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## Digitalization vector of EU labor market development

**Abstract**

The article is devoted to the development of digital economy and information networks on the basis of advances in information and telecommunication technologies, affecting the qualitative and structural changes in all sectors of social production, in particular in the EU labor market. This leads to the transformation of production systems, management and state regulation in most EU countries. Having recovered from World War II, humanity has launched a new economic model called "smart production and consumption". It is shown that the economy of the XXI century, acquiring more and more signs of digitalization, is significantly transformed into a global digital economy. The development of ICTs reflects notable changes in the organization of the production process and labor activities, as new technologies stop performing certain types of labor activities. At the same time, they create a demand for people with new professional and qualification characteristics and contribute to the emergence of new jobs, thus creating new opportunities and requirements that a modern automated worker should meet. The fact that new opportunities for Ukrainian IT specialists have appeared on the EU labor market deserves special attention, the number of which has increased significantly due to the military aggression of the Russian Federation against Ukraine. IT has become an integral part of modern life. Thus, at the beginning of 2022 there were 90 thousand IT specialists (programmers) working in Ukraine. However, it is worth noting that Ukraine is currently experiencing a very difficult military situation, which reflects an accelerated outflow of population to other regions of Ukraine and EU countries. About 3.5 million Ukrainians have moved to the European Union. Among the "forced migrants" there is a certain share of people with skills in the IT industry. Considerable attention is paid to the analysis of IT skills, which are the main driving force behind the digitalization of the EU labor market. In particular, these qualities include the ability to work with foreigners, to attract investment, to work with computer technology and use technology in various cases, and to learn quickly and know foreign languages. This makes IT specialists very demanding. On the EU labor market, professions such as IT recruiter, project manager, PR manager, product manager and system analyst are most attractive to men, while HR manager, SEO-marketer, copywriter and WEB-analyst are more popular among women. *Methodology.* The methodology of expert assessment of the level of digitalization in the EU labor market is determined by an integral indicator, namely the index of digitalization of the labor market. This index measures the share of employment in services, the share of employment in knowledge-intensive services, the level of access to ICTs, the level of use of ICTs, the level of adoption of new organizational models of work based on ICTs, the share of exports of information and communication services, and the share of exports of digital services. This methodology allows to rank the countries of the European Union on the degree of digitalization of the labor market and prove the ability of states to provide employment growth through the spread of digital technology and the development of a digital global space. *Results.* It has been argued that humans today are hostage to resource collapse. In this case there is a dilemma: either to move along the current path, or technologically to become part of nature, that is, to live at the expense of fundamentally new inexhaustible resources and technologies created by wildlife, but using the most modern technology. This means the convergence of science and technology, consisting of similarities in the device and function of relatively distant groups, namely the convergence in the evolution of such technologies as N-nano, B-bio, I-Information, C-cognitive, the so-called NBIC-technologies. It has been established that today's programmers come in different ranks: junior, middle, and senior, and are proficient in major programming languages such as C, C++, C#, Java, Python, JavaScript, and PHP.

**Keywords**

digitalization, globalization, Internet technologies, NBIC technologies, global digital economy, labor market digitalization Index, EU digitalized labor market, digitalized automated labor, European labor market, technologization, transformation of the European labor market

**JEL:** J44, O15, G14

With these qualities, programmers can work in a variety of industries because they are highly adaptable to change and have patience, because technology is constantly changing. Therefore, undoubtedly, such employees in the field of digital technology are very desirable for employers. *Practical implications.* As an effective practical method of analyzing the digitalization of the EU labor market the system approach and the development of IT-technologies are proposed. They cover the whole complex of scientific and technical problems, which, for all their specificity and diversity, are similar in their understanding and consideration of the objects and systems they study. That is, sets of interrelated elements that act as a whole. The index of digitalization of the labor market is one of these elements. It is used to assess the large share of IT services in various areas of the EU labor market. *Value/originality.* The article discusses the current directions of IT influence on the digitalization of the EU labor market. It shows how exactly IT contributes to the implementation of automated labor at the current stage of development of the digital economy in the EU. The number of people engaged in technical and technological labor in the digital space is relatively increasing, which forms the digital employment market. The digitalization of the labor market is automated through information systems and the spread of information technology. It requires a new type of thinking from the modern worker, formed on the basis of general education and special knowledge and skills in the use of innovative information technologies.



