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The Impact of the Digital Revolution on the Global Economy

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***Abstract*---**Today, the economy is undergoing serious changes based on new digital technologies and artificial intelligence, which has affected serious qualitative and structural shifts. The purpose of this work is to study the impact of new technologies on economic processes, the advantages and disadvantages of the rapid development of new technologies. The significance of the research is determined by the relevance of the topic of the work, as well as the importance of tracking the processes of the world economy. The authors conducted a study and revealed that the digital economy is influenced by trends in the use of modern technologies, described the consequences of these changes, as well as the possibility of preventing problems. Globalization, integration, acceleration of integration processes, industrialization, environmental, demographic and political factors of economic life around the world require balanced development of the national economy with special attention. This article examines the ways of economic development and the following consequences. Analysing the results, it can be noted that it is impossible to say unequivocally what can negatively or positively affect the development of the digital economy, because there is an unpredictability factor that needs to be constantly taken into account in research.

***Keywords*---**digital economy, digitalisation, GDP, technology, world market.

Introduction

Technologies lead to fundamental changes, the world is changing in political, social, and economic terms. New methods and approaches are replacing old

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institutions, and the global economy is also changing rapidly. Some governments agree to free trade agreements, others try to block their markets in a protectionist regime. Every country is looking for the "best way forward" as digitalisation dramatically accelerates the growth and influence of businesses around the world. It is necessary to assess the impact of digital innovations on the global economy (Gapsalamov et al., 2021; Dung et al., 2021).

From the very beginning of the computer era, scientists assumed the convergence of computer technologies with communication technologies. Since AT&T Bell Labs played a key role in the development of both directions, many considered it the most likely driving force of this direction of development. It was Bell Labs that originally developed the transistor, was the first to invent the electronic telephone switching systems (in fact, specialised computers), and it was at Bell Labs that Claude Shannon was a pioneer of information theory in the 1940s (Guizzo, 2003). However, until 1990, for one simple reason, the two technological streams remained completely different, at least as far as applications were concerned. Communications (including radio and television broadcasting) were still analogue, while computers were mostly digital (Oviogun & Veerdee, 2020; Jing, 2017).

The final convergence in practice was caused in part by the development of cellular communication and television technologies. Since 1972, the Japanese consumer electronics giants have spent a lot of money and years of development to design an advanced "high definition" or "hi-vision" television system. It was supposed to be the next generation of television and technology. Recently, more and more achievements are being presented in the field of automation. The development of robots and algorithms will change the way work is organised, and as a result, they can completely replace human labour. These hopes or fears are well illustrated by the March 2014 issue of The Economist magazine, which featured "Rise of the Robots" on its front page (Steiner-Khamsi et al., 2018).

The corresponding article on digitalisation started with the following words: "Prepare for a robot invasion. It will change the way people think about technology". However, many scientists and people speculate on how justifiable these fears are. If the digital revolution is really happening, what will be its consequences? The answers to these questions are very controversial not only among the general public but also among scientists. The key to solving all social, economic and other problems of society is to achieve sustainable development and economic growth of the national economy. The well-being of the population will ultimately depend on the level and pace of economic growth. Depending on the pace and degree of economic development, it is possible to assess the economic state of society. An indicator of how well its goals have been achieved is either GDP per capita or national income. It is worth noting that as a result of macroeconomic stabilization and economic growth in the country, the standard of living of the population is improving and the standard of living is increasing. Indeed, globalization, integration, acceleration of integration processes, industrialization, environmental, demographic and political factors of economic life around the world require balanced development of the national economy with special attention. In the conditions of economic globalization, knowledge of the criteria of economic equilibrium is important for the development of a reasonable economic policy of the state. In all countries, employment at different stages of

development, the strengthening of the national currency, and an increase in growth rates have always been relevant. Therefore, these issues are reflected in the economic policy pursued in each country, and solving these problems can directly improve the standard of living and well-being of people (Kustina et al., 2019; Jurgaitis, 2018).

Digital transformations change lives, affect the surrounding processes, and the world economy does not stand aside. The leap in technology development has affected the economy and largely influenced its processes. For example, automation of production entails a reduction in labour resources, but creates new vacancies, which, however, require additional competencies and skills. However, transformations do not only have a negative impact: The Internet and social networks allow entrepreneurs and ordinary people to expand their network of working contacts, interact with people around the world and create more and more high-quality and useful goods and services. The relevance of the research is determined by the rapid development of the digital economy and the introduction of technological solutions into the economic cycles of enterprises, companies and countries (Carlsson, 2004; Hojeghan & Esfangareh, 2011).

The purpose of the study is to consider the impact of digitalisation on the economies of countries, to explore the advantages and disadvantages of the rapid development of new technologies, as well as to determine the safe vector of development of the ways of the world economy. The tasks of the work will include the study of the issues of the digital revolution in the world, tracking the impact on processes in society, as well as highlighting the positive and negative consequences of the digitalisation of economic processes. The scientific significance of the work is determined by the study of the impact of the digital revolution on the economy and its processes in the context of considering the advantages and disadvantages, as well as determining a safe vector of development (Antikainen et al., 2018; Gromova et al., 2020).

