
CHAPTER 6

Digital transformation as a factor in the development of international business in the era of digital globalization

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Abstract

In the era of internationalization and digital globalization, digital transformation has become a key factor determining the nature of international business. Consequently, enterprises are now facing significant challenges. One of them is the need for comprehensive implementation of information and communication technologies, which undoubtedly impacts a company's success, especially on international markets. Digital transformation has ceased to be an exclusively technological trend and has become an indispensable strategy allowing enterprises to gain a competitive advantage. This is largely caused by the accessibility of tools such as artificial intelligence (AI), Big Data analysis, cloud technologies, blockchain and the Internet of Things (IoT).

The aim of this chapter is to highlight the importance of digital transformation and the role it plays as a driver of international business development. It attempts to analyze how digital transformation has become one of the key factors currently supporting the growth of international business in the context of digital globalization. The chapter also presents the level and scope of digital transformation in selected Central and Eastern European countries. Additionally, the author proposes an original index, which can be used to measure the level of digital transformation in the context of future international activities.

Keywords

Digital transformation, artificial intelligence, Big Data, blockchain, digital transformation indicator.

6.1 Introduction

In the face of increasing complexity and instability of the global economic environment reflected, for instance, in supply chains disruptions, geopolitical tensions

or growing expectations for sustainable development the importance of digital tools is clearly gaining ground. Today, digital technologies are becoming a crucial instrument that enables enterprises not only to survive but also to thrive under challenging market conditions. In the coming years, it will be the ability of organizations to effectively implement digital innovations and flexibly adapt to rapidly changing global conditions that will determine their competitive position on the international stage.

6.2 Digital transformation – theoretical and international perspectives

6.2.1 Digital transformation – a literature review

The advancement of transformational processes has driven the development of such technologies as artificial intelligence (AI), the Internet of Things (IoT), cloud computing, blockchain, and Big Data. Undoubtedly, these modern engines of economic growth contribute to the automation of production processes including the creation of Manufacturing Execution Systems (MES) and enable real-time behavioral analysis.

Digital innovations have significantly influenced consumer behavior and expectations, but above all, they have impacted business operations and their dynamic capabilities [1]. Digital transformation should be viewed as a multidimensional process that integrates digital technologies across all areas of an organization's activity [2]. It is not limited to the implementation of advanced technological solutions but encompasses changes in business models, organizational structures, management practices, and organizational culture [3]. The process of digitalization should be recognized as a future trend in the development of industry and logistics. It is based on information systems, which ensure increased functionality and networking [4]. The objective of digital transformation is therefore to increase operational efficiency, improve customer experience, and foster the development of innovative products and services [5].

It is also essential to refer to other definitions found in the academic literature. According to G. Vial, digital transformation is a process aimed at enhancing an entity by bringing about significant changes in its characteristics through a combination of information, computing, and communication technologies [6]. On the other hand, S. Kraus, S. Durst, J. J. Ferreira, P. Veiga, N. Kailer, A. Weinmann define digital transformation as the process of integrating digital technologies across all areas of an organization, leading to structural changes in how the organization operates

and delivers added value to its customers [7]. A. Hanelt, R. Bohnsack, D. Marz, C. Antunes Marante view digital transformation as an organizational change that is triggered and shaped by the widespread diffusion of digital technologies [8]. Thus, digital transformation should be understood as a transformation of the way digital technologies are utilized. These activities are intended to develop and implement a business model that supports the creation of added value and enhances its effective use by the organization.

It is also important to reference the flow model for digital transformation (**Fig. 6.1**).

Three types of external factors can be distinguished as key drivers of digital transformation. The first relates to digital technologies, which, over the years, have given rise to online payment systems, broadband Internet, and cloud computing. These elements now serve as a foundation for e-commerce sales. The COVID-19 pandemic also significantly accelerated the pace of digital transformation, highlighting the role of technologies such as artificial intelligence, blockchain, the Internet of Things (IoT), and robotics. The second factor – digital competition – has introduced profound changes in how enterprises compete. It is currently observed on a global scale and, through the growth of transnational corporations, relies on the exploitation of increasing volumes of data (Big Data) to achieve dominance in specific business sectors. The third factor involves changes in consumer behavior in response to the introduction of digital innovations. Consumer behavior has undergone substantial transformation due to, for example, the use of search engines and social media platforms. As a result, interdependencies in consumer behavior patterns have been intensified.

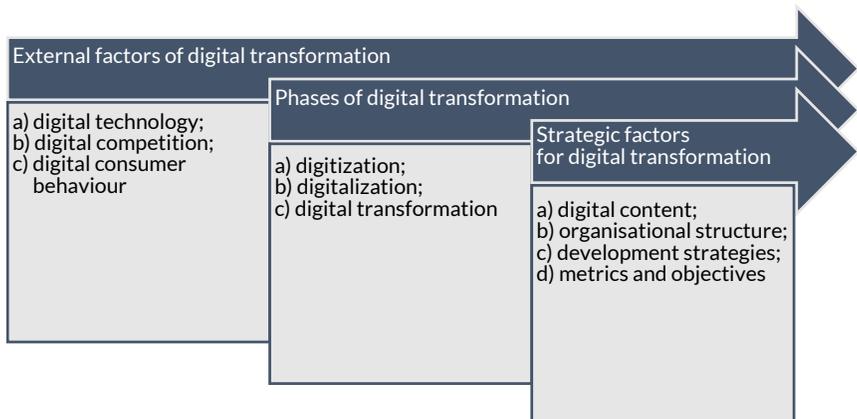


Fig. 6.1 Flow model for digital transformation
 Source: compiled by the author based on [1]

An important component of digital transformation is its progression through distinct phases, i.e. digitization¹, digitalization² and digital transformation [9]. The first two phases are characterized by the gradual improvement of an enterprise's existing operations, while the final phase entails a more comprehensive digital transformation. To better illustrate the differences between these phases, the following comparative table provides a concise overview (Table 6.1).

