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THEORETICAL APPROACHES TO RESEARCHING DIGITALIZATION PROCESSES IN THE GLOBAL ECONOMY

Abstract

Digitization as a new tool for the transformation of socio-economic relations and a modern tool for sustainable development is characterized by a global spread throughout the world. The article presents certain theoretical approaches to digitalization research. In particular, theories of the information society, theories of economic cycles and theories of globalization – the theoretical and methodological foundation of digitalization research – are systematized. These theoretically substantiate the patterns of digitalization of the economy. In addition, it is found that digitalization is a practical rather than a merely theoretical tool for modernization of the economy that can solve economic problems (in our study, this is the Mandell-Fleming dilemma). The study results reveal the main trends of digitization, in particular in the financial sector. In our opinion, the global monetary and financial system is being significantly modernized and will be characterized by the use of cryptocurrencies and/or digital currencies of central banks in

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international settlements. This trend is confirmed by the dynamics of significant growth in the volume of crypto-assets in the world. The article additionally examines the peculiarities of digitalization in Ukraine, in particular the banking sector. It is established that the digitalization of the Ukrainian banking sector contradicts the global trends of banking fintech solutions, because Ukrainian banks consider digitalization not as an opportunity for development, but as a «parallel world». Currently, domestic banks have a low level of participation in the capital of fintech companies. We recommend further involvement of Ukraine in global economic relations based on digital transformation.

Key Words:

digitization; information society; digital economy; cryptocurrencies; digital currencies of central banks.

JEL: F29, F39.

3 figures, 1 table, 1 formula, 23 references.

Problem Statement and Literature Review

Relevance of research. The modern stage of industrial revolution is associated with the development of the Internet communication technologies which have significantly changed the technology of business processes and were named «digitalization».

Digitization is a deep transformation that meets the modern requirements of sustainable development and creates new grounds for increasing the role of countries in the world economy. In addition, it provides an opportunity for improving the structure of production, acts as a tool for transformation in various areas of the economic system and can solve some previously unsolved economic problems.

The main goal of digitization is to stimulate the introduction of innovations in various sectors of the economy, achieve the digital transformation of existing sectors of the economy or create new ones. This will result in the emergence of society 5.0, while free flows of capital and data will be ensured.

Analysis of recent research and publications. At the same time, digitalization as a new driver of economic development is the subject of scientific interest of many scientists. D. Stiglitz, N. Colin, P. Mohnen, and A. Perrot have to be highlighted among the researchers of digitalization. The focus of their research is on the enterprise, as well as on how internal and external factors behave in the conditions of digital transformation and the development of their development strategy (Colin et al., 2015).

Other scientists such as Sh. Yuan, O. H. Musibau, S. Y. Genç, R. Shaheend, A. Ameen, and Zh. Tan have recently found a stable relationship between technological innovation and its determinants (GDP, R&D expenditure financing, financial risk) during a long time. Scholars have found that financial risk negatively affects technological innovation (Yuan et al., 2021).

In addition, Shuming Ren, Yu Hao, Lianqing Li, Haitao Wu, and Yueqi Han investigated the impact of digital economy agglomeration on green growth. They also recognized that the goal of the sustainable development model is to promote the overall and balanced growth of humanity, the economy and the preservation of the environment (Ren et al., 2022).

Thus, the topic of digitalization is very relevant from the point of view of sustainable development and can act as a tool for transforming the economy in order to solve a number of important economic problems.

The aim of the paper is to study theoretical approaches to digitalization of the world economy and identify the main current trends of digital transformation. To achieve this aim, it is necessary to complete the several objectives. First, induction, deduction, system approach methods were used to analyze and systematize approaches to defining the concept of «digitalization of the economy». Second, systematization and generalization methods were used to systematize economic theories as the theoretical and methodological basis of digitization research. Third, abstract-logical, economic-mathematical, comparative methods and the method of systemic approach and analysis and synthesis were used to single out the latest global trends in the development of digitization of the economy in general and the financial sector in particular, as well as the peculiarities of its implementation in Ukraine. **The study focuses on** the investigation of digitalization transformation of world economy.

