $18 trillion in economic value each year. 1 Enthusiasm for generative artificial intelligence (Gen. AI) has led to a growing awareness of the potential value of applied AI. In our recent global survey on the state of AI in 2024, 67% of respondents said their companies will increase their investments in AI over the next three years. 2 The survey shows that companies across all business sectors will continue to benefit from their AI initiatives. Regulators and policymakers also recognize the growing influence of AI. For example, the European Parliament passed a harmonized EU law on AI.

3. Industrialization of machine learning (ML), also known as machine learning operations (MLOps), refers to the expansion and maintenance of ML applications in the enterprise. Throughout 2024, MLOps tools will rapidly evolve, with improved functionality and interoperability. These tools facilitate the transition from pilot projects to robust business processes, enable the scaling of analytical solutions, and increase team productivity. Successful industrialization of machine learning helps make solutions sustainable, shortens the time to production of machine learning applications by eight to ten times, and reduces development resources by up to 40%. 1 Initially introduced by a few pioneering companies, MLOps is gaining traction as more companies use AI for a wider range of applications. The rise of generative artificial intelligence (Gen AI) has changed the AI landscape, requiring MLOps capabilities to be upgraded to meet its unique requirements. This is the latest area of

new development in the trend of industrialization of machine learning. MLOps and foundational model operations (FMOps) are essential for the safe and efficient industrialization and scaling of gene AI.

4. Next-generation software development. The software development landscape is currently undergoing profound changes, driven by the influx of cutting-edge technologies such as generative artificial intelligence (Generation AI) and cloud-native architectures. In 2023, AI tools will increase significantly, thanks to advances in software development and DevOps automation in previous years (such as continuous integration, continuous delivery, infrastructure as code, and improved integrated development environments). These innovations are revolutionizing the way engineers work throughout the software development life cycle (SDLC), from planning and testing to deployment and maintenance. These technological breakthroughs not only expand the capabilities of engineers, but also provide opportunities for less technically savvy professionals to participate in application development by simplifying and accelerating complex tasks.

While the path to widespread adoption may take longer due to barriers such as integration issues, lack of clear developer productivity metrics, and the need for significant retraining of developers and test engineers, the growing use of AI software development tools holds a promising future. Early adopters are already experiencing productivity gains, laying the foundation for broader adoption in the near future. This year will bring more breakthrough opportunities as mature technologies such as user-friendly low-code platforms, AI assistants throughout the SDLC, integration with gen-AI-enabled product management tools, and scalable cloud architectures converge to enable democratized development, high efficiency, and superior adaptability.

5. Digital trust and cybersecurity enable companies to manage technology and data risks, accelerate innovation, and protect assets. In addition, building trust in data and technology governance can improve business performance and improve customer relationships. This trend includes trust-enhancing technologies (such as digital

identity and privacy-enhancing technologies), cybersecurity capabilities (such as identity and access management), and Web3 (such as blockchain).

Digital trust and cybersecurity are growing in importance as companies adopt new and mature technologies (such as cloud and edge computing, applied artificial intelligence, and next-generation software development) in their businesses. 1 While adopting these new technologies brings exciting new benefits, it also exposes companies to cybersecurity and other risks, increasing the need for digital trust technologies. However, the adoption of digital trust and cybersecurity is hindered by many factors, including integration issues, organizational silos, skills shortages, and low consideration as a key component of the value proposition. To fully realize the benefits of digital trust and cybersecurity, top-down leadership and targeted changes across multiple areas of activity (from strategy and technology to business capabilities) are required.

6. Advanced connectivity technologies can revolutionize the experience of consumers and industries such as mobile, manufacturing, and agriculture. Companies have widely deployed mature technologies to improve their connectivity infrastructure, but they are reluctant to invest in some of the latest connectivity technologies due to unclear ROI.

As cutting-edge technologies such as the latest generation of satellite connectivity, private 5G networks, and eventually 6G continue to develop at a rapid pace, telecom companies and other businesses must be ready to take advantage of these innovations. An increasingly connected world requires businesses to rethink their strategies, investments, and business models to identify and capitalize on new growth opportunities.

7. Immersive reality technologies enable users to experience augmented versions of our world or the virtual world, while opening up a range of new use cases for consumers and businesses. These technologies simulate the addition of objects to real-world environments and enable interactions in virtual worlds by using spatial computing to render the physical space around the user. Industry players are pursuing different approaches, ranging from augmented reality (AR) to mixed reality (MR) to

virtual reality (VR). 2023 was characterized by weak investment and sluggish consumer demand. Seed funding fell by about 50% compared to 20221, and VR headset sales fell by 40%. 2 Some notable highlights, such as the launch of the Apple Vision Pro headset and continued enterprise interest in digital twin technology, have shown resilience despite financial and market barriers.

8. Cloud and edge computing. Enterprises are moving from traditional local storage and management to distribution across multiple infrastructure points, from remote hyperscale data centers to local servers at the edge of the enterprise. Public clouds enable companies to host workloads remotely and scale consumption of computing and storage resources as needed. This will lead to better economies of scale, greater flexibility, and faster application deployment. With edge computing, companies can process data closer to the source of the data. This provides lower latency, lower data transfer costs, and better data protection (while complying with data retention laws) compared to the cloud. Cloud and edge computing enhance the ability of AI to train and reason about basic models and will continue to be key drivers of adoption of these technologies. By distributing workloads across the cloud and the edge (and locations in between), organizations can optimize resources, latency, data protection, and security at scale, thereby increasing business value.

9. Quantum technology includes three pillars: quantum computing, which not only provides acceleration of current computer systems for certain problems, but also enables applications that are not possible on traditional computers; quantum communication, which is critical for secure communications in the era of quantum computers; and quantum sensing, which has higher sensitivity in more modes than traditional sensors in certain applications. The economic potential of these technologies is expected to exceed $0.9 trillion. Although actual quantum advantages for useful applications are still to be demonstrated, we see promising research and experimental activities being conducted by pioneering companies in various industries such as chemicals, pharmaceuticals, finance, automotive and aerospace. In 2023, both hardware and software have made steady progress. Companies have also taken practical steps to adapt their infrastructure and security to the technology.

Quantum technology must overcome many technical barriers to realize its benefits. This requires efforts from both the private and public sectors. It is strategic for companies to make smart investments now to benefit from future advances.

10. The Future of Robotics. Advanced robotic systems are characterized by their ability to automate a wide range of physical tasks and are highly complex. In recent years, the range of use cases, from consumer services to enterprise-level assembly, has expanded due to macroeconomic conditions and technological advances. From a macroeconomic perspective, rising global labor costs, aging populations, and the increasing complexity of offshore labor outsourcing have led to tight labor markets in many countries. Technically, artificial intelligence has brought many innovations, expanding the capabilities of physical robots and accelerating their training. Although technical and social barriers remain to be overcome, widespread adoption is essential to increase productivity and move the economy toward new ways of working that are fundamentally different from today's human-centric workplace.

11. The Future of Mobility. Technological advances, coupled with a growing focus on sustainability, have ushered in a new era of mobility. Autonomous vehicles and electric vehicles (AVs and EVs), urban air mobility, and ACES (autonomous, connected, electrified, and shared/smart mobility) technologies are the focus of many organizations seeking to revolutionize passenger and freight transportation while improving accessibility, safety, and sustainability. While the regulatory environment is still in its infancy, ACES technology is increasingly being adopted by both emerging and established companies in the automotive and aerospace industries.