Table 6.1 Characteristics of individual phases of digital transformation

Phase of digital transformation	Digital content	Organizational structure	Digital development strategies	Objective
Digitization	Digital assets	Regular hierarchical	Market penetration, product development and market development	Cost savings, more efficient allocation of resources across existing operations
Digitalization	Digital assets, digital agility, digital networking capability	Separate, agile units	Market penetration, product development, market development, platform-based market penetration, co-creation platform	Cost savings and increased revenues, more efficient production through business process reorganization, better customer experience
Digital Transformation	Digital assets, digital agility, digital networking capability, Big Data analytics capability	Separate units with flexible organizational structures, IT internalization and analytical functional areas	Market penetration, product development, market development, platform-based market penetration, co-creation platform, platform diversification	A new cost and revenue model, asset reconfiguration in the context of developing new business models

Source: [1]

Each of the aforementioned phases of digital transformation imposes specific demands on a company's digital resources, organizational structure, development strategies, and performance indicators. Enterprises, which primary objective is to pursue digital transformation must not only possess digital assets, but also acquire or develop capabilities related to digital agility, digital networking, and Big Data analytics.

¹ Digitization is the process of creating and developing documentation, which consists in transforming information in the analogue version into digital form. This makes it possible to process it using computers, as well as to store and transfer it

² Digitalization concerns the use of IT technology as a factor that will enable the use of new business opportunities based on the processes modified so far in the enterprise

6.2.2 Global technological trends affecting international business

Contemporary business is largely shaped by the dynamic development of digital technologies. Today, they constitute a key strategic pillar for business development in increasingly globalized economies. Globalization, driven by technological advancement, has enabled firms to expand more rapidly and efficiently into foreign markets. The emergence of global technological trends has been significantly influenced by the rise of technologies such as cloud computing, artificial intelligence (AI), the Internet of Things (IoT), 5G networks, and blockchain. These technologies are redefining the way business is conducted on international markets. The above-mentioned technological trends do not only support the optimization and automation of business processes but, more importantly, allow firms to tailor their offers to the specific needs and preferences of customers across different markets. On the other hand, analytic technologies, based on Big Data, empower organizations to make more accurate strategic decisions, thereby accelerating their global development. Global technological trends are thus reshaping international business by enabling enterprises to adapt to evolving market conditions and to compete more effectively abroad. It is therefore essential to examine these trends more closely.

The concept of *cloud computing*, as well as data processing in the cloud, was first introduced by S. Gillett and M. Kapor [10]. Cloud computing is based on or developed through solutions such as virtualization, network computing, utility of computer resources or autonomous computing. Selected definitions of cloud computing are presented in **Table 6.2**.

The analysis of the above definitions leads to the conclusion that cloud computing is a model of distribution of ICT solutions which, being accessible to users via a network (typically the Internet), are characterized by high availability, flexibility, and reliability, and are paid for based on actual resource usage (pay-as-you-go).

Whereas the process of internationalization itself previously involved physical activity and the transfer of a given company's capital to host markets, cloud computing has become the foundation for global business operations. Companies can now operate on a global scale without the need for physical presence in multiple markets and can scale their operations instantly [17]. Furthermore, several key benefits should be highlighted, particularly in the context of using cloud computing by companies operating internationally. These include, above all, global scalability (the ability to instantaneously launch services anywhere in the world), reduced market entry costs (no need to build physical IT infrastructure in each country), flexibility (easy adaptation of IT resources to the specifics and size of local markets), international collaboration (real-time access to data and systems from any location), and

compliance and security (cloud platforms provide the necessary solutions to meet local regulatory standards).

Table 6.2 Cloud computing – overview of definitions

Author(s)	Definition of cloud computing
E. Krok	Cloud computing can be defined as a remote, on-demand service that provides configurable hardware and software resources for storing and processing data
F. Etro	A new general purpose of Internet-based information technologies is to store data on external servers and deliver it as an on-demand service to clients
J. Staten	A form of computing in which massive, scalable, and accessible IT resources are provided as a service to external clients over the Internet
P. Mell and T. Grance	Cloud computing is a model that enables convenient and universal, on-demand network access to a shared pool of configurable computing resources (such as networks, servers, storage, applications, and services) that can be quickly provisioned and released with minimal management effort or interaction with the service provider
International Organization for Standardization (ISO)	Cloud computing is a paradigm that enables network access to a scalable and flexible pool of shared physical or virtual resources, with automated on-demand provisioning and management
M. Armbrust et al.	Cloud computing refers both to applications delivered as services over the Internet and to the hardware and system software in data centers that provide those services

Source: [11-16]

The Internet of Things (IoT) is a relatively new technology. It is a system of distributed, digitally interconnected identifiers, communicators, or sensors built into objects as well as carried or worn by people and animals, which can be identified and can transmit data over a telecommunications network without the need for human-to-human or human-to-computer interaction [18]. According to M. Porter and J. Heppelmann, the term "Internet of Things" was coined to reflect the growing number of smart, interconnected products and to emphasize the new opportunities they may bring [19]. Other authors claim that the Internet of Things refers to sensors and actuators embedded in machines and other physical objects, which purpose of application is to collect data, remotely monitor and make decisions and to conduct improvement processes in all areas of activity [20]. The Internet of Things could also be viewed as a global infrastructure that enables remote monitoring, control, and automation of physical objects over the Internet, using integrated sensor and network technologies [21].