Materials and Methods

Today, many discussions boil down to the fact that there is a period of accelerated automation, characterized by the large-scale introduction of robots and artificial intelligence into the workplace. Robots have been used in the automotive sector since the 1970s, and since the 1980s, welding workshops in automobile factories have been almost completely automated. Automation has gone even further in the food and electronics industries than in the automotive industry. The acceleration of technological change is a well-known phenomenon in the manufacturing and service sectors and a major theme in the sociology of labour because the revolution of the productive forces is a constant imperative of capital. This process took place in waves, which caused constant scientific debate. The relationship between automation and skills has been a key issue at various points in time: during the appearance of the first robots and machine tools with numerical control Noble (1986), during the introduction of computer-integrated production concepts in the 1980s and 1990s Brödner (1990); Adler (1992), as well as at the present time.

These waves of technological changes were accompanied again and again by radical predictions and conversations about technologies replacing people, as shown in Brödner (1997), in the critical deconstruction of cybernetics and the theory of artificial intelligence. As an example of such prophecies, he cites works Simon & Newell (1958), that state:

- Within ten years, a digital computer will become a world chess champion, unless the rules prohibit it from participating in competitions.
- Within ten years, a digital computer will discover and prove an important new mathematical theorem.
- Within ten years, a digital computer will create music that will be accepted by critics as having significant aesthetic value.
- Within ten years, most theories in psychology will take the form of computer programmes or qualitative statements about the characteristics of computer programmes.

Although the first forecast came true only in 1996 (28 years later than the forecast), the other three forecasts still remain an assumption. Yet if there is nothing new in the use of robots, computers and high automation, what exactly is new in the current digital revolution sometimes remains a question. A key topic related to automation is the development of so-called "cyber-physical systems", that is, self-regulating aggregates of objects (machines, but also parts) that communicate via the Internet of Things Holler et al. (2014), and use new technologies such as sensors and real-time computing methods. In one of the source documents of the German platform related to the concept of Industry 4.0, the authors described this development as follows:

- At the moment, many world leaders and large companies are creating global networks that include their equipment, warehouse systems and production facilities in the form of cyber-physical systems. In the production environment, these cyber-physical systems include intelligent machines, storage systems and production facilities capable of autonomously exchanging information, initiating actions and independently managing (der Forschungsunion Wirtschaft–Wissenschaft, 2013).
- The second important achievement in the field of automation was the emergence of new flexible and lightweight robots that can work together with people. There are other similar trends that are not related to automation; these include the so-called digital auxiliary systems (tablets, information glasses, smartwatches, etc.). Some authors suggest that artificial intelligence will become a way to automate some areas of work of office workers McAfee & Brynjolfsson (2017), but such developments do not correspond to reality yet.
- The third important transformation is the development of the so-called platform economy. Well-known companies such as Amazon, Facebook, Google and Ebay, and newcomers such as Uber, Lyft, Deliveroo and Upwork have created digital infrastructures (platforms) that provide a wide range of activities. Together, they caused the reorganization of markets, the creation and strengthening of new values in it and eventually led to a change in the standards of work. A number of new information and communication technologies contributed to this development, in particular, the transfer of

computable algorithms to an easily accessible cloud (Kenney & Zysman, 2019).

One of the new forms of work that has appeared in the platform economy is crowd-work (Gerber & Krzywdzinski, 2017). This term describes the growing transfer of tasks via Internet platforms to external parties who perform this work online in the digital cloud from various locations around the world. The range of tasks is wide and includes simple categorization of data or writing text, as well as more creative and complex tasks such as design, innovation in products and services, or scientific problem-solving. These tasks no longer require either employees or offices. Members of the so-called crowd (an indefinite number of persons) do not work, and they do not need to know the company they work for. Upon closer examination of the areas of technological innovation, it can be noted that they are based on older systems and that technological development is much more gradual than is assumed in the current discussions. However, the question remains relevant: why are we talking about the digital revolution taking place now (Lee, 2006; Chen et al., 2007).

There are two different explanations for this phenomenon. The first considers technological innovation as the main engine of progress. The book Brynjolfsson & McAfee (2014), emphasizes the important role of Moore's law. According to this law, the power of digital technologies is doubling every year. Initially, this law was related to the amount of computing power that can be bought for one dollar. The authors claim that this also applies to a wider range of developments, for example, the speed of computers and data transmission, installed computing power, and so on. The Exponential growth of technological capabilities leads to radical changes and radical acceleration of innovation at a certain point in time: The possibilities of today's calculations help to understand why progress in digital technologies seems much faster these days, and why there are so many recent examples of science fiction becoming a reality for business. This happens because the steady and rapid exponential growth of Moore's law has led to the fact that we are now in a different computing mode (Brynjolfsson & McAfee, 2014). There are various reasons to be sceptical about explanations regarding technology. One of the reasons is the well-known "productivity paradox" of information technologies (Brynjolfsson, 1993). For a long time, economists have been discussing the paradox that the introduction and spread of information technology in the economy does not seem to have a noticeable impact on productivity. The article Acemoglu et al. (2014), concluded that there is still no evidence of a revolution in productivity caused by new technologies.