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## 1 Introduction

The labor market is part of the whole market of the economy, which is formed as an organic part of the market system in general. The effectiveness of the labor market depends directly on the relationship with other markets. The market of labor, goods, securities, services, and financial resources is always very vulnerable to the situation in the world economy, because all the problems arising in one market have consequences of a different nature in other markets. The labor market, being a part of the market system, is subject to the laws of the whole system. It is subject to the entire organization of labor inherent in the entire system of markets. The labor market encompasses all categories of able-bodied people who have the opportunity to work for hire or on their own. Such a labor market has the ability to distribute labor resources across sectors of the economy, taking into account the training and qualifications of workers. At the same time, the market is part of the system of those relations that can form in society labor problems for the labor force in the field of information and communication technologies. The vector of such technologies is digitized automated labor, which today creates the conditions to meet the supply and demand for labor. Digital automated labor, based on the rapid development of innovative technologies, is becoming a leading vector in the formation of the global digital economy and labor market institutions. The form of labor is becoming remote and is not limited to geographic space and time. Its efficiency depends on a well-functioning system of communication in space. Since a significant share of the added value of currently created goods and services is not formed at the production facilities of the organization, it turns out that in modern economic conditions the need for many forms of classical organization of production

is significantly reduced. Examples include offices where jobs are filled by employees along a process chain; labor cost control procedures; job hierarchy, etc. The digitalization of work creates opportunities for organizing the employee workplace almost everywhere: at home, in a hotel, in the car, on a plane, on vacation, and so on.

## 2 The impact of digitalization on the employment market

Today's employment market is being transformed by many external and internal factors. The importance of mobility and readiness to develop and implement digital innovations, i.e., digitalization, is receiving a great deal of attention. Both the labor market as a whole and an individual company or its team can be digitized, which will affect the ability of workers to function effectively and provide for themselves in a changing, uncertain environment in different ways.

Digitalization processes are leading to a number of quantitative and qualitative changes in the labor market: the demand for highly skilled labor is growing mainly in the technical and technological direction, but middle level and unskilled personnel are losing their value. This is due to the mass automation and robotization of work processes, especially in the highly developed EU countries. Government social policies are designed to eliminate this inequality and protect the population from rapid job loss. Researching the EU and global labor market, Deloitte analysts note that already in 2019 the number of companies using intelligent automation doubled. At the same time, employers were trying to retain staff and assign more complex tasks and operations to employees through specialized and additional training (Deloitte).

Changes in the EU labor market are taking place not only under the influence of the digital

transformation of business, but also the digitalization of personal space. The latest technologies are so deeply penetrating human life that they now cover all aspects of it, forming a virtual human space whose boundaries are gradually blurring (Figure 1). Personal digital data, despite all levels of protection, are acquiring the characteristics of discreteness; they can be easily stored, copied, transferred, integrated between databases. Accordingly, a person increasingly exists in three realities – analog, augmented and virtual.

Components of these realities are used in the workplace, especially in complex processes, resulting in new forms and methods of work or labor relations.

Based on the chart, it is proven that digital technologies track a certain dynamic. For example, Fixed, which has been organizing international air, sea and multimodal freight shipments for more than 10 years, providing the entire range of related services required, uses global best practices and methodologies of experienced IT specialists, in particular DSL. Outsourcing company NGA and 4G, which has up-and-coming fourth-generation mobile technology with advanced requirements, are tracking the highest rates of digital usage, namely from 82% to nearly 100% in 2019–2020. Fiber to The Premises (FTTP) manufactures fiber optic cable for delivery that provides Internet access directly to the user or groups of users from an Internet Service Provider (ISP). The FWA online publisher is dedicated to showcasing innovation, that is, showing cutting-edge creativity, regardless of the medium or technology used. Data Over Cable Service Interface Specifications (DOCSIS) is a family of standards for transmitting data over coaxial (television) cable TV networks. DOCSIS 3.0 allows you to merge channels, increasing the access speed. Up to 16 forward and 8 return channels can be combined. DOCSIS 3.1 regulates direct channel speed of 10 Gbit/s and more.