12. The Future of Biotechnology. The combination of biology and computational technologies is enabling a range of product and service innovations in industries such as healthcare, food and agriculture, consumer products, sustainability, and energy and materials. Bioengineering technologies such as gene therapy could have a potential economic impact of more than $2 trillion over the next decade and hundreds of use cases, with the potential to improve human health and longevity, while technologies such as alternative protein production can contribute to

sustainable development. While the scientific basis for many of these use cases is now proven, these technologies must also be economically viable and address societal and regulatory challenges.

3.2. CHALLENGES FOR INTERNATIONAL BUSINESS IN DIGITAL ECONOMY

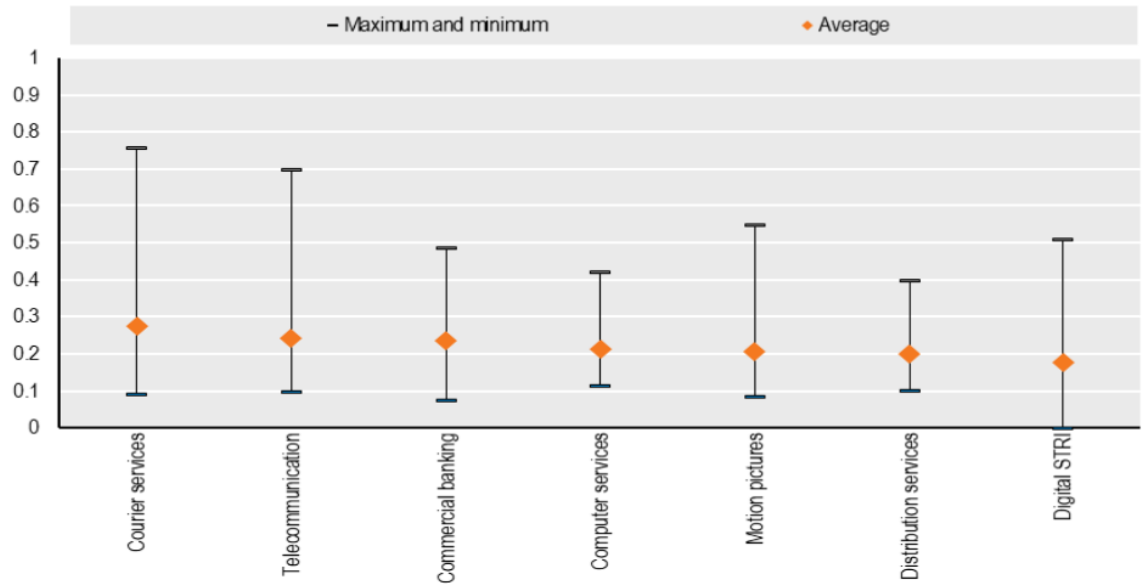
National regulatory environments are becoming increasingly restrictive.

Regulatory barriers make it more difficult and costly for businesses to conduct digital commerce. Recently updated OECD Services Trade Restrictiveness Index (STRI) and OECD Digital Services Trade Restrictiveness Index (Digital STRI) provide fresh insights to help better understand existing digital trade barriers.

The OECD STRI and Digital STRI cover several important elements of digital trade. The Digital STRI identifies overall barriers that affect cross-border digital trade, such as overall restrictions on cross-border data flows. In turn, the STRI provides insights into sector-specific regulatory barriers and can be used to track restrictions in key areas of digital commerce, such as computer services, telecommunications, express delivery services, distribution, commercial banking, and content-related services.

These indicators show that regulatory barriers to digital trade remain high (Figure 3.4, Panel A). Barriers are particularly high for express and telecommunications services, both of which are essential to enable e-commerce through efficient parcel delivery and communications infrastructure.

A. Average, minimum and maximum scores for selected STRI sectors and the Digital STRI, 2022



B. Change in average Digital STRI and the STRI scores for selected sectors (%), 2014-22

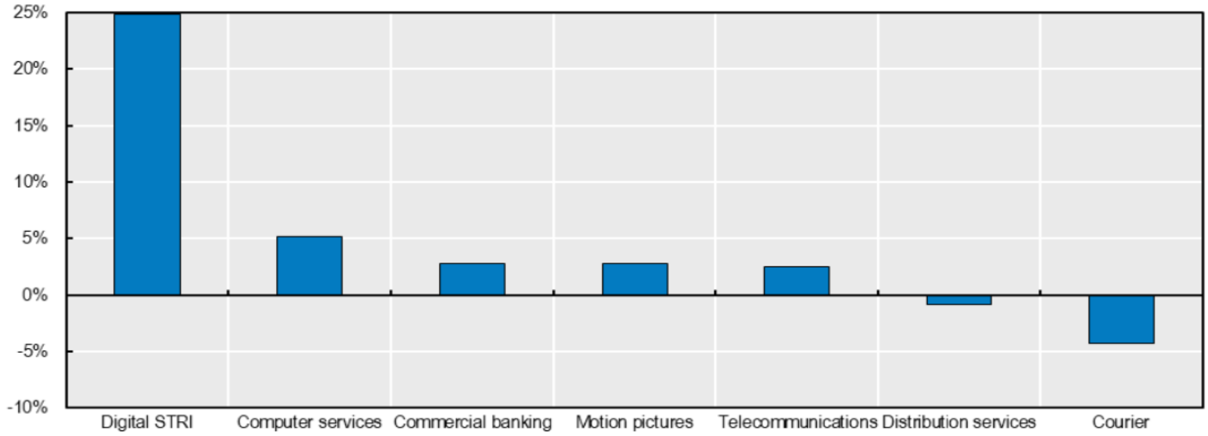


Figure 3.4 – Barriers to digital trade are high and have been growing

Source: constructed by the author

Regulatory barriers to digital commerce have also increased. The average Digital STRI score in 2022 has increased by 25% compared to 2014 (Figure 3.4, Panel B). Trade barriers have also increased in the computer services sector (5%), followed by commercial banking and film (3%) and telecommunications (2%). Distribution services and express delivery services are the only two sectors where the overall average has decreased, indicating that reforms and liberalization are generally ongoing.

Globally, the DSTRI shows that the greatest barriers are in the infrastructure and connectivity sector (Figure 3.5). This is due to restrictions on cross-border data flows, data localization requirements, and a lack of competition regulations that facilitate the interconnection of communications networks.

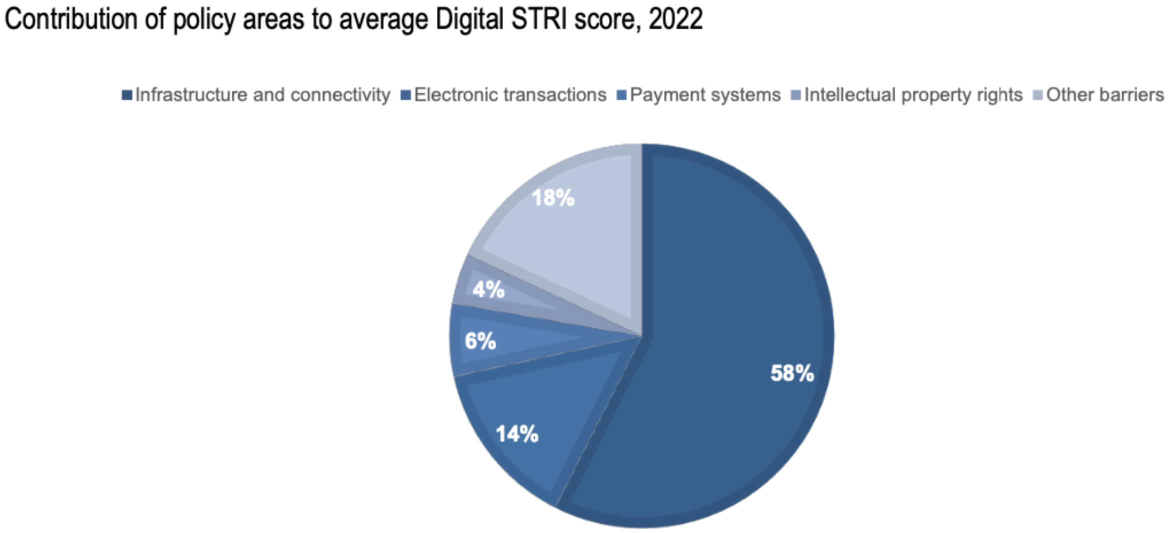


Figure 3.5 – Barriers are mainly in communications infrastructure and connectivity

