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## PECULIARITIES OF THE DEVELOPMENT OF THE IT SPHERE IN THE CONTEXT OF DIGITAL TRANSFORMATION OF THE ECONOMY OF UKRAINE

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**Abstract.** The article identifies key problems that hold back the prospects for developing the potential of the IT sphere in Ukraine. The specifics of functioning and development of the IT sphere in Ukraine in the conditions of digital transformation of the economy are considered. The paper analyzes the main scientific approaches to defining the essence of the definition "digital economy". Positive and negative aspects of the influence of digital economy and digital tools on the development of the IT sphere, employment of the population, and the course of business processes of economic entities are systematized. A comparative analysis of the values of indices of network readiness of Ukraine with respect to developed countries of Europe and the world is given. The influence of indices of access to information and communication technologies and the use of ICT on the state of development of digital economy of a certain country is determined. The main trends of new technologies within the framework of the formation of Industry 4.0, including: blockchain technologies, artificial intelligence, creation of "digital doubles", use of drones, 3D printing technologies, VR/AR, cyber security tools, etc., have been established. The fact of rapid development of the IT sphere in Ukraine has been established. At the same time, in terms of international comparisons, Ukraine lags behind developed countries of the world in terms of indicators characterizing the trends in the development of digital economy. The dynamics of changes in the number of individual entrepreneurs in the field of IT has been studied. It has been established that the digitalization of the economy radically changes the sphere of work and employment, increasing the share of digital workplaces, volumes of remote and virtual employment, as well as changing the structure of employment in general. The directions for improving the development of domestic IT sphere during the acceleration of the processes of digitization of the economy and social life, including the improvement of legislative framework by regulating the activities of business entities in the IT sphere, the development of digital economy, innovative activities and the protection of rights to intellectual property objects, continuous professional development of human resources on mastering and using modern digital technologies, development of social partnership relations and digital culture of citizens, compliance with cyber security and information protection measures, are substantiated.

**Keywords:** information, digitalization, digital transformation, digital technology.

### Introduction

Rapid development of digital technologies in Ukraine and the world creates a number of opportunities for increasing the efficiency of the functioning of domestic economic entities, which is possible thanks to the acceleration of the processes of information dissemination and

communicative interaction, the reduction of costs for the implementation of information exchange and economic operations, the activation of partnership relations and the introduction of the latest techniques and consumer engagement technologies. The IT sphere in Ukraine belongs to the most dynamic and promising spheres of economic activity, taking into account accelerated pace of its development, the implementation of achievements of the IT industry in many other spheres, the existing potential for growth in current and strategic perspectives.

At the same time, in the conditions of digitalization, the functioning of domestic IT sphere is also accompanied by a number of problematic moments, the prospects for maximum full use of its potential in the future depend on the timeliness and rationality of solving them.

### Literature review

Various aspects of the formation and development of digital economy and the functioning of the IT sphere in Ukraine are highlighted in scientific works of many domestic researchers. Among them, it is worth highlighting the works of such scientists as: S.V. Sazonova (2021), who considers the issue of strategic management under the conditions of the formation of digital economy; O.Ye. Chatchenko *et al.* (2022), who study the peculiarities of the influence of digital economy on the transformation of business processes and business models; T.O. Shmatkovska *et al.* (2021), who investigate the role of the latest information and communication technologies in the dimension of digitalization of economic processes; I.O. Sedikova *et al.* (2022), who cite a change in approaches to managerial activity under the conditions of digital economy; I.M. Zelisko *et al.* (2022), who characterize general determinants of the development of digital economy in our country; O.V. Lebid (2022), who notes specific features of digital transformation of the branches of domestic economy in the conditions of martial law. Peculiarities of the influence of digital economy on the labor market, employment and human resources management are the subject of consideration by such domestic specialists as Z.V. Smutchak (2022), O.V. Potemkina *et al.* (2022), etc.