VDSL (Very high speed Digital Subscriber Line) is a very high speed digital subscriber line belonging to the xDSL family of technologies. It is used in digital subscriber lines that require a very high data rate from the subscriber to the network. VDSL2 (Very-high data rate Digital Subscriber Line 2) is an ultra-high data rate Digital Subscriber Line 2. It is an access technology that uses the existing copper wire infrastructure originally deployed for POTS from central offices, from fiber-optic powered cable cabinets located near the subscriber room or in homes. These companies have digital adoption rates ranging from 30% to nearly 60% in 2019–2020. The 5G company, which has been on the market for a short time, has achieved a digital adoption rate of almost 17% in 2020.

Headhunting in metropolitan areas is complicated on the one hand by the high level of employee competition between corporations operating in the same industry, and on the other by the tendency of employees to periodically change jobs in search of better working conditions. The digitalization of the EU workspace has the potential to bring together technical and technological talent and employers from different countries (both economically developed and developing) on a global scale.

### 3 Adaptation of employees to work activities

In general, the digitalization of technical and technological labor in the EU offers a number of socio-economic benefits to the worker. For example, there are obvious savings in time and money, which can be used to improve education and professional skills, as well as to improve living conditions. These types of savings are associated with not having to travel home from work, with the ability to seamlessly combine work duties with recreation, child-rearing, family interaction, etc., as well as with the choice of

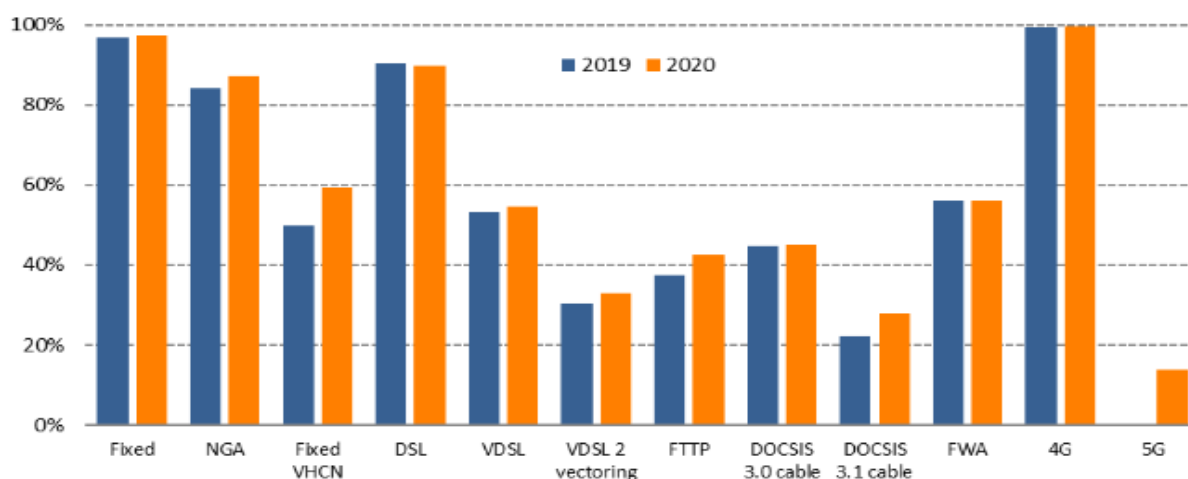


FIGURE 1 Total coverage of the EU population with digital technologies by their types (in % of households)

Source: (Digital Economy and Society Index 2021)

a comfortable place to live, no matter how far away the place of work is.

Employees adapted to the peculiarities of digitized work activities perform their work efficiently and on time. Therefore, a digital company performs its production function on a large scale and offers a quality and competitive product to the market, because it uses the highly productive labor of qualified specialists in the technical and technological field. Such employees can work in a continuous business mode. Continuity is ensured by hiring employees who live in different time zones, which allows for production in different time intervals (day, week, month, year).