Source: constructed by the author

In addition to the cross-cutting indicators covered in the STRI, other sector-specific restrictions on foreign market entry in digitally transformed services contribute most to the STRI score, particularly in the commercial banking, distribution, and express delivery services sectors (Figure 3.6). Common barriers mainly concern foreign investment. Barriers to competition are also prevalent in some sectors (particularly telecommunications and express delivery services), as are barriers related to the free movement of skilled workers (computer services).

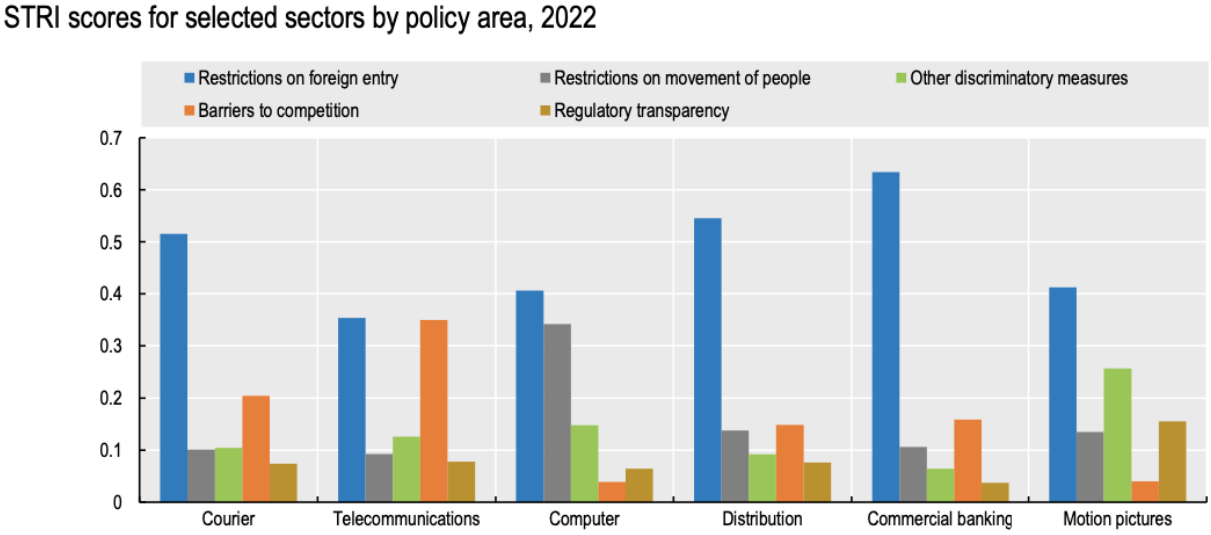


Figure 3.6 – Restrictions on foreign entry prevail across sectors

Source: constructed by the author

From a regional perspective, African countries face the most constraints, but are also the most reform-focused (Figure 3.7), with many economies having introduced significant liberalization measures in recent years. In the Asia-Pacific region, thresholds are also high on average and have increased in recent years. OECD countries have the lowest thresholds, but the recent trend is towards increasing strictness. In Latin America and the Caribbean, the regulatory environment has remained relatively stable, with signs of moderate liberalization.

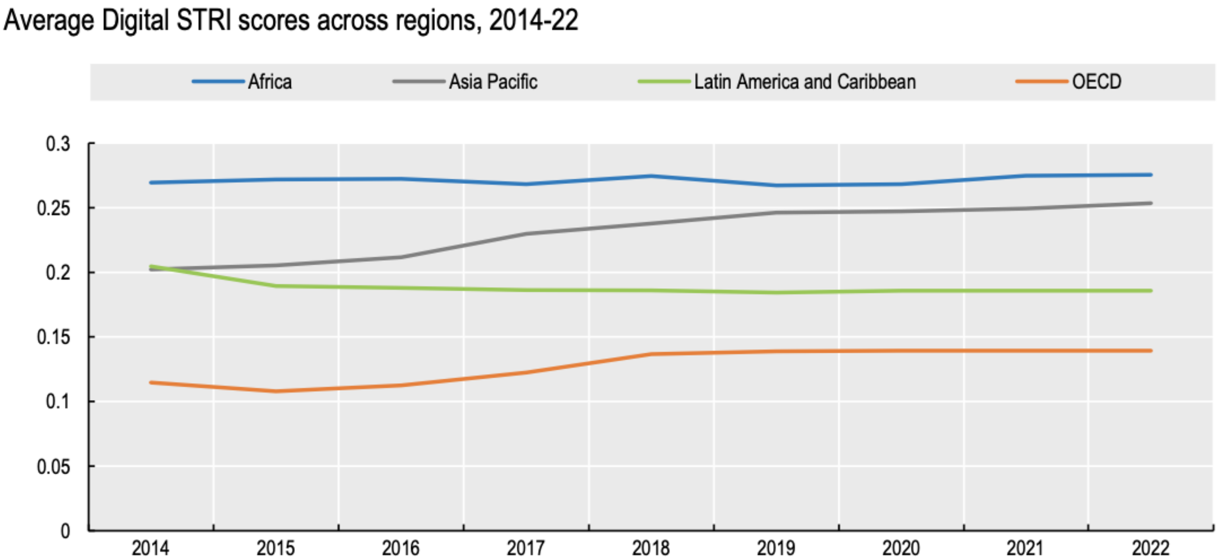


Figure 3.7 – Digital trade regulations differ across regions

Source: constructed by the author

There is a strong case for national regulatory reform. Deregulatory reforms can deliver significant benefits. It is estimated that a 0.1 point decrease in a country's DSTRI score (reflecting a significant national regulatory reform) is associated with a 145% increase in total exports (Figure 3.8). The largest increase was seen in exports of digitally delivered services, which grew by 277%, while exports of "other services" grew by 206%.

Importantly, reforms did not only apply to services. The corresponding decrease in national DSTRI scores was accompanied by a 176% increase in exports in agriculture and food and a 117% increase in manufacturing. Regulatory reforms also deliver larger benefits to emerging economies than to high-income countries (López-Gonzalez, Sorescu, and Kaynak, 2023).