The second reason to doubt the technological argument given in the article Brynjolfsson & McAfee (2014), is an alternative explanation of the current discussion proposed in (Pfeiffer, 2017). The authors claim that since 2010 there has been a change in policy on a global scale. The 1990s and 2000s were characterized by de-industrialization. Manufacturing was considered a holdover, while it was expected that future economic growth would be determined by the service sector and the financial sector. There have been big changes since the global financial crisis. On the one hand, the crisis has shown that uncontrolled growth of the financial sector can have very harmful consequences. On the other hand, countries with a strong manufacturing base, such as Germany, recovered

from the crisis much better than other countries. The World Economic Form has published several reports that emphasize the importance of a strong manufacturing base for economic growth and the need to invest in new technologies. In the case of the United States, which has experienced a sharp decline in production since the 1980s, presidential administration advisers issued a report calling for "American leadership in advanced manufacturing" (Kersey, 1996; Roure & Keeley, 1990).

The result of this change in strategy was global competition and a race for leadership in the process of digitalisation. It is expected that the pioneers will be able to define standards for the new industrial Internet of Things and its applications. Such an aspiration leads to the fact that the pioneer country will be able to sell technologies to other countries and, thus, ensure income growth and employment of the population. In Germany, the government, business associations, trade unions and research institutes have created the Industrie 4.0 platform, designed to promote the development of new technologies (Rajput & Singh, 2019). The French government has launched a similar project called Industrie du Futur. The private initiative Industrial Internet Consortium was founded in the USA with the aim of promoting standards for new technologies. But the activity was not limited to traditional industrialized countries. China has launched a large-scale program called "Made in China 2025" Li (2018), which includes a large number of sub-initiatives that range from efforts to develop advanced technologies in robotics and industrial Internet to programmes aimed at modernising traditional labour-intensive industries through the introduction of traditional automation concepts (Butollo & Lüthje, 2017). There are many other countries with similar projects. These national programs mobilize public and private money and are aimed at accelerating technological innovation. They also include campaigns to mobilize all companies and sectors, as well as encourage their investments in these technologies and create additional markets for them. PR campaigns aimed at increasing the perception of new technologies among workers and the general population are also included (Albuquerque et al., 2005; Taylor, 2005).

As a result of the literature review and analysis of the information received, it can be hypothesised that the new stage of digitalisation will certainly increase the activity of information exchange, but most likely will not have a significant impact on the expansion of international trade and acceleration of economic processes. Moreover, digitalisation can help to increase international communication in economic circles and to improve productivity. The process of interaction and the impact of digitalisation on the development of the world economy and international economic relations should be considered in two areas of research: as a dynamic process of international exchange (goods, services, capital, labour resources and information) and as a process of development of a set of national economies. In addition to the hypotheses presented, the authors of this article analysed and summarized the available research results of authoritative publications Simon & Newell (1958); Noble (1986); Brödner (1990); Adler (1992); Brynjolfsson (1993); Brödner (1997); der Forschungsunion Wirtschaft–Wissenschaft (2013); Acemoglu et al. (2014); Brynjolfsson & McAfee (2014); Holler et al. (2014); Kenney & Zysman (2019); Gerber & Krzywdzinski (2017); McAfee &

Brynjolfsson (2017); Pfeiffer (2017); Rajput & Singh (2019), processed primary statistical data and formed illustrative materials as an evidence base.

However, it is not necessary to associate the digital revolution only with technological innovations. Among other things, technology is embedded in the relationship of social power. Thus, their use and influence always depend on the need, preferences and strength of the participants. Therefore, behind all discussions about the technological revolution, shifts in the strategies of global and national economic actors, multinational companies, international organizations, as well as large governments and the transformation of global capitalism should be identified.

Results and Discussion

In the context of globalization, the digitalisation of the national economy plays an important role in the integration of the economies of developed countries. In the new economy, digital network and communication infrastructure provides a global platform for developing strategies for the development of enterprises and organizations. In addition, they ensure cooperation, economic communication, information exchange and efficiency. Currently, there is a transition to digital technologies. From the media to automobiles, tourism, agriculture and healthcare, efforts are being made to digitize the entire economic system. To develop the economy, it is necessary to acquire digital knowledge and modern information technologies. This will allow choosing and following the shortest paths of advancement. First of all, it is necessary to fully digitize construction, energy, agriculture and water management, transport, geology, cadastre, healthcare, education, archives.