On the other hand, the company, by using the labor of such employees, significantly reduces economic costs. It gets access to highly qualified personnel without having to pay the cost of moving them to the location of the organization. Savings also arise from reducing the cost of training highly qualified personnel by hiring them on a temporary (fixed-term) basis. Equally significant are the cost savings associated with the rental and maintenance of offices around the world. This happens by reducing the number of offices in their usual sense (buildings, structures, organizational and technical capital, etc.) or by abandoning them altogether. For example, 40% of IBM employees working remotely allowed the corporation to reduce office space by 7 million m<sup>2</sup>, approximately 5 million m<sup>2</sup> of which were sold. It made a profit of US \$ 1.9 billion. Revenue from the rental of premises that were not used by the company exceeded US \$1 billion. In fact, now the ratio of jobs per intellectual employee in this company is 8 to 1, and in some of its divisions it is 15 to 1. In Europe and the United States, annual savings in the cost of maintaining premises and their equipment by attracting intelligent workers amount to US \$ 100 million (Berkshire Hathaway, 2020).

Digital companies additionally gain cost savings by reducing expenses caused by factors that are not directly related to the organization's operations. These include employee absences due to bad weather, illness, and transportation issues. Some EU organizations with traditional forms of business lose hundreds of billions of dollars each year due to unplanned absences. Organizations that have enabled remote working have seen reductions in absenteeism and tardiness (Khadzhynov, Shkurat, 2018).

The introduction of new equipment and technology, particularly information technology, has a particular effect on the labor process and the level of employment in certain sectors of the economy. In addition to stating the undeniably positive effects that arise from this, the scientific community is spreading the view about the threats associated with the "fusion" of man and technology. It is about the growing risk of replacing human intelligence with artificial intelligence in the context of technological

progress. However, according to J. Bessen (Bessen, 2015), technology is not a substitute for employees. They are moving into new jobs where the work requires the application of knowledge updated to meet the demands of more advanced technology.

The rapid growth of digital technology is changing the form of work in almost every industry. For example, the position of cashiers has not been abolished, only their functional duties have changed. Now the work of these employees is mainly related to establishing relationships with customers to sell them various banking services and financial products. Computer-assisted typesetting has reduced the number of typesetters, but at the same time contributed to an increase in the number of graphic designers. With the introduction of automated telephone systems in companies, the number of telephonists was reduced, but the number of secretaries working with clients increased. They have taken over the functions of personal communication that used to be performed by telephone operators. Sometimes new jobs appear in completely unrelated fields. For example, when jobs disappear in agriculture, new ones appear in industry and services. At the same time, these workers turn from agricultural producers to agribusiness owners. Agribusiness has become a highly productive industry using capital, technology, and information. Thus, computer automation does not necessarily lead to mass technological unemployment. On the contrary, new technologies can lead to an increased demand for workers with new competencies.

#### 4 Survey methodology

During the two and a half months of Russia's military aggression against Ukraine, some 22,000 Ukrainian teachers and IT specialists have already left Ukraine. The number of such employees continues to increase for security reasons. According to a survey of 7 thousand representatives of the IT industry, about 60% of respondents were forced to leave Ukraine. 46% of them stayed in Ukraine, 14% went to Poland (35% of all specialists who left Ukraine), 10% went to Germany, and also to Romania, Moldova, Hungary, and Slovakia. But this list expands daily to include other EU countries. Particular attention should be paid to the number of displaced persons from Ukraine to Lithuania (50%), Latvia (25%), and Estonia (35%). About 80% of specialists who left Ukraine plan to return home after the end of hostilities (Ukrinform, 2022). The mutual integration of realities forms large volumes of data (Big Data), and subsequently generates such a phenomenon as the Internet of Things. In today's context, the Internet is no longer called an information network, but a network of everything (Pyshchulina, 2020). Big Data has become the basis for the development of artificial intelligence technologies and neural networks, which, by analyzing enormously large

volumes of information, are able to generate optimal and effective solutions to problems. This simplifies not only technological or production processes, but also the search for management tools, methods and technologies. Thus, many processes and device-things are constantly monitored and controlled via the Internet. "Robots, autonomous vehicles, computer vision, natural language processing, virtual assistants, and machine learning..." (Pyshchulina, 2020) are vivid examples of humans being displaced from the EU labor market by elements of artificial intelligence and neural networks.