Therefore, it should be emphasized that the Internet of Things is a system in which objects can communicate with each other with or without human intervention. According to M. Malucha, the construction of tools constituting the solutions for Internet of Things is based on [22]:

- objects equipped with sensors, detectors or transmitters that allow for communication, receiving commands, as well as collecting and transmitting information;
- IT systems and solutions that serve as recipients of the data collected and transferred by the objects, which are also responsible for processing the data and making decisions (e.g., laptops, tablets, smartphones, or home clouds);
- infrastructure enabling communication, i.e. transferring data between the objects.

To better illustrate the concept of the Internet of Things in business, it is necessary to identify the areas in which it supports the international operations of companies (Table 6.3).

Table 6.3 IoT in selected international companies

Name of company	Area of use	Example of use
Siemens	Industry 4.0/ Smart Manufacturing	IoT enables remote monitoring of machines, failure forecasting and automation of production processes in manufacturing facilities located in different countries. Siemens uses a platform called <i>MindSphere</i> to collect data from devices in its factories, thereby optimizing processes and minimizing downtime
Maersk	Smart Logistics	IoT enables real-time tracking of the location, temperature, humidity and condition of shipments, which is crucial for international transports. <i>Maersk</i> , the world's largest container shipping operator, uses IoT sensors to monitor transport conditions (e.g. in refrigerated containers), thus ensuring the safety of cargo and compliance with sanitary standards
Walmart	Retail	IoT enables the analysis of customer traffic, optimization of product placement, inventory management, and real-time offer personalization. Walmart uses IoT to manage refrigerator temperatures, track inventory, and automatically reorder goods
Tesla	Automotive & Mobility (Connected Vehicles)	IoT enables remote vehicle diagnostics, software updates, route optimization, and international fleet management. Tesla uses IoT to transmit data from its users' vehicles across various countries for diagnostic purposes, updates, and the development of autonomous driving
Hilton Hotels	Hotels & Tourism (Smart Hospitality)	IoT enables smart room management, guest experience personalization, and efficient energy use in globally operating hotels. <i>Hilton Hotels</i> has implemented IoT solutions that allow guests to control air conditioning, lighting, and entertainment through a mobile app across multiple countries

Source: compiled by the author

The concept called the Internet of Things is particularly important today. The Internet of Things, Services and Data, as it could be named, is becoming a crucial infrastructure that defines the next industrial revolution [4].

Another key component of modern technological trends is *blockchain*. This technology ensures secure and transparent transactions, which is of particular importance in international business. Blockchain is a distributed ledger technology used to structure, store, and transmit business information over the Internet. As its name suggests, blockchain is a decentralized data structure consisting of so-called blocks linked together in an unbreakable chain. These blocks store encrypted information [23].

In order to illustrate the areas in the company where blockchain technology is applied, it is worth examining the activities of selected international companies operating in this domain (Table 6.4).

Table 6.4 Use of blockchain technology in selected enterprises

Name of company	Scope of application	Example of use
IBM + Maersk (TradeLens), Carrefour, De Beers	Logistics & Supply Chain	Traceability and automatic recording of the flow of products
Ripple, JP Morgan (JPM Coin), Circle	Finance	Cross-border payments, smart contracts, asset tokenization
we.trade (blockchain platform of European banks)	International trade	Automation of commercial contracts with smart contracts
LVMH (Aura Blockchain), Prada, Cartier	Luxury & Fashion	Authentication of premium products (NFT, blockchain tags)
Walmart + IBM, Nestlé	Agriculture & Food	Logging the entire supply chain from farm to store
Sovrin Foundation, Microsoft ION	Personal Data Management	Decentralized digital identities (Self Sovereign Identity)

Source: compiled by the author

As evidenced above, the use of blockchain technology in various areas of international business operations may correlate with improved efficiency, reduced processing costs, enhanced transaction and product security, improved data quality, increased customer satisfaction and greater trust in the brand.

In the context of digital transformation and data management, Big Data and data analytics play a pivotal role. The term *Big Data* refers to data or sets of data that, due to their volume, cannot be processed using traditional applications. According

to A. Katal, M. Wazid, R. Goudar, Big Data involves such large volumes of data that it requires the implementation of new technologies and architectures in order to derive meaningful value from them [24]. Similarly, W. Fan and A. Bifet define the term as a dataset that cannot be managed by means of currently existing data mining methods or software tools due to its size and complexity [25].

Technology now has a tremendous impact on all spheres of the economy, business, and the state. Artificial intelligence, information and communication technologies, green technologies, biotechnology and blockchain confirm its leading role [26]. Global technological trends such as cloud computing, IoT, AI, 5G, blockchain, Big Data and sustainability significantly influence international business. Not only do they facilitate expansion into foreign markets but also transform how business is conducted, enhancing the efficiency, flexibility, and innovation of globally operating organizations. It is crucial to skillfully use these technologies to optimize processes, personalize the offer and introduce new business models.

Digital transformation is currently one of the key factors shaping how companies operate in international markets. In an environment of increasing competition, growing uncertainty and the need to ensure high operational efficiency, organizations are increasingly deciding to implement advanced technological solutions that enable process automation, data processing decentralization and dynamic management of global supply chains.