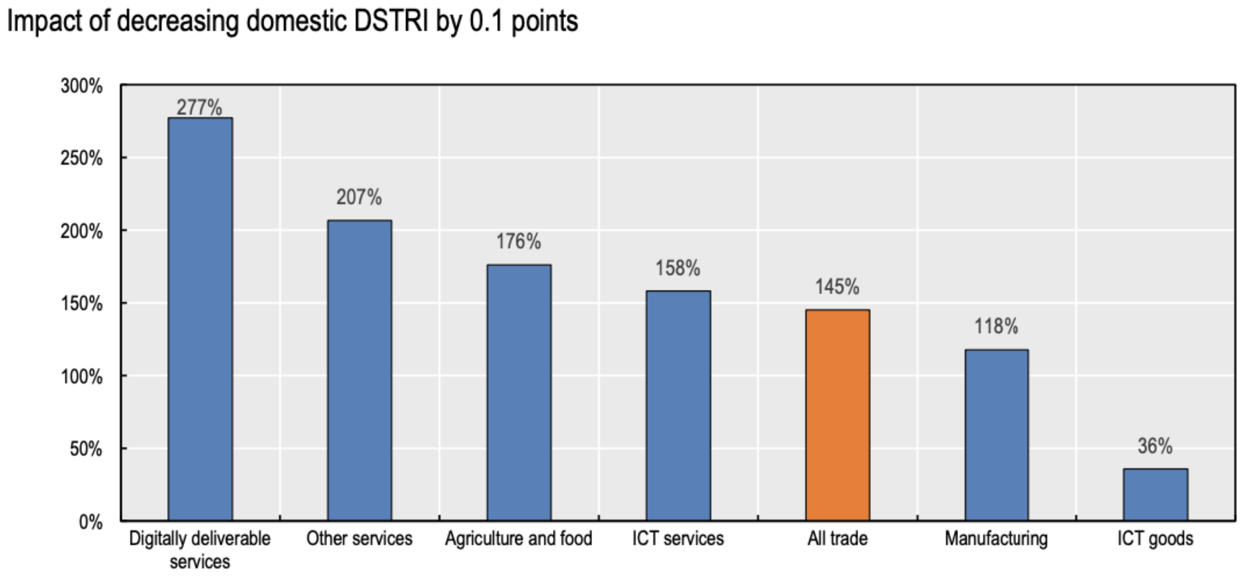


Figure 3.8 – Domestic regulatory reform can lead to strong benefits for exporters

Source: constructed by the author

The number of regulations affecting data flows is increasing. Economies and societies are more closely connected than ever before through data flows. They shape our social behavior, production, trade, and the way we respond to global challenges such as the COVID-19 pandemic or the green transition. However, cross-border data flows also raise or exacerbate challenges across policy areas, including privacy and data protection, national security, regulatory scope, intellectual property protection, and trade. In response, governments have enacted regulations that restrict cross-border data flows or require data to be stored domestically (Casalini and López González, 2019) (Figure 3.9).

A growing challenge is to ensure that data receives the required level of control and protection when crossing international borders. This combination of enabling cross-border data transfers and ensuring that they take place in trusted relationships is known as “data free flow with trust” (DFFT).

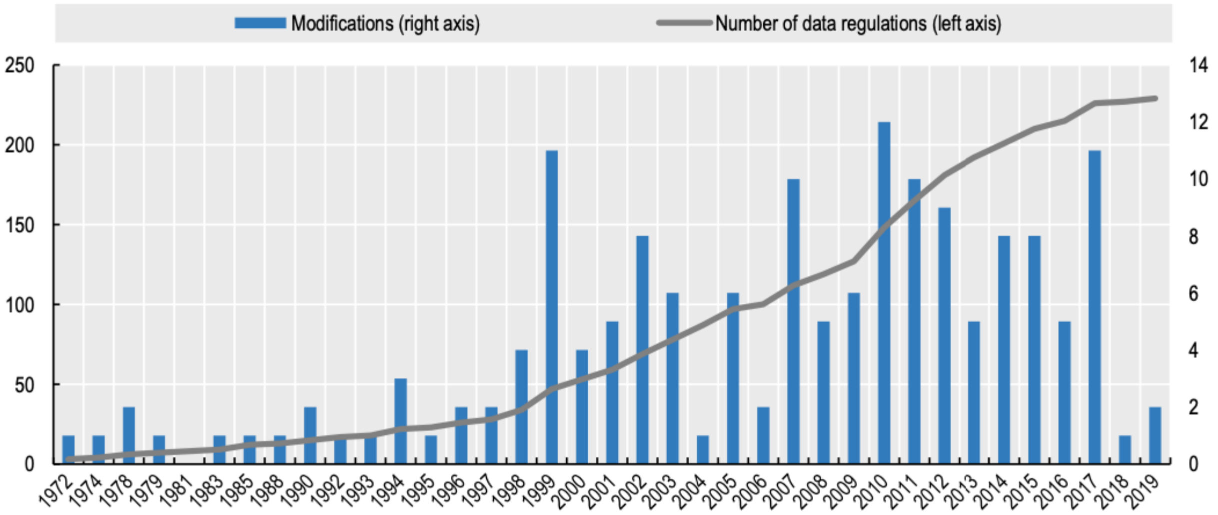


Figure 3.9 – A growing number of regulations affect cross-border data flows

Source: constructed by the author

Although approaches to regulating cross-border data flows vary, they can be broadly divided into four categories (Figure 3.10). An extreme example is the lack of regulation of cross-border data flows, often due to the absence of data protection laws (this applies particularly to least developed countries). While this does not imply any restrictions on data flows, it may affect the willingness of other countries to transfer data.

The second approach is open safeguards that allow the private sector a degree of discretion in ensuring the security of data transfers. Examples of “open safeguards” include adequacy by the private sector (data controllers are responsible for taking appropriate measures to ensure the adequacy of data protection during transfers, including within the framework of principles established by the public sector).

The third approach is to make data flows dependent on the existence of "pre-approved" safeguards. Data transfers abroad are generally permitted if a public authority certifies that the system in another jurisdiction meets certain requirements (based on transparent criteria), such as B. through an "adequacy decision". If no such decision has been made, data transfers may be based on government-approved contractual clauses or binding corporate rules.

The last general approach involves systems that only allow data transfers on an ad hoc or case-by-case basis, and are subject to review and are usually at the discretion of the competent authority. This approach applies not only to personal data for privacy reasons, but also to a broader category of data known as "critical data", including data in the context of national security.

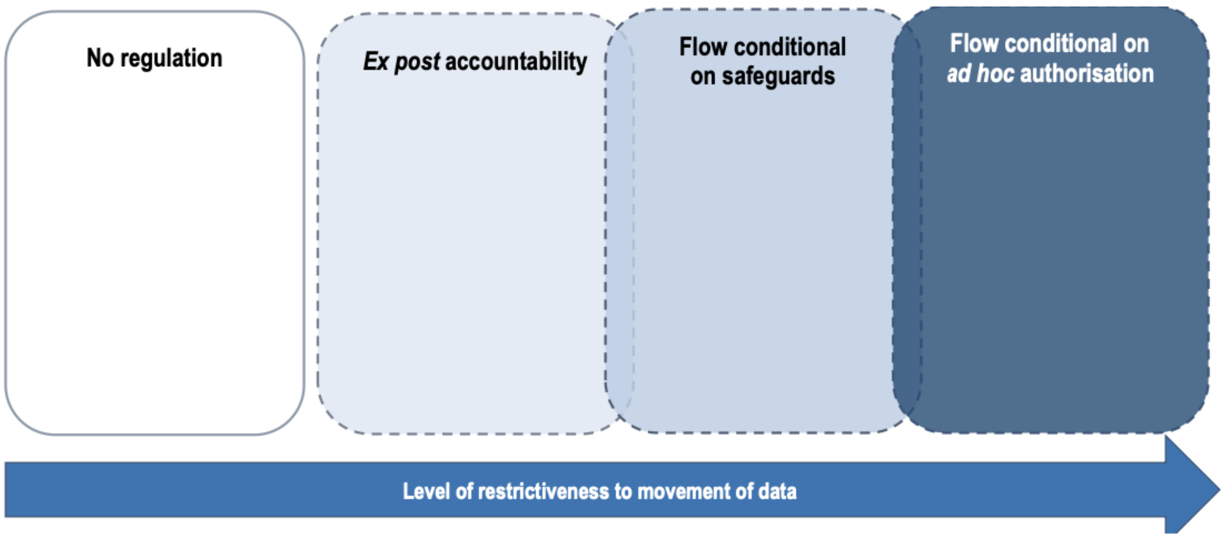


Figure 3.10 – There are different approaches to regulating cross-border data flows

Source: constructed by the author

While there are valid reasons for increased regulation of data flows and regulatory diversity, the diversity of applicable systems has led to an increasingly complex and fragmented regulatory landscape (see also OECD (2022) and Evenett and Fritz (2022)). This complicates not only the effective implementation of policy objectives such as privacy and data protection across different jurisdictions, but also the cross-market activities of companies. This undermines their international capabilities and the benefits of global activities. The challenge for governments is to promote regulatory approaches that enable data flows while ensuring that data receives the required protection, security and control when it crosses borders.