At the same time, modern aspects of the influence of digital transformation of domestic economy on the functioning of the IT sphere need systematization and generalization, which will serve as a basis for substantiating the directions of intensification and increasing the efficiency of its development in today's conditions.

**The purpose of the study** is to systematize positive and negative aspects of the influence of digital transformation of the economy on the development of the IT sphere, to assess the dynamics of its development and to formulate proposals aimed at increasing the effectiveness of the functioning of this sphere in the conditions of modern realities.

### Results and discussion

The development of the IT sphere in Ukraine today takes place in the conditions of accelerating the processes of digital transformation of all spheres of the economy and social life, is closely interconnected with general trends of the formation of digital economy, digitalization of workplaces, the use of digital technologies and the latest technologies in general, which meet the requirements and priorities of Industry 4.0 (and in the future - Industry 5.0).

I.M. Zelisko *et al.* (2022) note that digital transformation of the economy is "a permanent process related to the development of various IT sectors in order to stimulate the creation of innovative technologies for cooperation and development at international level." At the same time, participation and joint activity in ensuring digital transformation of economic processes of both state institutions and the business sector and civil society are important.

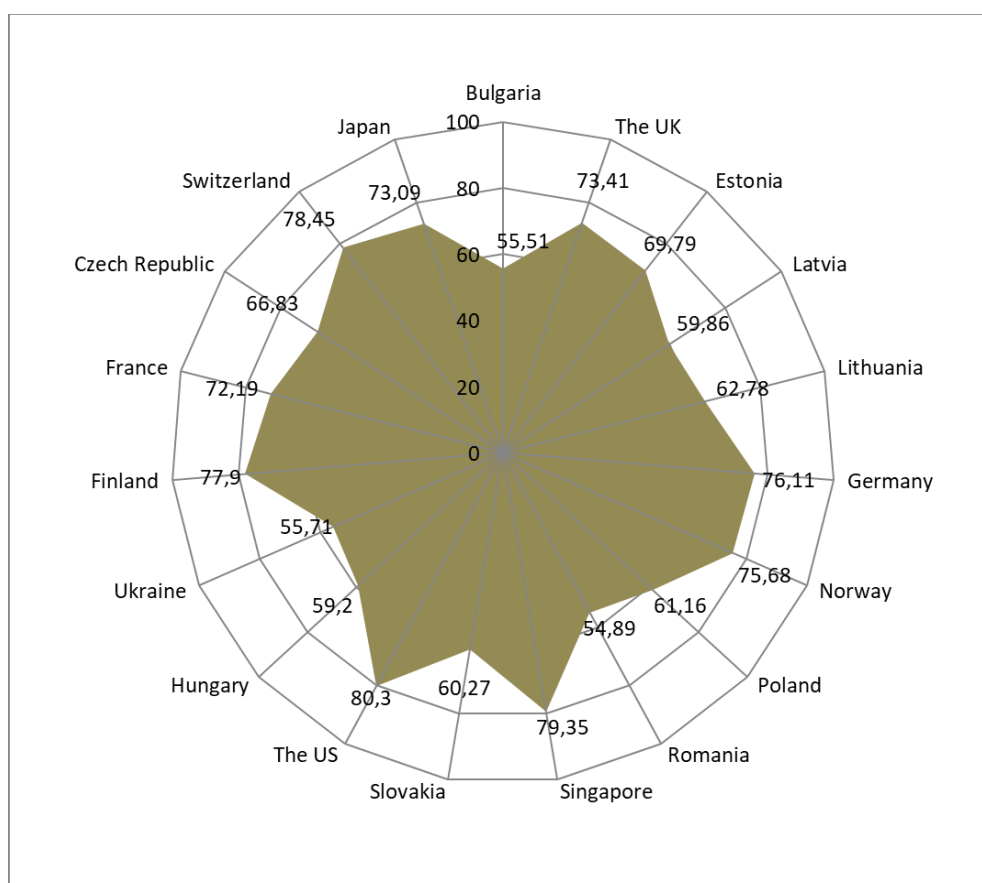
According to the interpretation of the Ukrainian Institute of the Future (Ukraine 2030E, n.d.), digital economy is "a type of economy where digital data (binary, information ones, etc.) and network transactions, as well as their use as a resource are the key factors and means of production, which makes it possible to significantly increase the efficiency and productivity of activities and value for received products and services".