6.3 Digital globalization as a new environment for business development

6.3.1 The nature and importance of globalization in digital transformation

The spread of globalization, rising consumer demand, made-to-order production, lean management, shorter production cycles, and the rapid development of information technology are placing increasingly high demands on enterprises [27]. Globalization is perceived as a process encompassing all social spheres of a country and extending to international institutions, political and economic relations between countries, as well as changes in national economies and their domestic policies [28]. Today, it is defined as a process of growing economic interdependence driven by the rapid development of international trade and cultural exchange. The economic interpretation of globalization most often refers to business activities, economies, industry markets, enterprises, and the surrounding competition [29]. However, globalization is not just a concept used to analyze purely economic phenomena occurring in the modern global economy. It is often understood as a specific condition of

the world economy – namely, the liberalization of trade and capital flows, along with accelerating processes of integration and internationalization [30]. Globalization involves the intensification of capital, trade, service, and information flows on a global scale, leading to the merging of national economies and the formation of so-called transnational corporations [31]. These flows are initiated and stimulated by the most developed countries, but they do not occur without the participation of other market participants. In the context of globalization, those most likely to "survive" are the ones building transnational corporations [32]. An important aspect in the process of business globalization is the analysis of factors that have a direct impact on its development. The concept of globalization is usually examined from economic and political perspectives, which demonstrate both its positive and negative effects. In addition to its economic and political dimensions, globalization also includes technological, social, and cultural aspects.

Digital data has become especially important in today's world, serving as a critical resource in the global economy. Transnational corporations as well as small and medium-sized enterprises active in international markets use data to analyze and assess consumer behavior, manage global supply chains, optimize logistics processes, and tailor market entry strategies. Naturally, with the growth in the volume and value of data, the importance of digital platforms – such as Amazon, Google, and Facebook – has also increased. The emergence and development of digital platforms have rendered the notion of geographical borders rather secondary. Numerous businesses can now operate on foreign markets without the need for a physical presence in the host countries. Thus, establishing sales offices or subsidiaries is, in some cases, no longer justified.

Online platforms represent a specific type of business model that can take on various forms. M. Cusumano, A. Gawer, D. Yoffie distinguish three types of platforms: innovation platforms (which enable the development of new complementary products), transaction platforms (electronic marketplaces, which facilitate the exchange of goods, services, and information), and hybrid platforms (which combine the features of both previously mentioned types) [33]. In comparison, T. Doligalski identifies four types of platforms. He classifies the first two as community-based platforms, while the remaining two fall under the category of multilateral platforms [34].

Despite its many advantages, globalization driven by digital technologies faces numerous challenges. Among the most significant are the issues related to personal data protection, cybersecurity, the dominance of a few technological giants over global information flows, and limited access to digital infrastructure in certain parts of the world. These challenges are also faced by the world's largest online platforms, such as Netflix, which offers a wide range of content tailored to local markets and

Amazon, the largest online retailer, which enables cross-border sales and provides data storage services.

6.3.2 New forms of internationalization in the digital economy

Internationalization is the process of gradually involving a company in operations on foreign markets, based on growing experience with and knowledge of those markets [35]. It refers to the expansion beyond domestic markets with the aim of increasing sales, spreading risks, or gaining a competitive advantage [36]. Thus, internationalization involves extending economic activity beyond national borders. An important aspect of this process besides imports and exports is entering foreign markets. Internationalization, understood as the globalization of firms, markets, or institutions, is a dynamic process contributing to the globalization of the world economy. The dynamic conditions of globalization, combined with the nature of international business, make it possible to link macro- and microeconomic issues, especially in relation to multinational enterprises [29]. According to J. Rymarczyk, internationalization includes any form of business activity that a company undertakes abroad [37].

The definitions above emphasize that the internationalization of enterprises particularly in terms of active forms of foreign operations should traditionally involve the physical transfer of capital or know-how. However, modern digital technologies have fundamentally changed how companies approach international expansion. Instead of relying solely on a traditional physical presence in foreign markets, businesses increasingly adopt online-based solutions, ranging from online sales platforms and social media channels to cloud-based services. Classical models of internationalization typically requiring a company to establish a physical presence abroad are now being complemented by digital distribution channels and e-commerce platforms.

One of the key manifestations of change in modern international business is a phenomenon referred to as digital global expansion. That simply means conducting business in foreign markets with the help of information technologies [38]. In the context of economic globalization, increasing attention is being drawn to enterprises that are globally oriented since their establishment, commonly referred to in the literature as "born global". The main objective of these companies from the very beginning – is to enter foreign markets while leveraging digital solutions to scale and broaden their international reach [39]. Such companies are most often active in sectors like information technology, e-services, online education, or SaaS (Software as a Service) business models. Thanks to the digitalization of sales and customer service processes, the costs of entering foreign markets have been significantly reduced.

6.3.3 Internationalization of e-commerce

Digital transformation is a process in which organizations use digital technologies to change their business models, operational processes, and the way they deliver value to customers. In the international context, e-commerce is no longer viewed as merely a sales channel, but it has become a strategic tool of digital transformation, as it drives changes in business models, alters relationships with customers, and transforms the structure of competitiveness in the global market.

E-commerce (online trade) should be seen as the processes of buying and selling supported by electronic devices [40]. Hartman defines e-commerce as a specific type of e-business venture, centered around individual transactions using the Internet as the medium of exchange [41]. In general, e-commerce refers to a series of activities carried out to complete transactions through electronic means.