The number and restrictions on data localization requirements are increasing. Closely related to restrictions on data flows are requirements for local storage. There is currently no unified and universally accepted definition of data localization. Although there is a general consensus that data localization leads to more local storage or processing, there are different views on which measures fall into the category of data localization. In this report, data localization is defined as an explicit requirement that data must be stored and/or processed domestically (Lopez-Gonzalez, Casalini, and Porras, 2022) (OECD, forthcoming).

Data localization measures can be divided into three broad, albeit vaguely defined, categories (Figure 3.11). These reflect the fact that data localization requirements are often accompanied by different types of processing and/or data flow restrictions. For example, some approaches may require that health data be stored and processed locally and may only be transferred abroad under specific conditions.

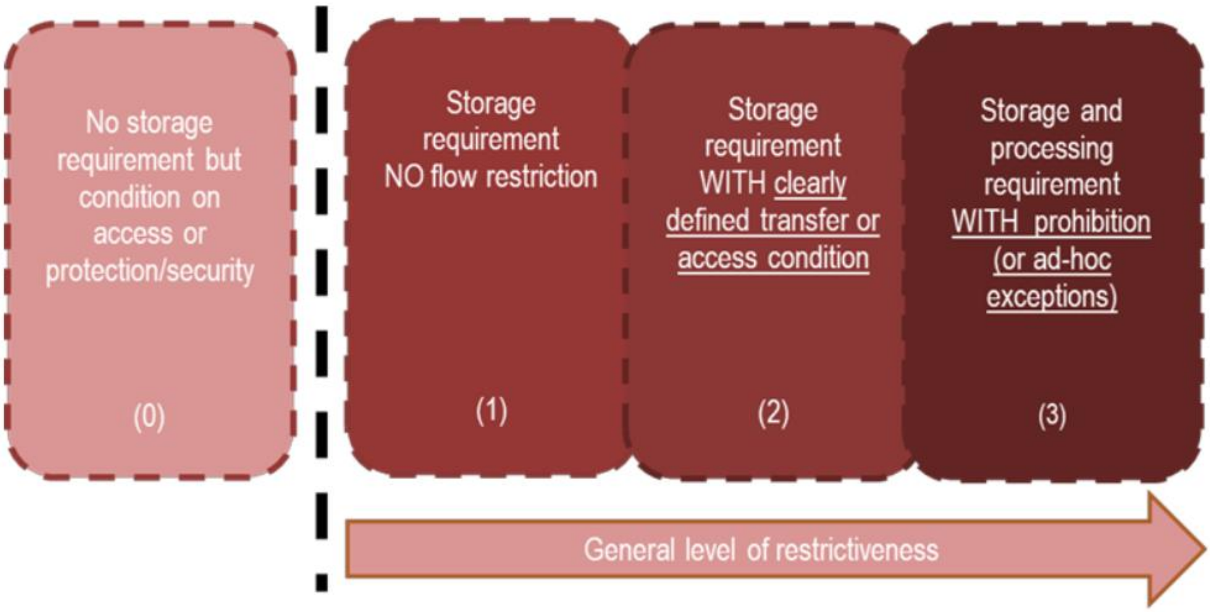


Figure 3.11 – Approaches to storage and processing requirements are diverse

Source: constructed by the author

The first category of approaches includes measures that require local data storage but do not prohibit storage or processing in other countries (category 1). These measures are often used to ensure that regulators do not face jurisdictional issues. In a way, some of the new rules in this category can be seen as transferring analog rules to the digital world, such as allowing physical access to a company's financial data for audit purposes.

The second category of measures includes measures that require local storage and processing but allow international access or transfer under clearly defined conditions (category 2). These are relatively new approaches and are mainly applied in the field of health data. They contain localization requirements and also wording that helps to identify the specific conditions under which transfers are allowed.

The third category of approaches includes measures that require local storage and processing of data while prohibiting transfers to other countries (or only on a temporary authorization basis) (category 3). These broader restrictions may apply to a range of data, including banking, telecommunications or payment data, and to a wider range of information categories. Their scope of application is often less transparent and unclear.

Outside of this type, a new category of approaches has emerged that focuses on access rather than location (category 0). These measures do not require local data storage, but companies must guarantee access to the data.

The number of explicit data localization measures has increased (Figure 3.12). As of early 2023, there are 96 measures in 40 countries and 4 draft regulations (of which 3 previously applicable measures are repealed). Almost half of the identified data localization measures were implemented after 2015. Importantly, these measures are becoming more stringent; as of early 2023, more than two-thirds of the identified measures include storage obligations (category 3) of data flow bans.

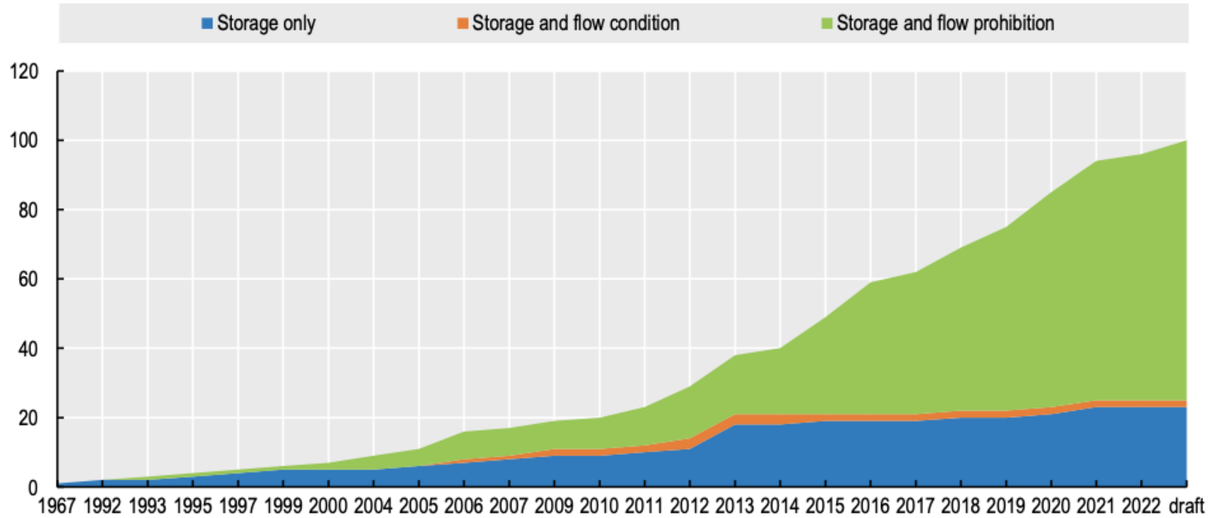


Figure 3.12 – Data localisation is growing and becoming more restrictive

Source: constructed by the author

Data localization measures in non-OECD countries are more prevalent, accounting for about 70% of all measures (74 in total), and are more restrictive. Overall, 55% of measures implemented in OECD countries involve storage requirements only, while in non-OECD countries, where data flow bans predominate, storage requirements are in place (91% of identified data localization measures).