T.O. Shmatkovska *et al.* (2021) emphasize that digital economy is a key strategic priority of the latest social progress and is marked by a transformation of the way of thinking, ensuring a transition from classical models of economic development to dynamic ones based on continuous improvement and application of innovations in practical activities. Under such conditions, digitalization not only complements existing business processes of business entities, but also requires rethinking and changing of relevant organizational structures, existing corporate culture, and the culture of society as a whole.

S.V. Sazonova (2021) singles out a number of important areas of influence of digital economy on the process of managing the activities of business entities in a strategic dimension: increasing the role of information as both a separate product and "raw material"; the growth of opportunities to accumulate, store, process and use extremely large amounts of information (which can later be used during the formation of business plans, development of strategies of various levels); the growth of opportunities for the implementation of the latest models of business activities, etc.

I. Yakushko (2022), studying the specifics of state regulation of the economy in the conditions of digitalization, singles out two main directions of the state's regulatory influence on digital development: spatial one (includes territories, industries and technologies) and behavioral one (implies influence on the activities of enterprises, households, state authorities and local self-government).

Comparing the value of the network readiness index in Ukraine with other countries of the European Union and the world (Fig. 1), we can state that in our country in 2022 it was 55.71, while in the USA - 80.3, in Germany – 76.11, in Japan – 73.09. That is, Ukraine had a relatively lower value of the network readiness index (which allows for a comprehensive assessment of the state of development of digital economy).

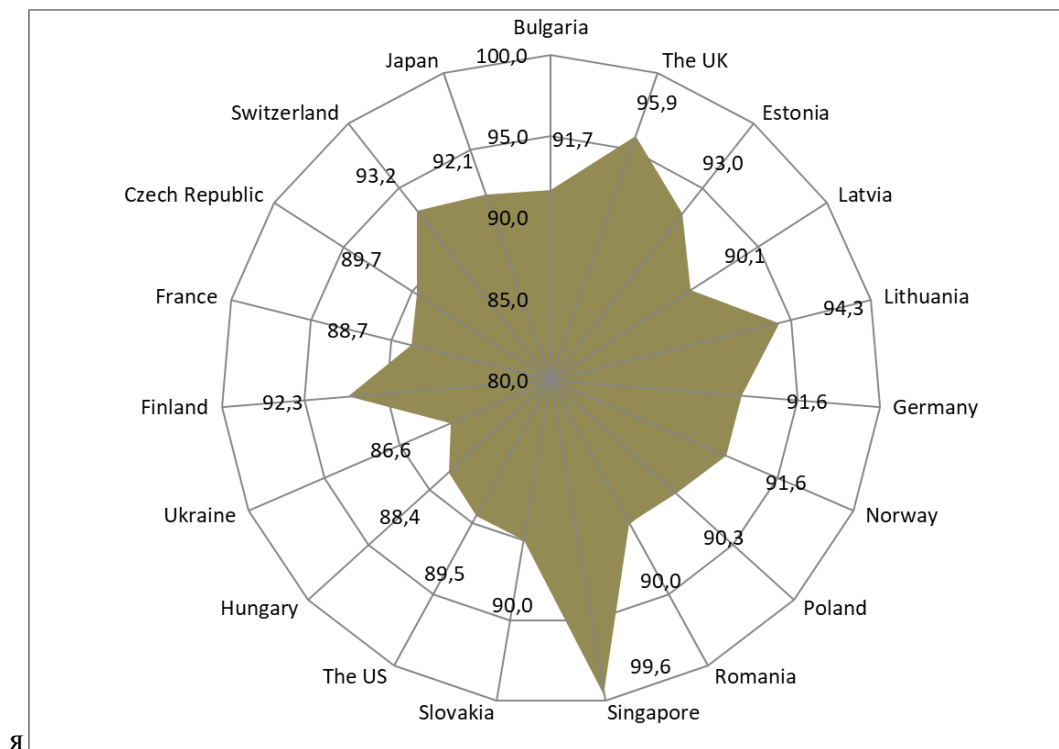


**Figure 1.** The value of the network readiness index in some countries of the world and in Ukraine in 2022 (scale 0...100)