Three main forms of e-commerce can be distinguished:

- B2C (business to customer) – a business relationship between a company and an individual customer;
- B2B (business to business) – a relationship between two companies;
- C2C (customer to customer) – a type of transaction between private individuals.

E-commerce has become not only a new sales channel, but also a powerful tool for transforming business models and internationalizing enterprises.

The ongoing digitalization of commerce has led to the emergence of various types of sales platforms, which enable businesses to operate effectively in the online environment. Depending on how they function and the degree of control over sales processes, three main types of e-commerce platforms can be distinguished:

- open-source – software that can be freely modified or extended with custom plugins;
- SaaS (Software as a Service) – cloud-based software services providing infrastructure and servers for running an online store;
- dedicated platforms – custom-built e-commerce solutions created from scratch, often tailored to specific business needs [42].

According to H. Brdulak, the share of e-commerce in retail sales varies. It depends on the level of digitalization in a given country and consumer habits, ranging from a few to several percent. A steady increase in the share of e-commerce in total retail sales is therefore evident [43].

Thus, it is worth analyzing the development of e-commerce within the European Union. From a statistical standpoint, in 2023, 17.7% of businesses in the EU conducted e-sales exclusively via websites or apps, 3.1% used only Electronic Data Interchange (EDI), and another 3.1% applied both methods. Among EU enterprises,

turnover from e-commerce via own websites or apps in 2023 was nearly six times higher than via marketplaces. In the accommodation sector, 99.6% of EU businesses engaged in e-sales in 2023 received orders through websites or applications.

Notably, between 2013 and 2023, the share of companies in the EU conducting online sales increased from 17.21% to 23.83%. Meanwhile, their turnover from e-commerce rose by 5.31 percentage points – from 13.81% to 19.12% – although the 2023 turnover was 0.71 percentage points lower compared to the peak level recorded in 2019 (Fig. 6.2) [44].

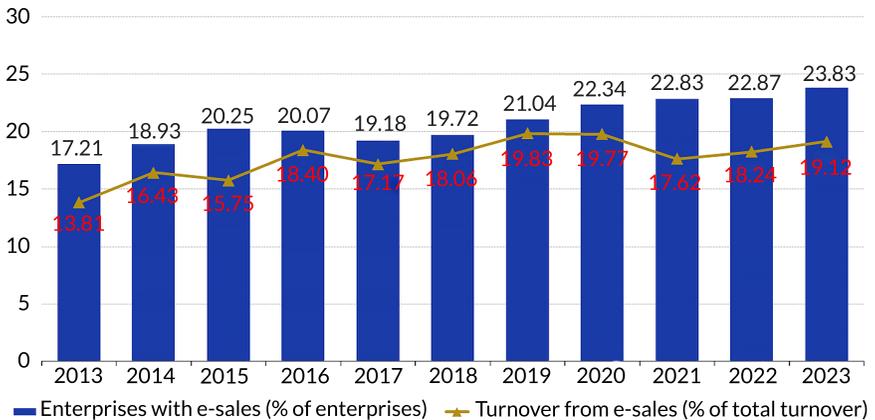


Fig. 6.2 E-sales and turnover from e-sales, EU, 2013 to 2023

Source: [44]

The level of engagement in e-commerce and the share of e-sales in total enterprise turnover in 2023 varied significantly depending on company size. Among large enterprises, 46.45% engaged in electronic sales, with revenues from this channel accounting for 24.44% of their total turnover. For medium-sized companies, 30.51% conducted e-sales, which constituted 14.99% of their total revenue. In contrast, the lowest level of engagement was recorded among small enterprises, with only 21.88% of them selling online and generating 9.49% of their total turnover that way (Fig. 6.3).

E-sales can be conducted through websites or mobile applications (internet sales), or carried out automatically via Electronic Data Interchange systems. Companies may offer one or both of these options to their customers. In 2023, among EU countries, the proportion of companies engaged in e-sales ranged from 12.20% in Luxembourg and 14.74% in Romania to 42.07% in Lithuania, followed by Ireland (39.57%), Denmark (38.76%), and Sweden (36.50%) (Fig. 6.4).

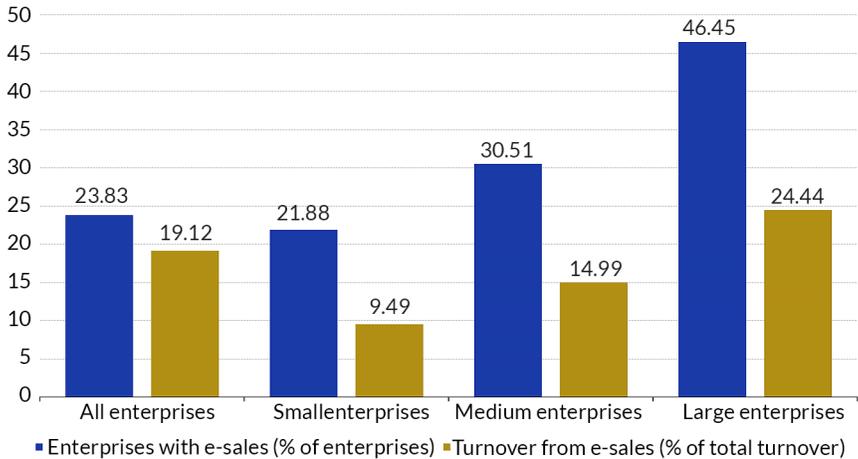


Fig. 6.3 E-sales and turnover from e-sales, by size class, EU, 2023

Source: [44]