The transformation of digitalization is clearly visible in EU labor market segments such as electricity, manufacturing, medicine, retail, education, logistics and healthcare. Artificial intelligence and neural networks are an integral part of the work of most scientists, analysts, and policymakers in the EU and the United States. Cloud technology is the processing of any data, including Big Data analytics, in the "cloud". The "cloud" is simply a set of powerful servers from one of many providers. They can often browse and query large data sets much faster than a normal computer. Big Data refers to very large sets of data that are output by various programs and relate to any of a wide range of data types that are usually too big to view on a normal computer. Cloud technology and Big Data are very often used by large enterprises (from 32% to 39%), small and medium-sized enterprises (SMEs) use them half as often (from 12% to 17%), and all enterprises (Figure 2) (Digital Economy and Society Index 2021).

As a result of the interaction of these components, a completely new phenomenon is forming in the labor market, namely the hyg economy, where the labor market is undergoing radical changes. The demand for permanent work is significantly reduced

(both on the part of employers and employees). At the same time, the demand for temporary projects from various companies and firms is intensifying. In this context, even a new direction of management is emerging – the management of contingent personnel, consisting of workers temporarily involved in the work of the enterprise. Such management is based on informal arrangements, short-term contracts or one-time agreements. Such employees are mostly involved in semi-automated processes that cannot be fully implemented digitally and require human intervention (Pyshchulina, 2020).

It is the gig economy that brings employment and the digital space mostly to online platforms. Thus, employment takes remote forms, sometimes temporary. This flexible work allows potential workers to achieve the highest level of specialization and concentration on their work, increasing their productivity. Enterprises also get rid of the need to keep certain specialists on a permanent basis, thereby reducing their own costs by hiring them on a temporary basis. This can be either direct contracts with specialists or outsourcing through specialized agencies. However, at this stage the social and regulatory functions of the state should be activated to protect the interests of workers and employers in such specific relationships. After all, there are prerequisites both for labor exploitation for improper remuneration on the part of employers and for substandard and untimely performance of tasks on the part of workers. Therefore, labor legislation must develop adequately to the demands of the times and transformations in the labor market.

Increasing the inclusion of all segments of the population in labor relations is an undeniable advantage of transforming the EU labor market into a hygienic economy. People with disabilities, women

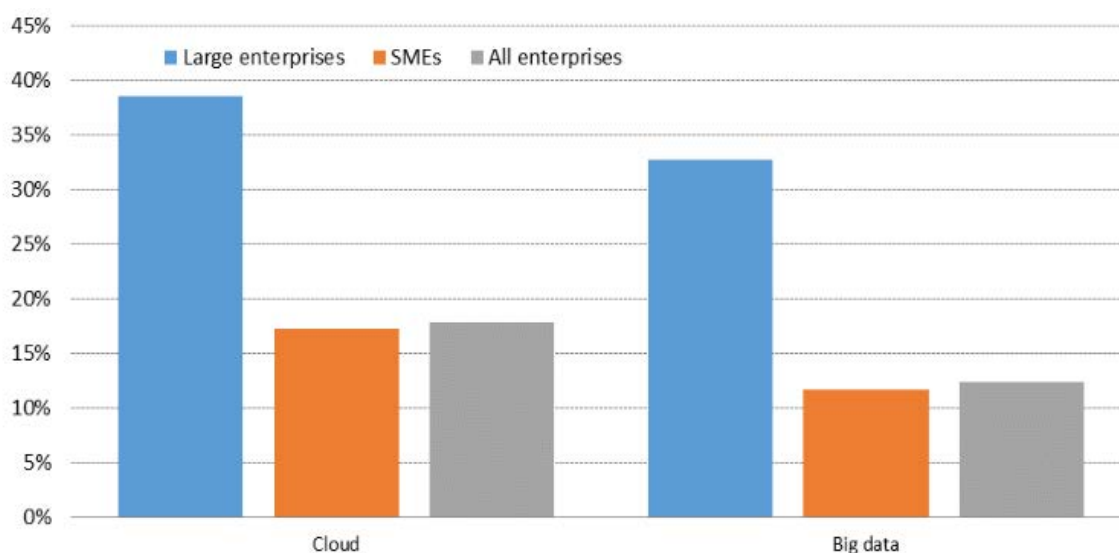


FIGURE 2 Application of cloud technologies and Big data by EU enterprises, % of their total number