**Source:** built according to data (Network Readiness Index, 2022)

Indexes of access to information and communication technologies (ICT) and use of ICT are important international comparators characterizing the state of development of digital economy of a certain country. Their comparative analysis is presented in Figs. 2 and 3.

Regarding the index of access to ICT (Fig. 2), we note that despite its rather high level (86.6 in 2022), its value still remains lower with respect to developed countries of the world. For example, in Singapore this indicator was 99.6, in Great Britain - 95.9, in Lithuania – 94.3.



**Figure 2.** The value of the index of access to ICT in some countries of the world and in Ukraine in 2022 (scale 0...100)

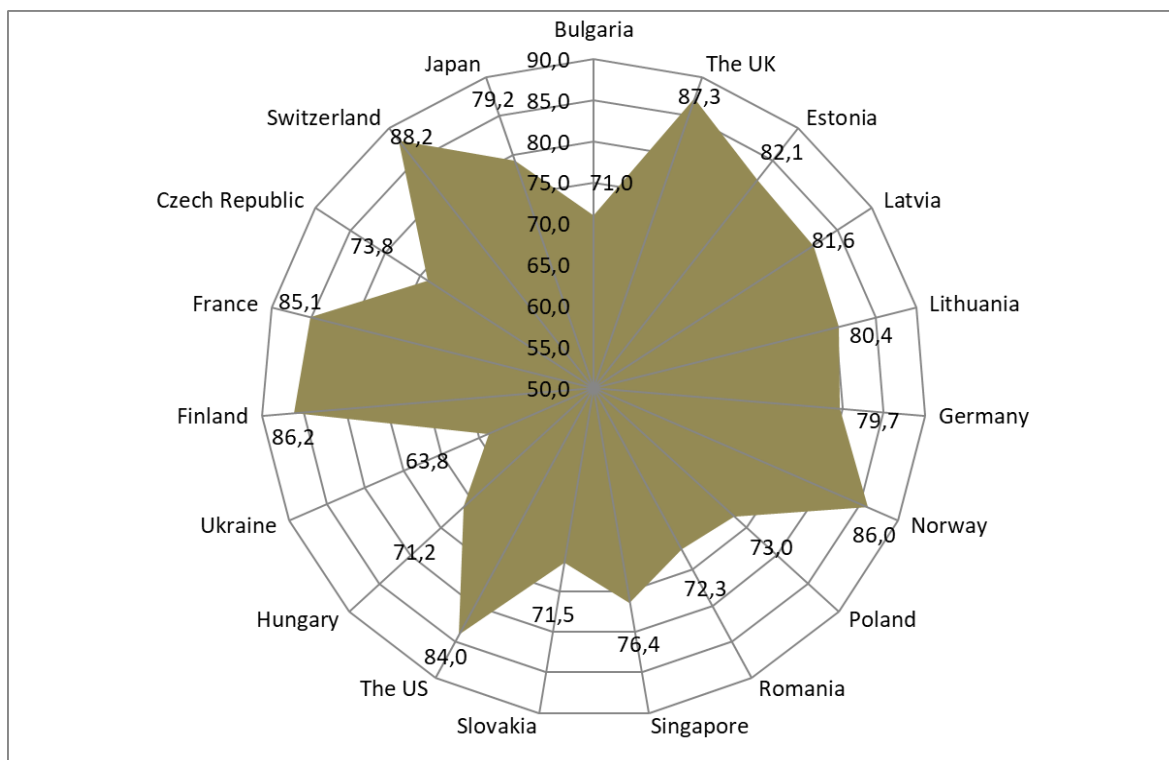
**Source:** built according to data (Global Innovation Index, 2022)

The situation with regard to the ICT use index in 2022 is similar (Fig. 3). For Ukraine, its value was quite low (63.8), while in Switzerland it was 88.2, in Great Britain - 87.3, and in Finland - 86.2.