Research methods. Research methods are based on general scientific and fundamental provisions of economic theory. The subject of research and specific research tasks encourage the use of general and special methods of cognition, including systems analysis, induction, deduction, systematization and

generalization, abstract-logical, economic-mathematical, comparative methods, etc. Primary and secondary sources used in the research include official publications and methodological materials of the State Statistics Service of Ukraine, international organizations, including the NASDAQ, Bloomberg, and scientific works of Ukrainian and foreign scientists.

Research Results

Digitization, as a defining trend of the development of modern human civilization, is expressed in the introduction of digital technologies in all spheres of life. It is characterized by an exponential decrease in production cost, and as a result – acceleration of economic growth within the framework of the concept of sustainable development.

The concept of digital economy appeared for the first time in 1995 in the works of A. Tapscott (Tapscott & Tapscott, 2016) and the American computer scientist N. Negroponte (1995). The concept was characterized by the use of information and communication technologies as a new way of creating and selling various products and services.

Nowadays, a single unified definition of the concept of digital economy has not been created (Table 1), but it is generally accepted that the digital economy is the economy of the fourth industrial revolution, which is based on digital resources and is closely related to the production, exchange and consumption of modern information and communication technologies (ICT). Therefore, in the conditions of digitalization, society is moving from a material-oriented economy to a high-developed digitalized economy.

Digitization is a key mechanism of economic growth due to the ability of technology to positively influence the efficiency, cost and quality of economic, social and personal activities. The main goal of digitalization is the digital transformation of existing sectors of the economy and the creation of new ones, transforming the main spheres of human activity into more efficient and modern ones. The main goal of digitization – economic growth – is possible only in conditions of new ideas and implementation of initiative programs in sectoral, regional and national development strategies of the state.

Taking into account the fact that the digitalization process is a rather complex systemic phenomenon, we have to highlight the main, in our opinion, theoretical foundations of its development. Here, we include theories of the information society (they define the role and place of information and knowledge in the economic system), theories of economic cycles (characterize the dynamism of development and qualitative transformations of the system), as well as theories of globalization (describe the ways and mechanisms of digitalization spreading throughout the world) (Fig. 1).

Table 1

Differentiation of the interpretation of «digital economy»

No.	Institution	Definition of digital economy
1.	World Bank Group	a paradigm of accelerated economic development based on data exchange in real time.
2.	Organization for Economic Cooperation and Development	a set of transformational effects that were resulted because of new technologies action in the field of information and telecommunications.
3.	European Parliament	a complex structural process consisting of several stages interconnected by an almost infinite and constantly growing number of nodes. Platforms exist in interconnectedness, allowing users to connect directly through multiple channels, thereby making it difficult to exclude specific players, i.e. competitors.
4.	Economist Intelligence Unit	an economy that has the ability to provide high-quality ICT infrastructure and mobilize ICT capabilities to create benefits for consumers, businesses and the state.
5.	Institute for Global Development (Manchester)	a part of the total production that is completely or mainly produced on the basis of digital technologies, the business model of which is based on digital products or services.