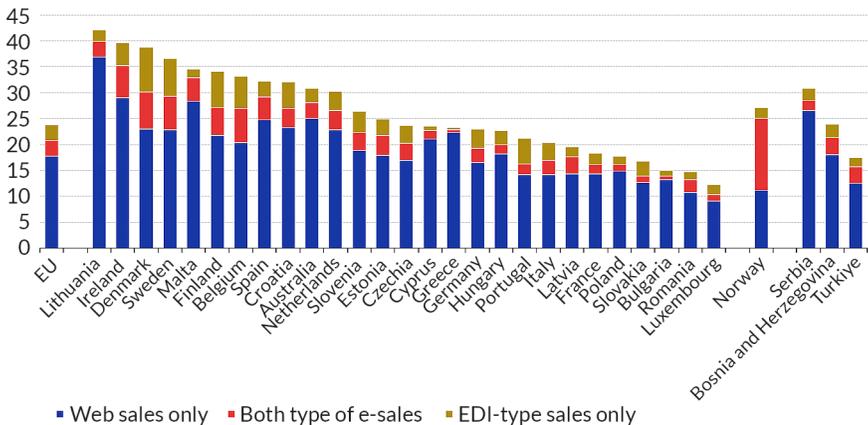


Fig. 6.4 E-sales broken down by web sales and EDI-type sales, 2023 (% of enterprises)

Source: [44]

In 2023, 17.69% of companies in the EU conducted e-sales exclusively via websites or apps, 3.08% used only EDI, and 3.06% employed both channels. Internet sales remained the dominant form of e-commerce across all EU member states. The share of businesses receiving orders solely through websites or mobile apps ranged from 36.89% in Lithuania to 9.09% in Luxembourg. As companies increasingly

recognize the importance of online presence, websites and mobile apps have become popular sales tools, enabling customers to place orders conveniently online. On the other hand, the proportion of firms relying solely on EDI for e-sales varied from 8.72% in Denmark and 7.23% in Sweden to under 1% in Greece (0.44%) and Cyprus (0.87%). The highest percentage of enterprises using both internet sales and EDI was observed in Denmark (7.06%) and Belgium (6.55%), while the lowest was in Greece (0.47%) and Bulgaria (0.74%).

According to the data presented in Fig. 6.5, in 2023 nearly all businesses operating in the "Accommodation" sector and conducting e-sales (99.55%) received orders via websites or mobile applications. In contrast, 8.36% of these businesses used EDI system to carry out sales.

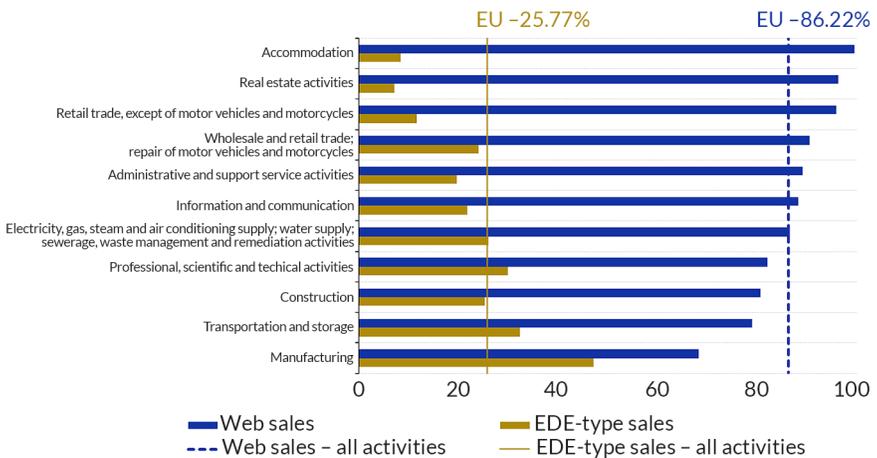


Fig. 6.5 E-sales broken down by web sales and EDI-type sales, by economic activity, EU, 2023 (% of enterprises with e-sales)
 Source: [44]

Nearly half of the enterprises in the "Manufacturing" sector engaged in e-sales reported receiving orders via EDI (47.10%). Other sectors with a high percentage of companies using EDI included "Transportation and storage" (32.34%) and "Professional, scientific and technical activities" (29.96%). Among manufacturing companies, the share of firms using websites or applications for e-sales and those using EDI was relatively close – 68.26% and 47.10%, respectively. In other sectors of the economy, sales were primarily conducted through websites or mobile applications (Fig. 6.5).

Among small e-commerce enterprises, 89.40% conducted sales via websites, while 20.22% used EDI. In the case of medium-sized enterprises, the difference between the shares of sales made through these two channels was smaller, with 78.12% of companies selling online and 39.15% using EDI. The smallest difference between these two types of sales occurred among large enterprises (Fig. 6.6).