Despite the existence of national regulations, the Internet is global and important efforts are being made in various forums to find ways to cooperate internationally to promote digital trade. This section provides an overview of the development of international cooperation, including the recent update of the OECD Digital Trade List, and highlights the existing evidence on the benefits of such cooperation.

Multilateral discussions on digital trade began in 1998 with the launch of the Work Programme on Electronic Commerce (WTO, 1998). In the same year, WTO members agreed to a moratorium on tariffs on electronic transmissions (see the next section for a more detailed explanation). However, progress on digital trade issues has been slow. It was not until December 2017 that a group of WTO members agreed to "launch joint exploratory work on future WTO negotiations on trade-related aspects of electronic commerce".

As of July 2023, the Joint Initiative on E-commerce (JI) has 89 members and covers a range of topics, including facilitating electronic transactions through discussions on electronic signatures and electronic payments, as well as paperless commerce, data flows, data protection, consumer protection, cybersecurity, and market access. On July 28, 2023, the co-chairs of the JHA discussions (Australia, Japan, and Singapore) noted in a statement that negotiations were making steady progress and were expected to be concluded by the end of 2023.

Regulation of digital trade issues has also shifted to bilateral and regional trade agreements. According to the Trade Agreement Provisions on Electronic Commerce and Data (TAPED) database (Burri and Polanco, 2020; Burri, Vasquez Callo-Müller, and Kugler K., 2022[24]), as of June 2022, a total of 116 agreements contained digital trade or e-commerce provisions, accounting for 33% of all existing agreements. Of these, 74 agreements contain digital trade or e-commerce chapters, accounting for 21% of all existing agreements. Overall, 44% of agreements signed since 2001 contain provisions on digital trade or e-commerce (Figure 3.13).

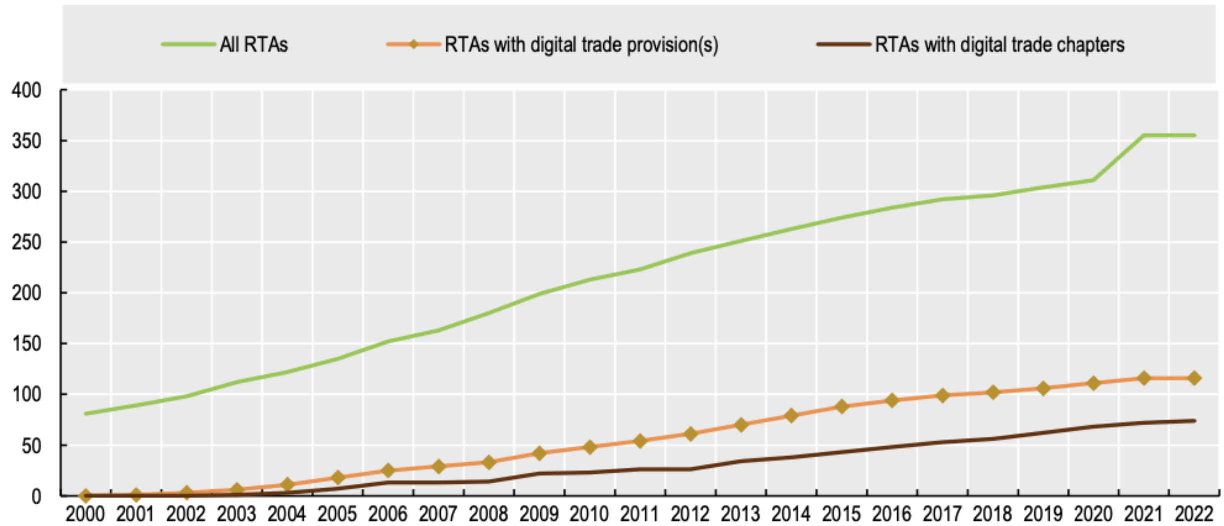


Figure 3.13 – A growing number of RTAs have digital trade provisions

Source: constructed by the author

Digital trade provisions in regional trade agreements (RTAs) cover a wide range of issues related to digital trade in goods and services (Figure 3.14). This includes a range of cross-cutting issues, from facilitating digital trade (e.g., paperless commerce, electronic certification) to privacy and data protection, consumer protection, source code, electronic transmission tariffs, and cybersecurity. Countries participating in WTO joint implementation discussions tend to cover digital issues more comprehensively in their preferential trade agreements.

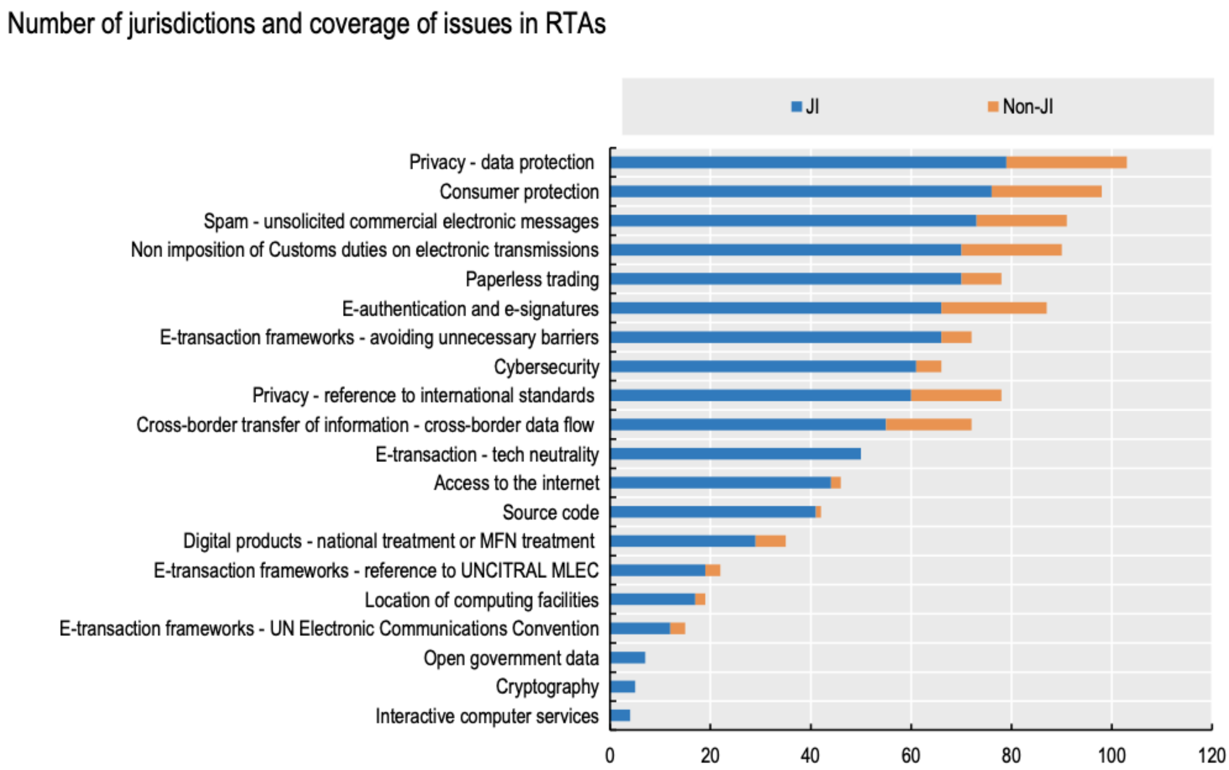


Figure 3.14 – RTAs cover a wide range of digital trade issues

Source: constructed by the author

The trade impact of e-commerce chapters in RTAs is positive for both high-income and emerging market economies. In fact, signing an RTA that includes e-commerce provisions would increase exports of high-income countries by 10.3%, almost twice as much as superficial agreements (i.e., agreements without e-commerce chapters), while exports of emerging economies would increase by 16.9% (López-Gonzalez, Sorescu, and Kaynak, 2023). However, the relationship between e-commerce chapters and trade depends largely on the depth of the e-commerce provisions signed. Further research is needed to clarify their impact on countries at different levels of development.