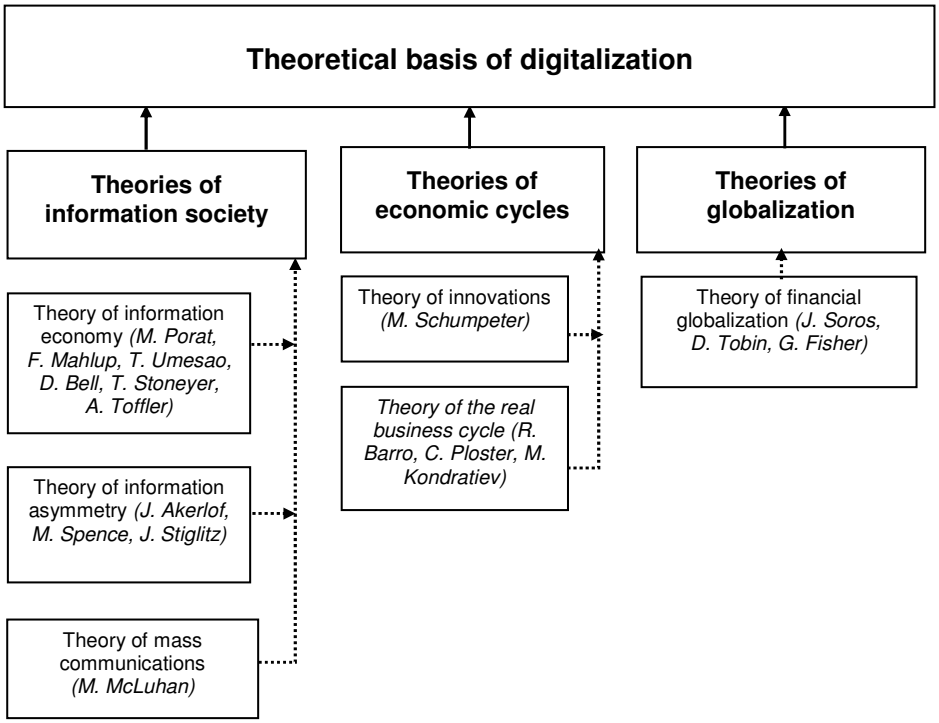
Source: compiled by the authors based on data of the World Bank (n.d.), the OECD (2022), and European Parliament (2022).

It should be emphasized that the modern world economic system is characterized by disproportionality and imbalances of development caused by uneven distribution of production factors – land, labor, capital, and knowledge. In such conditions, the lack of information resources and technologies leads to a digital development gap. In practice, these theories do not work perfectly, but they determine the main principles of the phenomenon. Let's highlight the main theoretical aspects of economy digitalization process.

The information economy deals with information asymmetry. The concept of markets with asymmetric information was introduced and investigated by Nobel laureates J. Akerlof, M. Spence and J. Stiglitz. This concept is fundamental to understanding the information economy definition. In the information economy, the emphasis is on the leading role of electronic and informational technical means of communication in the development of all major spheres of the economy. At the same time, the information itself is equated with commercial products. In contrast, the classical theory of general equilibrium considered markets under conditions of complete and perfect information and the absence of transaction costs.

Figure 1

Theoretical basis of digitalization of the world economy



Source: systemized by the authors based on data of Economics.Studio (n.d.), Schumpeter (1939), Mensh (1979), Hirooka (2006), Colin et al. (2015).

The three key features of the information economy are: (1) the information used by subjects of economic relations, while they are involved into making decisions, is different; (2) market participants are informed in different ways about the market situation, the participants in economic relations and the characteristics of goods; (3) in order to conduct a market agreement, market subjects must exchange information, however, there are situations when unreliable information can be provided to obtain a one-sided benefit.

J. Stiglitz mathematically substantiated the impossibility of achieving general market equilibrium in the presence of information asymmetry. In such conditions, state intervention in selective industries equalizes the functioning of the

market economy. The positive result of the economic reforms carried out in Vietnam, and the former USSR (NEP) in the 1920s is an example of this.

The concept of information asymmetry proves the possibility of multiple market equilibria and thus justifies the need for state regulation to achieve a more effective economic market equilibrium. Equalization of asymmetric information or elimination of asymmetry is possible only in the conditions of the development of the information economy and state regulation.

Within the framework of the study of digitalization of the economy, the provisions of J. Schumpeter's innovative concept are important. J. Schumpeter formed the basis of the theory of innovations and determined long-wave fluctuations as a manifestation of economic dynamics that arise as a result of the development of innovations. He determined that when innovations are introduced into the country's economy, a «whirlwind of creative destruction» is formed, which unbalances the existing economic system, forcing it to move away from outdated technologies and dysfunctional organizational structures. This leads to the emergence of new industries and spheres, and this is exactly what stimulates the growth of the economy. According to the views of Schumpeter, clusters of innovations are key in the formation of long waves (Schumpeter, 1939).