Source: (Digital Economy and Society Index 2021)

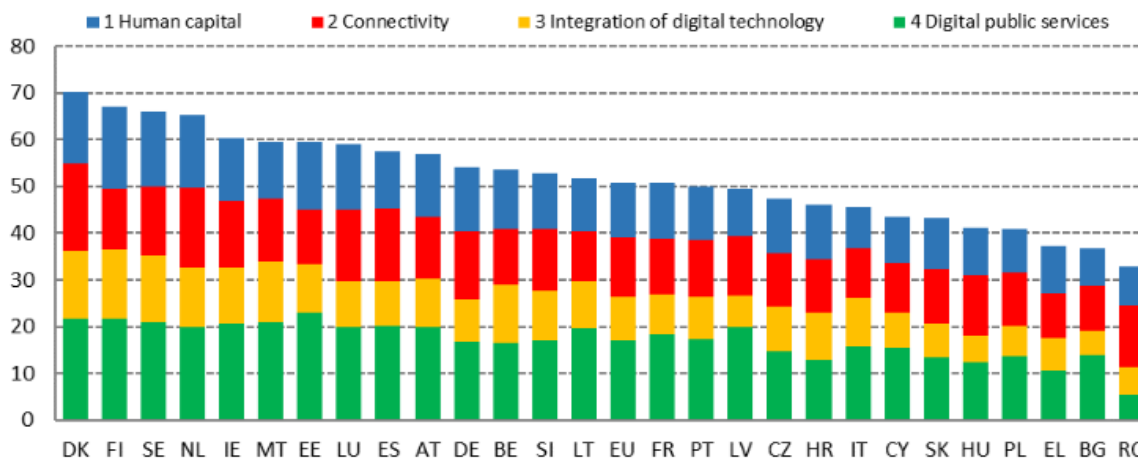


FIGURE 3 The European Commission's digital economic and Social Development Index in 2021

Source: ("Berkshire Hathaway" Business Wire, 2020)

on maternity leave, residents of geographically remote areas, and so on can work remotely. A prerequisite for such work is the availability of technological equipment (computer, smartphone, etc.) and a quality Internet connection. These technologies are also developing rapidly and cover more and more areas and more users.

Summarizing these components of the digitalization of the EU labor market, the European Commission annually forms its own Digital Economy and Society Index (DESI), that is, the index of digital development of the economy and society. Its components are human capital, connectedness, digital technology integration, and the volume and availability of digital public services (Figure 3).

As can be seen, when forming such a generalized index Human capital is used by 26-70%. Connectivity is used 25-54%. Integration and digital technologies are used by 5-36%. Digital government services are used 5-22%. These components are considered separately and play a fundamental role based on the quantitative percentage usage among European Union countries.

## 5 Conclusions

The digitalization of the EU labor market encourages employers to get a larger scale of production activities and a higher quality product

that optimizes the cost of creation. Automated employees receive a higher level of remuneration for their work results compared to their colleagues working in traditional companies. At the stage of the formation of a digitized EU labor market based on the rapid development of innovative technologies along with the integration of the gig economy, the form of employment and the space of digitalization have changed to online platforms. Work is becoming predominantly remote or temporary and is not limited by geographic space and time. Its effectiveness depends on an established system of communication in the digital space. The technological complexity of the EU labor market requires most companies to employ highly skilled automated workers. There are some features of technical and technological labor in the digital economy, namely: 1) automated labor is associated with innovation; 2) it is unlimited in space and time; 3) it is implemented in the ICT system; 4) it is designed more for workers in technical professions; 5) it turns consumers into workers and vice versa; 6) it is personalized, individualized and collective simultaneously; 7) it is multifunctional, focused on self-organization and self-control; 8) is characterized by altered motivation; 9) creates equal conditions for all participants of labor relations; 10) as well as result-oriented, promotes the growth of income of employees and cost savings for organizations.

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