New technologies in the framework of the formation of Industry 4.0 can include: blockchain technologies, artificial intelligence, creation of "digital doubles", use of drones, 3D printing technologies, VR/AR, cyber security tools, etc. (Ukraine 2030E, n.d.).

The latest digital technologies significantly influence key elements of the business model of economic entity. O.Ye. Chatchenko *et al.* (2022) believe that such influence is carried out within the framework of the following elements of the enterprise's business model: value proposition, consumer segments, customer relations, sales channels, sources of income (monetization methods), key resources, key partners, key types of activities (including those based on digital platforms), cost structure (increase in efficiency).

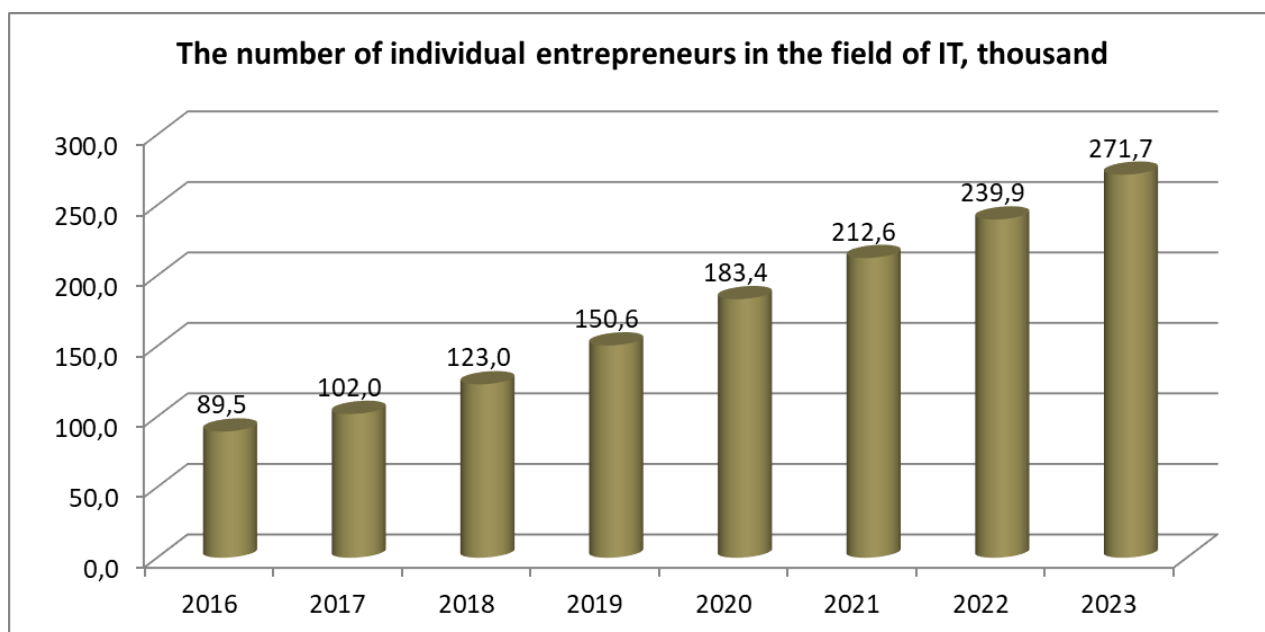
O.V. Lebyd (2022) notes that the transformation of business processes of business entities in the context of implementation of the achievements of the IT industry will make it possible to accelerate the speed of business operations, build new channels for information exchange, and facilitate the development and implementation of new products. In particular, the potential for further application of blockchain technologies as a tool that will help increase the speed and security of information transmission is significant.