New agreements on the digital economy are emerging. At the same time, countries are increasingly signing more comprehensive digital economy agreements

(DEAs), such as the Digital Economy Partnership Agreement (DEPA)[6] between New Zealand, Singapore, and Chile and the DEA between Australia and Singapore. In addition to areas covered by RTAs, these agreements include provisions in new areas such as artificial intelligence, digital identity, and open government data. Interest in these agreements is growing, as evidenced by the number of newly signed DEAs[7] and the increase in the number of members of existing agreements such as DEPA.

In addition to the WTO's Joint Initiative on e-commerce, regional trade agreements and digital economy agreements, digital trade issues are also being discussed in various international forums such as UNCITRAL, UNECE/UN Centre for Electronic Commerce, OECD, and regional forums such as APEC, ASEAN, ESCWA and ECOWAS. OECD Digital Trade Inventory (DTI) (Nemoto and López González, 2021) Figure 3.15 shows the international developments in measures and disciplines related to the WTO's Joint Initiative on e-commerce.

The OECD Digital Trade Inventory maps the range of international rules, principles and standards relevant for discussions on digital trade. The Digital Trade Inventory maps countries' overall engagement in 35 international instruments introduced in different international fora, based on the policy framework that underpins the discussions in the JI on e-commerce at the WTO as of December 2022	**Enabling** e-commerce: electronic transaction frameworks, electronic authentication and electronic signatures, electronic contracts, electronic invoicing, and paperless trading.
	Openness and e-commerce: customs duties on electronic transmissions, open government data, access to and use of the internet for electronic commerce/digital trade.
	Trust and e-commerce: online consumer protection, unsolicited commercial electronic messages, personal information protection/personal data protection, source code, ICT products that use cryptography, and cybersecurity.
	Cross-cutting issues: cross border transfer of information by electronic means/cross-border data flows, and location of computing facilities.
	Telecommunications: disciplines related to telecommunication services.
	Other: logistics services, use of technology for trade facilitation, domestic regulation, entry of business persons or issues of goods and services market access.

To enable interpretation, a very preliminary summary of progress across the measures covered by the DTI is provided. The DTI covers 193 economies over the period 2000-2023.

Figure 3.15 – The Digital Trade Inventory

Source: constructed by the author

The DTI aggregate indicator (ranging from zero to one) provides information on the progress of discussions on digital trade issues. It highlights the growing acceptance of international instruments related to e-commerce, particularly in terms of their support (including the UNCITRAL Model Instruments) and in the broader category of "other" subjects (including logistics services or the use of technology to facilitate trade) (Figure 3.16). It highlights the large differences between regions. While OECD countries are leading the way in adopting instruments, African countries are also joining many international instruments.

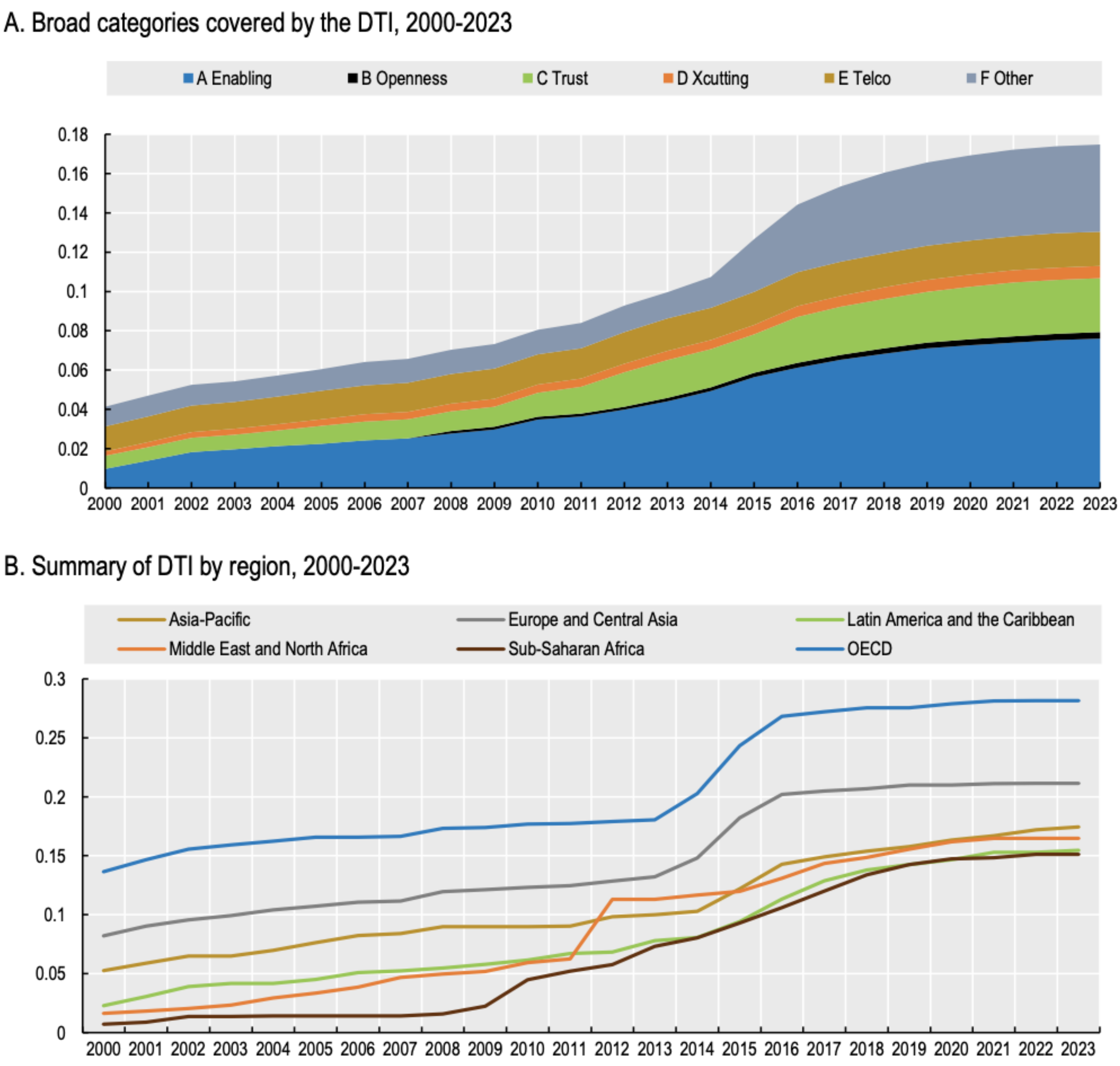


Figure 3.16 – Countries are increasingly adopting international instruments related to digital trade

Source: constructed by the author

The greatest progress was made in the areas of telecommunications and the promotion of e-commerce. In other areas, including trust (reflecting issues such as data protection or consumer protection) or cross-cutting issues such as cross-border data flows, progress was slower. In 2023, OECD countries made good progress in all policy areas, especially in telecommunications. Sub-Saharan Africa also made significant progress, especially in the promotion of e-commerce, due to its adherence to specific regional instruments.