The digitalisation of all sectors of the economy is not an easy task, but without it, integration into the global economy will not be possible. To do this, it is necessary to perform the following tasks in a number of priority areas. Including:

- Modernisation of digital infrastructure taking into account modern requirements.
- Creation of "digital production" using technologies to ensure product quality and competitiveness in industries, as well as to increase efficiency.
- Creation and maintenance of efficient small and medium-sized enterprises in the field of digital technologies, platforms and services.
- Creating data centres that provide simple, stable, secure and cost-effective data storage and processing services for government, business and citizens;
- Implementation of digital data platforms to meet the needs of authorities, businesses and citizens.
- Full transition to non-cash (electronic) payments, remote access and other electronic forms of banking and financial activities.
- Ensuring the integration of electronic payment systems with global payment systems.

Digital technologies will be crucial in achieving these systemic changes. Countries should make maximum use of digital solutions in the interests of the economy. To do this, it is necessary to remove obstacles to their dissemination, ensure the free

flow of data across networks and borders, strengthen confidence in the data economy and maximize the synergy between digital economy programs. The practise of using digital solutions in Russian companies and industries shows that it is necessary to increase the efficiency of their use, since many are simply added as one of the tools, but are not sufficiently supported when used. The vast majority of business leaders are taking steps to introduce automation of production processes due to new trends, often "provoked" by generous promises of sales specialists, the results of scientific conferences, articles in the popular press, successful examples from foreign experience and wonderful dreams about management. All this promises them to reduce labour costs, automate processes, but to achieve these goals, it is necessary to competently integrate new solutions into the production environment, digitalisation will be successful only with full interaction of all areas of the economic process. For example, actual production tasks are often overlooked, since a virtual digital double is created specifically for a real-life enterprise. Table 1 presents the most popular and demanded options for enterprise management automation systems in terms of ensuring high productivity and high profitability of sales.

Table 1
Priority directions of digital solutions at Russian enterprise

Digital transformation	Content of the event	Expected effectiveness of the event
Comprehensive solutions for forecasting and modelling customer behaviour	To ensure the production of products of sufficient volume, which the consumer will definitely buy	Reducing project execution time and increasing its efficiency. This is a key decision for most small and medium-sized companies to improve efficiency, to become flexible and adaptable
Systems for monitoring the operation of own equipment	Ensure high reliability of equipment and product quality	Implementation of the project on time and within budget – the client is satisfied, and then they will reapply with the order and bring new customers
Automation of solutions for targeted production planning, creation of virtual production systems	It is necessary to take into account a number of factors and criteria: availability of production facilities, order queues, enterprise environment parameters, risks, requirements of stakeholders and influence groups.	Visual implementation of the training effect. When implementing a project, even when agreeing on a strategy, potential risks may arise and plans may be disrupted. They must be prevented. Ensure the sustainable development of the company
Complex automated control systems of fixed assets of production according to	Quickly identify areas with deviations in equipment reliability, compliance with production processes.	It is necessary to ensure a better competitive position. The concomitant effect improves the reputation of the company. To prevent the increase in the cost of products by preventing

specified parameters.		equipment failure or reducing the number of its downtime
Advanced AR/VR design visualization technologies and 3D modelling	A virtual analogue of the real work of assembly lines, production processes and the whole production is being created	This advantage is important not only inside the company, but also outside it. This is due to increased efficiency and competitiveness

For Russian managers and businessmen, four directions of innovative development provided by digital technical methods are now most relevant:

- Restructuring of the existing hardware and software management infrastructure of the enterprise.
- The use of product lifecycle management and product data management in production.
- Implementation of optimizing analytical systems for making more calculated decisions online.
- Adaptation of employees to innovations and new hierarchical positions in a digital enterprise.

Many Russian enterprises need to start not with digitalisation, which is actively taking place in the economy, but with primary automation and informatisation of traditional production. Thus, after analysing the possible ways of economic development, the advantages of the impact of the digital revolution on the world economy were highlighted in the course of the work. The creation, extraction, processing and exchange of data using digital technologies such as sensors, connected devices and online platforms will lead to more intelligent use of resources. By providing real-time data on the condition of components, sensors placed on products such as tires and elevators allow companies to anticipate failures and know when to service, replace or repair components. This allows for preventive maintenance and prolongs the service life of the product.

Companies can also sell products as a service by using sensors to track their usage. Users pay a commission based on consumption, while companies retain ownership of the product. This is a mutually beneficial partnership: companies receive a continuous stream of income and are interested in ensuring that their products are used for longer, while consumers have to pay only for what they need. Digital technologies can also contribute to more sustainable consumption patterns. For example, smartphone applications can be used to read the digital passport of a product, providing information about the materials and resources used for its production, as well as about its durability, reusability and recyclability. Digitalisation can help to remove some of the barriers that currently hinder new achievements. In order to use the full potential of these solutions, it is necessary first to remove obstacles to their implementation. Too many companies remain unaware of the existence of new possible technologies or their potential in terms of improving resource efficiency. Funding is also crucial. Too often, businesses lack the financial resources to adopt more progressive business models. Similarly, access to data and its free movement across borders is hindered by insufficient digital infrastructure, compatibility between systems,

geo-blocking and the unwillingness of companies and individuals to share their data.