**Figure 3.** The value of the ICT use index in some countries of the world and in Ukraine in 2022 (scale 0...100)

Source: built according to data (Global Innovation Index, 2022)

In particular, a significant increase in the number of natural persons-entrepreneurs (NPEs) carrying out their activities in the specified sphere is an evidence of the rapid development of the IT sphere in Ukraine (Fig. 4). Thus, for the period from 2016 to 2023, their number increased from 89.5 thousand to 271.7 thousand people, that is, it actually tripled.



**Figure 4.** Dynamics of the number of NPEs in the IT sphere in Ukraine in 2016-2023, thousands of people

Source: (How many IT workers, 2023)

Specialists also single out a number of problems related to the formation of digital economy in domestic space: shortage of properly qualified personnel in certain areas; non-compliance with copyright and intellectual property rights; use of unlicensed software in the activities of business entities; gaps in legislative framework regulating the functioning of the IT sphere; relatively lower rates of implementation of the latest digital technologies compared to developed countries of the world; dominance of the orientation of producers of digital technologies and software on foreign sales markets, etc. (Lakiza, 2022).

Therefore, it is important to take into account relevant risks accompanying the formation of digital economy in Ukraine, timely implementing a set of measures related to their identification, interpretation, establishing the circle of responsible officials, determining indicators and criteria for risk assessment, choosing the best alternative solutions (Sazonova, 2021).

Digital transformation of the economy has an unprecedented influence on the field of work and employment, gradually increasing the share of digital jobs, volumes of remote and virtual employment and changing the structure of employment in general.

According to Z.V. Smutchak (2022), "a digital workplace is a virtual equivalent of a physical workplace, which requires proper organization, use and management, as it should become a guarantee of increased employee efficiency and the creation of more favorable working conditions for them".

I.O. Sedikova *et al.* (2022) rightly emphasize that, over time, there will be significant changes in the field of management activities caused by digitalization. Thus, artificial intelligence and the latest digital technologies (chat-bots, virtual assistants) will be able to take over a significant part of managerial functions. It is positive in this context that managers will be able to use the time freed from performing routine actions and tasks to solve problems and issues of a strategic nature, perform creative work, increase their own professional level, self-improvement and search for ways to improve current and strategic activity.

O.V. Potemkina *et al.* (2022) emphasize that in the conditions of modern realities, the system of human resources management at the level of business structures is significantly complicated, since specialists in their activities must take into account a complex set of digital software solutions that form the basis for the performance of many labor functions and tasks.

At the same time, according to S.V. Sazonova (2022), digitalization contains numerous advantages in the context of the implementation of technologies for innovative personnel management and their professional development. Gamification, which, thanks to the use of game techniques during work and training of the personnel of IT enterprises, allows to increase the activity of employees in professional sphere, thereby contributing to stable functioning and development of business entities as a whole, is one of such technologies.

Thus, we consider it expedient to include the following as areas of intensification and improvement of the effectiveness of the functioning of domestic IT sphere in the context of digital transformation of the economy:

- the optimization and improvement of legislative and regulatory framework that regulates the activities of economic entities in the IT sphere, the development of digital economy, innovative activities and the protection of rights to intellectual property objects;
- the increase in professional qualification level of employees (in particular, the development of digital skills, the formation of knowledge and skills in the field of practical application of the latest information and communication technologies, overcoming of digital gap in digital skills);
- the promotion of the provision of a high level of digital literacy and digital culture for both the employed population and all citizens of the country in general;
- the increase in practical orientation and quality of educational programs for training specialists for the IT sphere in educational institutions (including specialists of both technical and non-technical profiles) based on further intensification of interaction with leading domestic and international IT companies;

- the intensification of social partnership relations and social dialogue on issues of regulating relations on the labor market, which is due to the transformation of the structure of labor and employment market as a result of the influence of digital technologies;
- the increase in the effectiveness of measures aimed at ensuring cyber security and protecting information resources from negative interference, etc.