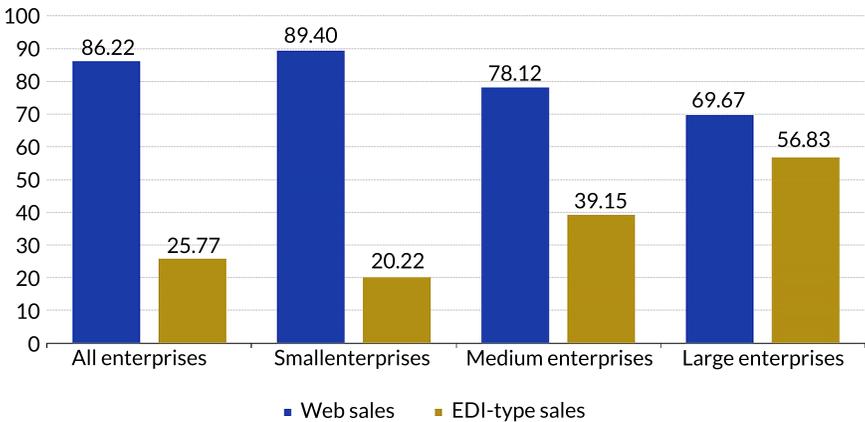


Fig. 6.6 E-sales broken down by web sales and EDI-type sales, by size class, EU, 2023 (% of enterprises with e-sales)
Source: [44]

The results of the e-sales analysis across various industries and companies of different sizes reveal significant differences in preferred online sales channels. In 2023, sales through websites and mobile applications were the most commonly used form of e-commerce, especially in the Accommodation sector, where almost all companies relied on this channel. In contrast, the use of EDI was more prevalent in the Manufacturing, Transportation and storage, and Professional, scientific and technical activities sectors. Small enterprises predominantly opted for internet-based sales, while medium and large companies were more likely to combine both channels, demonstrating a more balanced approach.

In the context of internationalization, digitalization acts as a key catalyst, removing traditional barriers associated with entering foreign markets, such as high logistics costs, the need for physical presence, or the development of extensive distribution networks. The use of digital tools enables companies to achieve international reach while also facilitating real-time data collection and analysis, allowing them to tailor their offers precisely to local needs and expectations. As a result, digital

transformation not only supports the internationalization process but increasingly becomes a prerequisite for companies seeking to operate internationally.

When analyzing digital transformation, it is important to consider the Digital Economy and Society Index (DESI) of selected EU countries. This tool, developed by the European Commission, allows for tracking the progress of digital development within EU member states. It enables the evaluation and comparison of the level of digitalization across countries and highlights the areas requiring further action or support [45]. DESI is based on four main pillars:

- human capital – assessing citizens' digital skills, both basic and advanced (e.g., in ICT);
- connectivity – analyzing digital infrastructure, including the availability of high-speed internet, 5G network development, and quality of online services;
- implementation of digital technologies by companies – measuring the adoption of modern technological solutions by companies, such as cloud computing, data analytics, or online sales;
- digital public services – evaluating the digitalization level of public administration, access to e-health services, and the use of open data.

The DESI index also plays an important role from the perspective of company internationalization, as a country's high level of digitalization creates favorable conditions for conducting business on international markets. Countries that score high on the DESI ranking provide companies with:

- a developed and stable technological infrastructure;
- access to qualified ICT professionals;
- favorable conditions for the development of e-commerce and digital services;
- a modern, efficient public administration available online.

To illustrate the DESI index level in selected Central and Eastern European (CEE) countries, it is worth analyzing it across several dimensions.

The first indicator showing the level of DESI is online sales by SMEs (**Fig. 6.7**).

Between 2021 and 2023, the highest share of enterprises engaging in online sales (30% of all enterprises) was recorded in Lithuania, while the lowest was observed in Romania and Bulgaria. In the case of Bulgaria, a moderate annual growth rate in the share of enterprises selling online is noticeable.

Among the countries of Central and Eastern Europe and Germany, the highest percentage share of enterprises, relative to all enterprises using big data, was observed in Germany. Since 2019, a steady, moderate annual growth rate has been visible. All EU countries have also shown a moderate annual growth rate. However, for some countries, 2019 marked the beginning of significant declines in the share of enterprises using Big Data. These countries include, most notably, Lithuania, Romania, and Slovakia (**Fig. 6.8**).

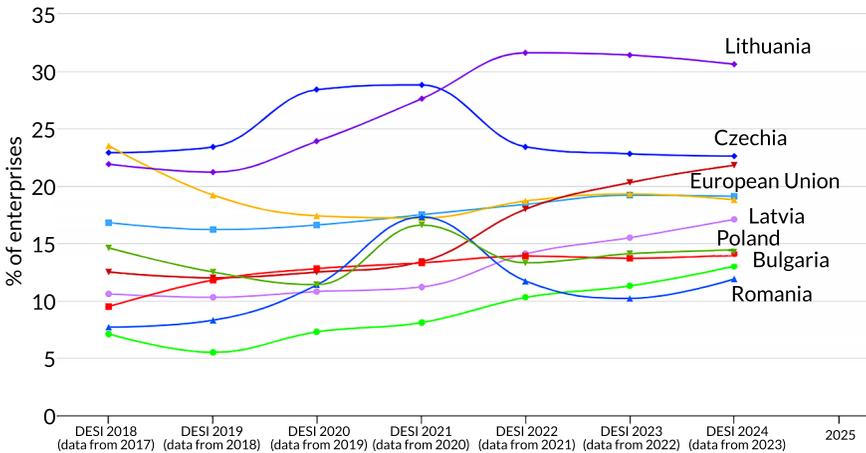


Fig. 6.7 SMEs selling online, Small and medium-sized enterprises
Source: based on [46]