The policy frameworks of various countries often play a role in promoting the use of digital technologies to achieve the goals of the economic cycle. Stakeholders should be able to collect, process, share and reuse data in a secure environment. In this regard, the initiatives envisaged in the framework of the European Commission's mid-term review of the Digital Single Market of May 10, 2017, are relevant for the economic cycle. The free flow of open data can make it easier for companies to analyse and transfer data and expand innovative business models. In this regard, various regulations have recently been introduced: the Strategy "Building a European Data Economy", outlined in January 2017, which aims to maximize the potential of digital data for the benefit of the economy and society, as well as the proposal to regulate the free flow of non-personal data from September 13, 2017. A deeper understanding of the potential implications of regulation aimed at building a European data economy for economic cycles is needed.

Trust is also of paramount importance. To participate in the practice of digitalisation of the economy, stakeholders must be able to collect, process and exchange data in a reliable and secure environment. As a consequence of the free flow of data, it is very important to clarify the circumstances regarding the access and use of this data. Stakeholders in the chain of creation of goods and services should be aware of the conditions of responsibility, confidentiality, interoperability and have fair access and use in these conditions. In addition, the provisions of the Commission's Cybersecurity Package (adopted in September 2017), aimed at improving the cybersecurity of connected objects, and the General Data Protection Rules, which come into force in May 2018, can also benefit economic relations. However, more legal and technological safeguards are needed to convince businesses and consumers that their data is protected from cybercrime threats and that they can safely develop and use digital tools to achieve their goals.

In addition, it is necessary to continue studying and implementing blockchain technology, as it can help to gain more knowledge about material cycles and processes in the value chain and allow data exchange in a secure environment. The Blockchain Observatory and Forum, launched in February 2018, will explore the potential of this technology. It would also be useful to study its impact on the environment. Since by 2020 the Commission plans to allocate 340 million euros for projects using blockchain technology, specifically targeting projects that seek to achieve the goals of a closed-loop economy can have many other advantages. Online platforms make it possible to create models of a collaborative economy in which consumers can share, exchange, buy and sell used or new goods, as well as services. Unused products take on new life rather than being thrown away, while consumers can earn or save extra money.

Professional development in the field of digital technologies requires additional investments. More efforts need to be made to ensure that entrepreneurs who want to develop innovative business models can acquire the necessary digital skills. The introduction of innovations and new technologies into economic processes is associated with a correct understanding of the necessity, connections and

opportunities presented to researchers and people. This implies understanding the interrelationships and using the synergy between the programs of the digital economy and economic cycles. The smart use of data and digital solutions must be supported in order to encourage the digitalisation of the economy. However, if countries and governments do not go in this direction, the opportunity to improve the processes in the economy may be missed. Fragmentary initiatives may appear, but major systemic changes will remain unattainable. In many industries, digitalisation will change the rules of interaction and management both within the company and in the ways of dealing with customers, thus new markets arise, strategies, processes and structures will be transformed. It is necessary to focus on creativity, critical, systematic and interdisciplinary thinking.

However, it is also worth highlighting the shortcomings that are pursuing the digital revolution in the economy. Although several pioneers have made a profit, the digitalisation of public administration and commerce has not been able to close the digital divide. As shown in the book Terra Incognita: 100 Maps to Survive in the Next 100 Years Martin et al. (2018), rich countries and companies still have much more digital connections than poorer ones. It will be difficult to solve this issue. This is due to the fact that success in the digital economy is determined not by the number of mobile phones and wireless connections, but by the ownership of infrastructure, code and data. Wealthier countries in North America, Western Europe and East Asia host more than 90% of the world's data centres, while Latin America and Africa account for less than 2%. The US and China account for more than 75% of cloud computing, 75% of all blockchain-related patents and 50% are related to the development of the Internet of Things. Together they own more than 90% of the market capitalization of the world's largest digital platforms. As a result, some countries, companies and industries benefit much more from digitalisation than others. The dividends of the digital economy are still unevenly distributed. A relatively small number of countries, including the USA (35%), China (13%), Japan (8%) and the states of the European Union (25%), benefit financially from the global digitalisation of the economy. Likewise, several firms - Amazon, Alphabet, Apple, Google, Facebook and Microsoft, as well as Alibaba, Baidu, Huawei, Tencent, WeChat and ZTE - have achieved market dominance and captured 90% of all revenues and profits. Large retailers and manufacturers are changing their structure and switching to digital technologies or risk being destroyed. Most businesses are becoming virtual in the hope of benefiting from network effects and increasing competitiveness.