### Conclusions

The results of the conducted research allow us to state that today digital transformation of the economy and social relations has a high influence both on the activities of companies belonging to the IT sphere and on the functioning of all business entities as a whole. Positive consequences of the influence of digitalization on the activities of business structures dominate over negative ones, creating unprecedented opportunities for intensifying entrepreneurial activity, attracting potential customers, accelerating and optimizing information flows, expanding channels of work with the target audience of consumers, business monetization, rationalization and cost reduction, etc.

The IT sphere in Ukraine and the world at the current stage is characterized by high rates of development and significant potential for further growth. However, in terms of international comparisons, Ukraine lags behind developed countries of the world in terms of indicators characterizing the trends of digital economy. Considering this, the need to introduce measures to improve legislative framework, stimulate business activities, professional development of human resources, form a high level of digital culture, etc. is becoming more urgent.

Prospects for further research on the topic of the study are in the need to systematize the tools of regulatory influence on the development of digital economy in Ukraine as a whole and the IT sphere, in particular, substantiate the ways to stimulate accelerated and effective development of business entities operating in the IT sphere, intensify the cooperation with foreign partners on the application of the latest digital tools and technologies.

### Acknowledgements

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### Conflict of Interest

None.

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## ОСОБЛИВОСТІ РОЗВИТКУ ІТ-СФЕРИ В КОНТЕКСТІ ЦИФРОВОЇ ТРАНСФОРМАЦІЇ ЕКОНОМІКИ УКРАЇНИ

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**Анотація.** У статті визначено ключові проблеми, які стримують перспективи розвитку потенціалу ІТ-сфери в Україні. Розглянуто специфіку функціонування та розвитку ІТ-сфери в Україні в умовах цифрової трансформації економіки. Проаналізовано основні наукові підходи до визначення сутності дефініції «цифрова економіка». Систематизовано позитивні та негативні аспекти впливу цифрової економіки і цифрових інструментів на розвиток ІТ-сфери, зайнятість населення, перебіг бізнес-процесів господарюючих суб'єктів. Наведено порівняльний аналіз значень індексів мережевої готовності України щодо розвинених країн Європи і світу. Визначено вплив індексів доступу до інформаційно-комунікативних технологій та використання ІКТ на стан розвитку цифрової економіки



певної країни. Встановлено основні тренди нових технологій у рамках становлення Індустрії 4.0, серед яких такі: технології блокчейну, штучного інтелекту, створення «цифрових двійників», застосування дронів, технологій 3D-друку, VR/AR, засобів кібербезпеки тощо. Встановлено факт стрімкого розвитку ІТ-сфери в Україні. Поряд із тим, у вимірі міжнародних порівнянь Україна дещо відстає від розвинених держав світу за показниками, що характеризують тенденції становлення цифрової економіки. Досліджено динаміку зміни кількості фізичних осіб-підприємців у сфері ІТ. Встановлено, що цифровізація економіки кардинально змінює сферу праці та зайнятості, підвищуючи частку цифрових робочих місць, обсягів дистанційної та віртуальної зайнятості, а також змінюючи структуру зайнятості в цілому. Обґрунтовано напрями вдосконалення розвитку вітчизняної ІТ-сфери під час прискорення процесів цифровізації економіки і життя суспільства, включаючи поліпшення законодавчої бази шляхом регламентування діяльності господарюючих суб'єктів в ІТ-сфері, розвитку цифрової економіки, інноваційної діяльності та захисту прав на об'єкти інтелектуальної власності, безперервний професійний розвиток людських ресурсів з питань опанування та використання сучасних цифрових технологій, розвиток відносин соціального партнерства і цифрової культури громадян, дотримання заходів кібербезпеки та захисту інформації.

**Ключові слова:** регулювання, інформація, цифровізація, цифрова трансформація, цифрова технологія.