This position found its development in the work of G. Mensh (1979) *Stalemate in Technology: Innovations Overcome the Depression*. The modern stage of the development of innovation theory is associated with this work. In G. Mensh's model, the key factor is a cluster of basic innovations. The wave nature of economic development causes uneven growth of the economy. Thanks to the synergistic effect, the innovations of the cluster determine the growth of the economy, providing it with a breakthrough character. G. Mensch proves that basic innovations occur in the long-wave depression phase. This forces us to look for new development alternatives (Mensh, 1979).

M. Hirooka continued to develop the innovation-cyclical theory of economic development, proposing an innovative paradigm of three logistic trajectories: technological, development and diffusion. He proved that some innovations go beyond one cycle, creating a long trajectory of development called «infratrajectory». In the current fifth Kondratieff cycle, these are computer technologies. Now, there are already factors that confirm the beginning of the formation of the 5th technological system and the clustering of innovations, where nanotechnology, genetic engineering, biotechnology, information and communication technologies, new materials, alternative energy will be key (Hirooka, 2006).

Having analyzed some regularities of the innovation-cyclic theory of development, we summarize: innovations obey the law of renewal from time to time; cyclicality is natural and cycles can be of different duration and depth; there is an interaction of innovation cycles of different durations, as well as their interaction with cyclical dynamics in adjacent and distant spheres; innovative waves are un-

evenly distributed in space, so their centers sometimes shift and the leaders of innovative activity change.

The concept of digital economy is not limited by the implementation of IT, but radically transforms spheres and business processes into Internet-based ones. The highest level of digitization is characterized by radical transformations of the industrial relations of the participants. This should lead to the integration of production and services into a single digital (cyber-physical) system, the main characteristics of which are: (a) elements of the economic system exist simultaneously both in physical form and in the digital dimension; (b) physical products and objects become an integrated part of a unique IT system due to the presence of a digital copy and a communication element; (c) given the presence of digital copies and being part of a single system, all elements constantly interact with each other in conditions close to real time, ensuring constant optimization of the system.

From a theoretical point of view, digitalization allows not only to eliminate or minimize the phenomenon of information asymmetry, but is also a tool for solving some other economic dilemmas. As an example, consider the Mundell-Fleming model, which states that an economic system cannot support an independent monetary policy, a fixed exchange rate, and a free flow of capital at the same time. It was developed in the early 1960s by American economists R. Mundell (1961) and J. Fleming (1962) as a Keynesian extension of the LM-IS model for the case of an open economic system. According to the theoretical foundations of the theory, it is possible to simultaneously support only two of the three conditions. This dilemma is known as the «impossible trinity».

We believe that this can be solved practically in the modern conditions of the digital environment. Information and communication technology is a tool to support three conditions simultaneously: the government could support 2 of the 3 pillars, i.e., independent monetary policy and a fixed exchange rate, while the free flow of capital could be ensured by digitization. The digital economy became the basis of the Fourth Industrial Revolution and the third wave of globalization. In the information society, information acquires the economic and social functions of capital.

The Mundell-Fleming model is used for the analysis of economic processes in an open economic system and provides a solution to the problem of achieving external and internal balance with the help of fiscal and monetary policy tools; in the modern conditions of the 4th industrial revolution, the free flow of capital (financial and informational resources) is ensured information and communication technologies.

Another example of the practical application of classical theories in the digital economy is the market model of H. Markowitz (1990), which in the context of digitalization can be used when choosing an effective investment portfolio in the IT industry, because a close connection has been established between the

digitization of the economy and the level of investments in IT. This is a model for choosing an efficient portfolio, which involves searching for a portfolio with a given level of expected return and minimum variance.

The Markowitz model is a quadratic programming problem and can be solved by standard methods. Most difficulties are related to the practical use of the model – the preparation of initial information about the expected level of profitability, standard deviation and covariance coefficients of assets. An investor does not necessarily have to choose only the one solution, he can choose any combination of possible investments, distributing his wealth in different areas of investment.

The Markowitz model can be defined as follows: it is necessary to find the following proportions of the distribution of finances between available assets: x_1, $x_{2,\ldots,}$ x_n (where x_1 is for finances invested in the *i-th* asset), so that the portfolio risk σ_p at a given level of profitability μ_p would be minimal.