Even worse, the digital economy generates serious negative externalities, including accelerating climate change. Despite the efforts of some tech companies to fix their operations, they are still considered some of the most volatile and environmentally damaging in the world. To meet the growing demand for equipment, they are increasing the extraction of rare earth minerals and other precious metals such as cobalt. The redundancy of technologies and planned obsolescence lead to the formation of a large amount of waste. Most worryingly, the expansion of Internet services consumes about one-tenth of the world's electricity production. In addition to social and environmental problems, the digital economy Trittin-Ulbrich et al. (2021), is growing faster than the real economy. Both advanced and emerging economies will benefit if they can use new technologies to optimize processes and production, reduce transaction costs and

modernize their supply chains. But progress will be difficult if they cannot overcome the structural problems associated with the creation, storage, processing and transmission of data. And the growth of the digital economy may decline if it does not become more sustainable in the near future.

The COVID-19 pandemic is accelerating the digitalisation of the economy almost everywhere. The unprecedented shift to remote work and the active growth of online content and consumption are contributing to an increase in data volume. As more and more people replace business trips with videoconferencing, communication platforms and data providers are rapidly evolving. But the pandemic is also increasing inequality between and within less connected and digitalised societies. Countries that lack digital resilience and market power are lagging behind. To ensure a fairer global digital economy, it will be necessary to develop flexible government regulations, oblige universal broadband, improve the skills of workers and introduce social protection measures to distribute profits more fairly and minimise losses. Global and regional agreements to better manage cross-border information flows, regulate competition and taxation, and ensure confidentiality is no less important in an era of weakening offline cooperation. Governments and companies need to invest in sustainable digital transformation not only to thrive, but also to survive in the market in the 21st century. With the right combination of incentives, surveillance and investment, the digital economy can play a key role in the recovery of the economy after COVID-19, as well as in the potential growth of the number of small and medium-sized entrepreneurs in low-income countries. This will require large expenditures on critical infrastructure and its wider redistribution. The infrastructure supports services and applications that manage the digital economy. Most importantly, public and private entities will also have to evolve in order to adapt to digitalisation, benefit from it and minimise risks. Digital resilience is no longer mandatory.

The digital revolution is changing the way we live and interact, but it is neither sustainable nor fair. The COVID-19 pandemic accelerates the transition to digitalisation, but also increases the digital divide. The digital economy can accelerate the way out of the pandemic, but governments need to ensure that it is inclusive. The digitalisation of the economy is actively taking place now. In the mid-1990s, technology enthusiasts predicted that the rapid spread of the Internet and supercomputers would lead to the emergence of new efficient technologies, innovations and increased opportunities for savings through scaling processes and cycles. But the promised revolution in e-business and e-commerce stopped when the dot-com bubble burst. The dot-com bubble is an economic bubble that was formed as a result of the rise in shares of Internet companies, as well as their active appearance. However, since then, the digital footprint in the world has increased exponentially. Today, global IP traffic is almost 150,000 GB per second compared to 100 GB per day three decades ago. Ubiquitous data transmission and connectivity are the driving force behind the new economy. The proliferation of cloud computing, artificial intelligence, and billions of digitally connected devices takes goals and objectives to a whole new level. These trends have only intensified since the beginning of the COVID-19 pandemic.

The Industrial Revolution marked a turning point in economic history: there was a transition from the economic stagnation of several centuries to a steady

increase in per capita income and an increase in the standard of living of society. This unprecedented change meant that, for example, GDP per capita in the United States grew by almost 50% in half a century (Bareket-Bojmel et al., 2020). Although this is a huge growth, it has occurred partly due to the spread of digital technologies. These figures confirm the extent and speed of the impact of the digital revolution on society, which is changing and will continue to change the structures of the economy as we know it. Global discussions often consider the macroeconomic impact of the digital revolution and the determining factors necessary to create an ecosystem that serves as the basis for digital expansion. The positive effects of the digitalisation of the economy can be seen in many aspects, from increasing economic activity to improving the quality of life in society. The flagship of the digital revolution was the invention of the Internet, which connected the world and contributed to globalization. As an example, to quantify the significance of the digital revolution for the economy, the relative weight of the Internet and related sectors Dongbo & Jiarui (2018) reached 3.4% of GDP in 2009 for a group of 13 countries. Classical sectors, such as agriculture, utilities and education, became one of the main drivers of economic growth with a contribution of 7 units in the 15 years preceding the crisis. This role, which the Internet and other digital technologies are now playing in economic activity, not only appeared in the "clean" sectors born of the digital revolution (for example, Google and Facebook), but its impact has become even more tangible, affecting all sectors. According to the report of the Organization for Economic Cooperation and Development, the capital of information and communication technologies helped to increase the value added of the sectors of the economy as a whole by 0.4-1.0 units per year in the period from 1995 to 2007. Digitalisation has also played a role in significantly increasing aggregate factor productivity, helping to produce more products with the same investments of capital and labour.