Conclusion for the third chapter.

It is concluded that the trajectory of enterprise technology adoption is often described as an S-curve that traces the following pattern: technical innovation and exploration, experimenting with the technology, initial pilots in the business, scaling the impact throughout the business, and eventual fully scaled adoption. В третьому розділі проаналізовано тренди розвитку цифрової економіки: Generative AI (gen AI), Applied AI, Industrializing machine learning (ML),next-generation software development, cybersecurity, advanced connectivity technologies, immersive-reality technologies. cloud and edge computing, quantum technologies, robotics, mobility, bioengineering, space technologies, electrification and renewable-energy technologies, climate technologies. All these technologies will spur development of digital economy and these spheres are perspective for IT companies at world market.

But also we have challenges in international trade.

The domestic regulatory environment is becoming increasingly restrictive. These indicators show that regulatory barriers to digital trade remain high. The number of regulatory barriers that affect digital trade has also been growing.

Globally, barriers are greatest in the area of infrastructure and connectivity. But restrictions on foreign entry prevail across sectors (notably telecommunications and courier services). African countries have the highest levels of restrictions, but are also the top reformers with many economies having introduced significant liberalisation measures in recent years. In the Asia-Pacific region, barriers are also high on average, and have been increasing in recent years.

There are legitimate reasons for growing data-flow regulation, and for diversity in this regulation, the multiplicity of applicable regimes is leading to an increasingly complex and fragmented regulatory landscape. Data localisation requirements are increasing in number and restrictiveness.

As a summary measure, there are measures of progress in discussions on digital trade issues. It highlights the growing adoption of international instruments related to e-commerce, in particular with respect to enabling e-commerce (including UNCITRAL model law instruments) and the broader category of ‘other’ disciplines (which includes logistics services or use of technology for trade facilitation). It shows the wide heterogeneities across regions; while OECD are at the forefront of adoption, African countries are also adherents to many international instruments.

All this can contribute to the development of international business of IT companies.

CONCLUSIONS AND RECOMMENDATIONS

The study concluded the following general conclusions:

The digital economy is a modern form of economic activity organization based on the use of digital technologies, innovative business models, and processing of large amounts of data. It has a systemic impact on the transformation of production processes, consumer behavior, global trade, and market structure.

IT companies are the core of digital transformation, as they not only develop digitalization tools, but are also drivers of innovation and structural changes in the economy. Their role in the development of the digital economy is strategic - from generating digital products to forming new formats of international business.

The analysis confirmed that the business models of IT companies in the digital economy differ significantly from the models of the industrial age, in particular, in that their main value is an intangible asset - information. It is its scalability, multiple use, and difficulty of protection that create both significant opportunities and challenges.

The development of the IT sector in the world is uneven. The main problems remain: insufficient development of ICT infrastructure in developing countries; unequal access to digital services; gender and professional disparity in the IT industry; technological lag of SMEs. These factors hinder full integration into the global digital market.

The work proves that e-commerce, digital trade and transnational data flows are key elements of international business in the digital age. They contribute to reducing transaction costs, expanding access to international markets, increasing business productivity, especially for SMEs.

The prospects for the development of IT companies on a global scale are associated with technological megatrends, such as generative artificial intelligence, cloud computing, cybersecurity, quantum and climate technologies, robotics, mobility, bioengineering. These directions will set the vector for future innovations and market opportunities.

Despite the progress of the digital economy, regulatory barriers remain a serious obstacle to international IT business. In particular, this concerns data localization, barriers to entry for foreign companies, fragmentation of rules and the lack of harmonization of digital legislation at the global level.

At the same time, institutional support for digital trade from international organizations is growing, standard legal documents are being developed, and countries - even developing ones - are actively implementing tools to promote digital commerce.

Therefore, the results of the work allow us to conclude that the international business of IT companies has a strong potential for growth, but its implementation requires the removal of infrastructure, educational and regulatory barriers, as well as strategic planning at all levels - from companies to governments.

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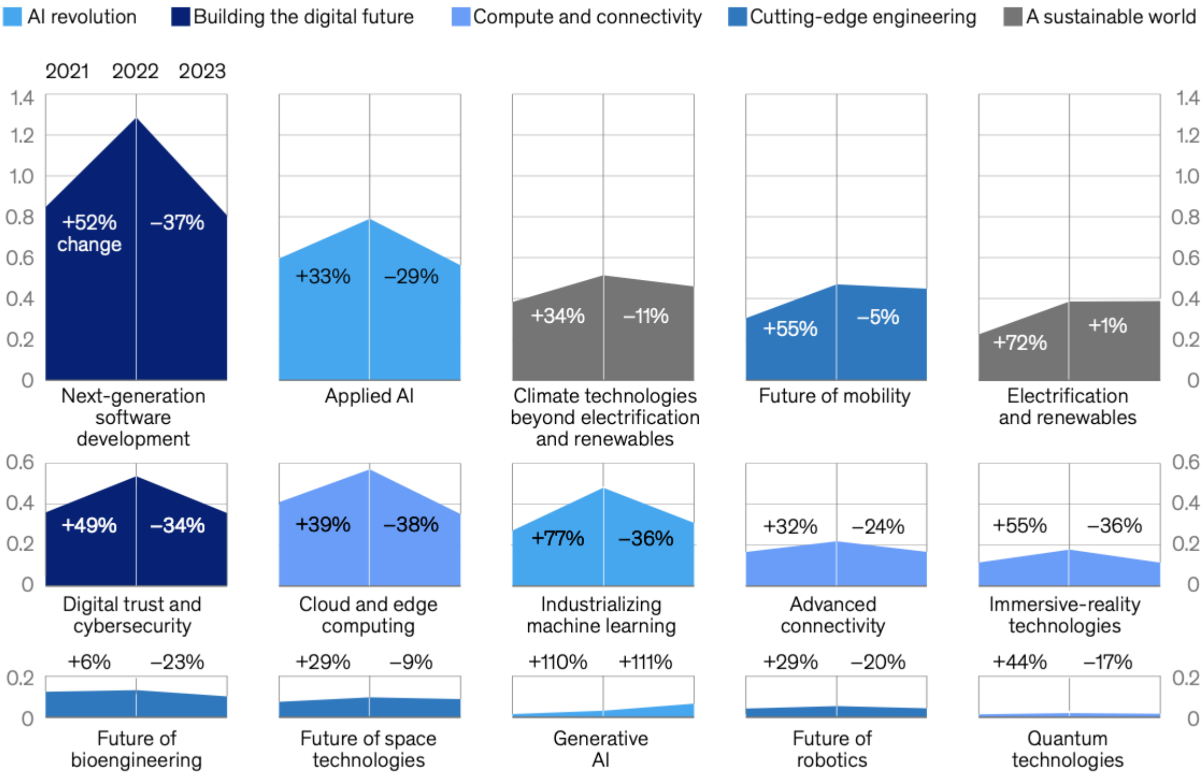
Appendix A

Annual change in tech trend job postings, 2021–23, millions of postings[1]



Cumulative change in tech trend job postings, 2021–23, millions of postings[1]