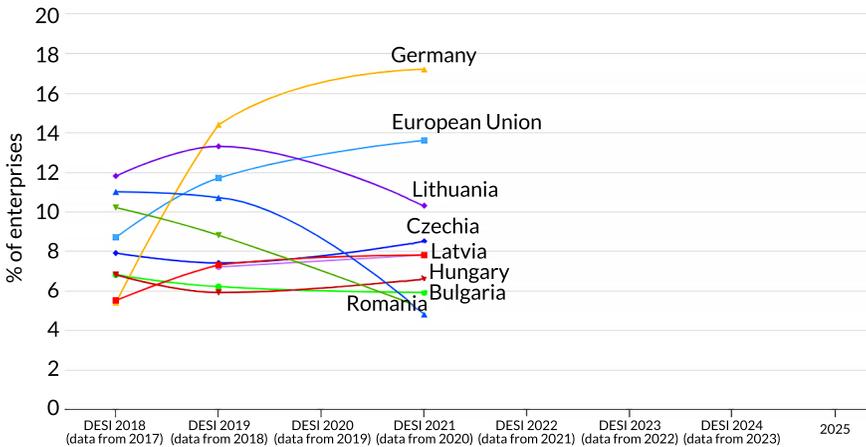


Fig. 6.8 Big Data, small and medium enterprises
Source: based on [46]

Therefore, it is worth mentioning the Digital Intensity Index (DII) in selected countries of Central and Eastern Europe (Fig. 6.9).

The share of enterprises with a high or very high Digital Intensity Index in EU countries stood at 34.3%. In Poland, this figure reached 33.2% in 2024, ranking

17th among all EU member states. The lowest shares of enterprises with a high or very high DII were recorded in Bulgaria and Romania, at 17.6% and 23.0%, respectively.

The use of artificial intelligence by enterprises in selected European countries should also be analyzed (Fig. 6.10).

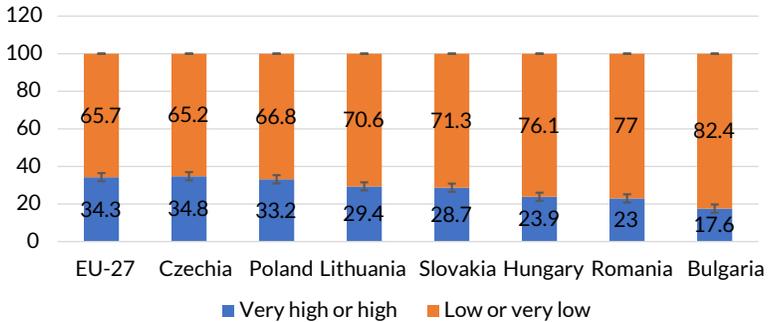


Fig. 6.9 Enterprises by level of DII in selected CEE countries in 2024 in % of enterprises
Source: compiled by the author based on [47]

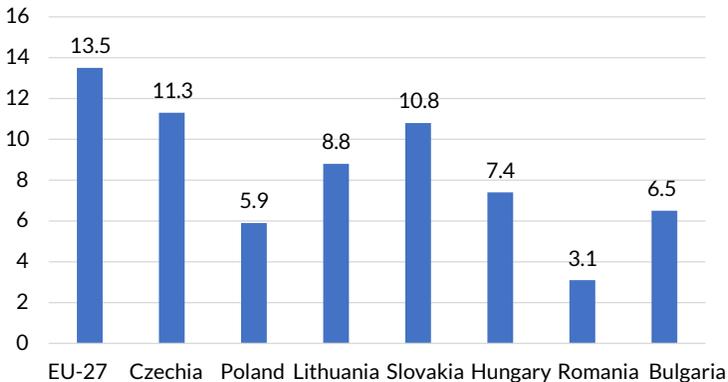


Fig. 6.10 Use of artificial intelligence in countries (2024, % of enterprises)
Source: compiled by the author based on [47]

The lowest share of enterprises using artificial intelligence was observed among Polish and Romanian companies, with only 5.9% and 3.1% of enterprises, respectively, making use of AI.

Digital innovations have a significant impact on consumer behavior and expectations, but, most importantly, they shape intelligent logistics and transportation

systems [48]. An increase in a country's DESI score contributes to enhancing its economic competitiveness and the quality of life of its society. As a result, foreign investments are intensified, highly qualified professionals are attracted, and the citizens can access advanced digital and infrastructural services more easily.

6.4 Digital transformation index in an international context

To determine the impact of digital transformation on a company's capacity for international expansion, it is proposed to develop an Enterprise Digital Transformation Index (EDTI). For the construction of this instrument, the following variables need to be considered:

1) country digitalization – the level of digital development in the country where the enterprise operates should be determined using available statistical data, such as the DESI index or other country digitalization indexes;

2) company digitalization – the level of a company's digital maturity should be assessed, for example, using a four-point scale:

- lack of a digital strategy in the enterprise (1 point);
- implemented ERP/CRM systems, digitalized processes (2 points);
- implemented ERP/CRM systems, digitalized process, integrated tools, automation, e-commerce (3 points);
- implemented ERP/CRM systems, digitalized process, integrated tools, automation, e-commerce and at least digital strategy, Big Data and AI (4 points).

The formula will therefore be as follows

$$EDTI = \frac{HCD + ED}{2},$$

where *EDTI* – Enterprise Digital Transformation Index; *HCD* – Host Country Digitalization Level; *ED* – Enterprise Digitalization Level.

It should be assumed that as the level of an enterprise's digital transformation increases, so does its readiness to engage in internationalization activities.

6.5 Conclusion

Digital transformation is a long-term and costly process of implementing digital technologies into a company's operations. Its primary goal is to increase efficiency, foster innovation, and improve the quality of services provided. In the global

context, digital transformation plays a crucial role in building competitive advantage. Enterprises with a higher level of digitalization are better equipped for international operations. Digital transformation has a significant impact on economic development, innovation, and integration with global markets, and today constitutes an important element of development strategies – both at the national and international levels.

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