The expansion of the country's digital economy is possible only if there is a reliable digital ecosystem. In particular, the development of the digital economy will depend on three factors: digital infrastructure, human capital and the quality of legal institutions. Just as infrastructure played a key role in the first industrial revolution with the invention of the telegraph, simplifying the dissemination of information, and the railway network, which radically changed the transport connection, infrastructure is also crucial for the digital revolution. The digital infrastructure consists of all the infrastructures necessary to support digital business, including hardware and software companies, communication networks and payment service providers and digital content. Although these infrastructures are already developed in most advanced economies, in some countries there is still a long way to go to eliminate the sources of friction that limit the growth potential of the digital economy. The most difficult limitation is the availability of the mobile spectrum (the network through which mobile data traffic moves). Spectrum allocation should be unified in the European Union and other political associations of countries in order to meet the increasing growth of mobile services data traffic and increase competition and efficiency in this industry (Tang et al., 2019).

Another obstacle that sometimes limits the growth of the digital economy is the lack of investment in infrastructure, as evidenced by recent work and discussions about who should bear the costs: communication network providers or digital

content providers who also benefit (Cieślik & Goczek, 2018). There is not enough investment not only in the infrastructure supporting the digital economy, but also in research and development work related to the digitalisation of the economy. Investments in research and development in the field of information and communication technologies in the economy are much lower than in other areas of digitalisation. This limited capitalization in information and communication technologies can be explained by three factors: a larger proportion of small firms that are less likely to innovate; limited development of alternative financial markets, such as venture capital (widely used by new technology firms) and relatively unskilled workers.

The second factor in the development of the digital ecosystem is human capital and human resources. Although large numbers of unskilled labour were required to work in factories during the first Industrial Revolution, the quality of human resources has become more important in the new digital revolution. Knowledge of information and communication technologies and the Internet has become a basic requirement for most jobs. In particular, in 2012, 55% of jobs in the EU countries required basic knowledge in the field of computer technology. Such a change in the skills of the in-demand workforce may increase polarization in the labour market, which will make it difficult for some workers to find work, especially for those who lack the necessary qualifications and knowledge and those who have skills related to very specific sectors, such as, for example, construction.

The last factor in the development of the digital ecosystem is the quality of the security and legal system. Continuing our comparison with the Industrial Revolution, one of the key elements of its success was a legal regime that guaranteed the right to private property and provided suitable incentives for all economic agents. Today, the function of legal institutions should still be to establish rules and laws of interaction and, in particular, to protect certain rights that have become even more important in the digital economy, such as protecting privacy and copyright, as well as providing a suitable environment for promoting investment and innovation in the digital ecosystem.

Thus, in order to maximise the benefits of digitalisation, it is necessary to commit to the long-term growth of the digital economy, remove obstacles to the expansion of its infrastructure and modernise policies and regulations in order to stimulate investment and innovation in the digital ecosystem. For example, realising the importance of digitalisation, the European Commission has presented a digital single market strategy, which aims to eliminate some of the obstacles and standardise the rules at the European level. This initiative is likely to be the first of many. The digital revolution has come to transform the economy as we know it. Despite the efforts of national governments and business associations to promote the positive impact of digitalisation, public discussions and views are still strongly influenced by scenarios involving massive job losses and increased social inequality. One of the most influential articles Frey & Osborne (2013), in which the authors tried to calculate the probability that various jobs will be replaced by robots or computers. They concluded that 47% of all jobs in the United States can be occupied by machines. These calculations have attracted a lot of media attention. Mainly production, as well as trade, administrative and other services are at risk.

The authors pursue a special approach to calculating the likelihood of computerisation. They use the US Department of d database, which includes information on more than 900 professions. The researchers used descriptions of these professions to classify them according to three criteria:

- The first criterion is social intelligence. It includes interacting with other people, negotiating, teaching and caring for others. For example, according to frey and osborne, a dishwasher requires little social intelligence, and public relations practitioner requires a great deal.
- The second criterion is creativity, which means the ability to come up with unusual ideas, as well as compose and perform music, dance, theatre productions and more. A court clerk, for example, hardly needs to be creative, unlike a fashion designer.
- The third criterion is perception, interaction and manipulation. It describes a person's ability to accurately handle very small objects, move their hands very quickly and collect complex objects even in uncomfortable positions. A telemarketing specialist does not need special manipulation skills, while this is a basic requirement for a surgeon.

Frey and Osborn distinguish between high-risk professions (the probability of automation of which exceeds 70 percent), medium-risk professions and low-risk professions (the probability is less than 30 percent). Based on their estimates, they claim that 47 percent of total employment in the U.S. is in the high-risk category, which means that related professions can potentially be automated for some indefinite number of years, perhaps a decade or two. It is important to note that according to this argument, many service tasks will be automated in the long run, because it is often routine work. It may even affect highly skilled jobs such as programming. Many programming works involve mostly simple actions and are largely based on logical inferences and formal rules. In production, for example, companies are already working on applications that will be able to output program code for machines directly from technical drawings. In contrast, some low-skilled jobs remain relatively immune to computerisation or automation. Manual operations such as cleaning, hairdressing or medical care, as well as some areas of manual production pose a serious challenge to automation, as they require very precise and flexible manual skills that cannot be mastered by robots. Despite the fact that scientists conclude that some jobs with intermediate qualifications are threatened by automation and that some low-skilled jobs are relatively safe, the analysis presented by Frey and Osborne shows a clear linear relationship between the level of education required for a particular profession and the likelihood that certain tasks and jobs will disappear due to computerisation and automation. While highly qualified employees find themselves relatively safe, digitalisation can threaten less qualified employees - leading to unemployment or a reduction in their wages, as they have to compete with increasingly cheaper automation solutions (McAfee & Brynjolfsson, 2017).

To date, discussions show that the question of how technological changes affect employment and inequality is still unresolved. The main issue is the lack of data. It seems obvious that technology is not just replacing human labour, instead, it is possible that the consequences of digitalisation will be the polarisation of employment structures and increased inequality. Although the impact of

technology is not entirely clear, there are other events that could further contribute to social inequality: deregulation of labour markets, weakening of trade unions, poor government regulation of human welfare and increased global competition. Instead of blaming technology, it would be more reasonable to consider all possible issues of regulation, maintenance and interaction of government, economy and the links between them. The rapid transition to the "digital economy" has become possible through innovations that can support and interact with each other. Computing has led to the development of the semiconductor transistor, integrated circuit, personal computers, operating systems and graphical interfaces. The physical layer of telecommunications was made possible by the advent of optical fibre and new wireless technologies, while the creation of networks led to the development of the Internet (essentially packet switching) and the World Wide Web. These achievements have enabled the implementation of a number of new information and communication technology applications, such as business software, e-mail and e-commerce. However, progress has seriously slowed down due to the collapse of the dot-com bubble, which, among other things, revealed a huge amount of misdirected investments that could be used more productively. Thus, the relevant issue is the beneficial use of new "killer apps" to stimulate a new round of growth. The use of cell phones to transmit text, images and videos is a rapidly developing field, but it is unlikely that these applications will have a macroeconomic impact. Entertainment is a key industry that information and communication technologies are associated with. Indeed, the use of information and communication technologies to create innovative entertainment products is an important factor in the continuous growth of the industry.

Conclusions

The digital revolution is changing the relationship between people, employees and employers, customers as technology permeates almost everything we do - from buying products online to finding a job. As computing power dramatically improves and more and more people around the world participate in the digital economy, it is necessary to carefully consider and analyse ways of new interaction, how to create a security policy that will allow people to fully take advantage of the digital revolution, minimising possible issues.This digital transformation is the result of what economists who study scientific progress and technical changes call a universal technology that is capable of continuously transforming, gradually expanding and increasing productivity in all sectors and industries. However, such transformations are rarely found, since most often new technologies face barriers in the environment. Only three previous technologies have earned this title: a steam engine, an electricity generator and a printing press. Such changes bring huge long-term benefits. The steam engine, originally designed to pump water from mines, marked the beginning of railways and industry through the use of mechanical energy. Benefits from farmers and traders bringing their goods from the hinterland to the coast, facilitating trade. By their very nature, general-purpose technological revolutions are also very disruptive. The Luddites of the early 19th century resisted and tried to destroy the machines that made their weaving skills obsolete, even though the machines opened up new skills and jobs. Such a failure occurs precisely because the new technology was flexible and ubiquitous. Consequently, many benefits come not just from

accepting the technology, but also from adapting to it. The advent of electricity generation has allowed electricity to be delivered at exactly the right time and place, significantly increasing production efficiency and paving the way for a modern production line.

An important component of new technologies is that they must first be widely accepted before society adapts to them. The delivery of electricity depended on generators. The current technological revolution depends on computers, technical fundamentals, the Internet, search engines and digital platforms. Due to the delays associated with adapting to new processes, such as replacing traditional printing with online publishing, it takes time before production growth accelerates. In the early stages of such revolutions, more and more resources are directed to innovation and reorganization, the benefits of which are realised much later. But it is worth noting that the digital revolution already occupies an important place in people's lives and, directly, in the global economy. In addition to transforming jobs and skills, it is also reshaping industries such as retail, publishing, trucking and banking. In the UK, online transactions already account for almost a fifth of retail sales, excluding petrol, compared with one-twentieth in 2008. Furthermore, e-commerce sites are applying their data skills to finance. Chinese e-commerce giant Alibaba already owns a bank and uses its customer data to provide small loans to Chinese consumers. Amazon.com, an American e-commerce site, is moving in the same direction.

It is worth noting that economic growth also means the expansion of countries' production capacities. Quantitative growth and qualitative improvement of the results of national production will eventually lead to economic growth. Economic growth stimulates an increase in the number of social products, which leads to an increase in the welfare of the population. This suggests that the economy will be better able to meet existing needs. The development of science and technology is an important factor in ensuring labour productivity and economic growth. Technological progress includes not only new production methods, but also new forms of management and organisation of production. Thus, science and technology mean the emergence of new methods that require the creation of combinations of existing resources to increase output. Currently, the main task of our country in the modernisation and diversification of the economy is the application of new methods and technologies in production, the introduction of new methods and forms of organisation and management of production.

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