The starting position of the model is: the total sum of the weights of each value in the portfolio, multiplied by its covariance, should be equal to the estimated variance of the portfolio. For each value of V*, we will have a different composition of the portfolio. The model has the form (Markowitz, 1990):

$$\sigma_p^2 = \sum_{i=1}^{n}\sum_{j=1}^{n} X_i X_j \sigma_{i,j} = V^* \quad (1)$$

Thus, from a practical point of view, digitalization is a consequence of the transformation of the economy under the influence of ICT, and from a theoretical point of view, it is not only a result of evolutionary improvement, but also a tool for solving some economic dilemmas.

Moving on to the practical implementation of digitalization of the economy, let us note, first of all, its main segments (Pyshchulina, 2020):

- sector of information and communication technologies, e-business infrastructure (networks, software, computers, etc.);
- digital production, including industry, which ensures the organization of electronic business processes using computer networks;
- electronic commerce, i.e. retail trade of goods on the Internet.

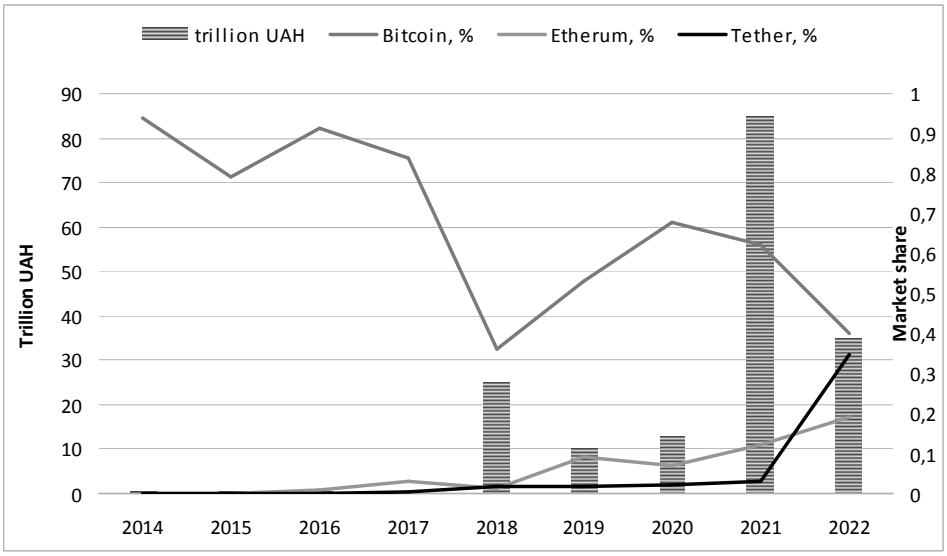
The world economy has entered an active phase of digital transformation aimed at accelerating economic growth, increasing productivity and creating new areas of activity. By 2025, the digital economy is expected to reach $23 trillion (or 23.3% of global GDP). At the same time, digital banking will play a huge role in the development of the economies of various countries in the near future. According to the European Retail Banking Radar report conducted in 2019, around

20% of Europeans are expected to start using digital banking services in the next five years, and by 2023 the number of customers of such banks will reach 85 million, compared to around 15.6 million in 2019, the growth in the number of digital banks will be driven primarily by new generations who prefer digital products (Zhang et al., 2020).

To function effectively, the digital economy needs a digitized currency. Such currencies are decentralized cryptocurrencies (virtual currencies Bitcoin, Ethereum, Tether, etc.) and centralized digital currencies of central banks. Starting from 2009, the sector of cryptocurrencies began to develop, and more recently – digital currencies of central banks. Although recently there has been a steady increase in crypto-assets in the world, cryptocurrencies are very volatile (Fig. 2) and highly dependent on market conditions. There is a tendency of shifting from fiat currencies to cryptocurrencies as they are subscription based.

Figure 2

Dynamics of crypto-assets in the world (trillion UAH) and shares of the main cryptocurrencies in the general market



Source: created by authors based on CoinMarketCap (n.d.).

Having studied the peculiarities of the cryptocurrency market, we found that there is an upward trend in the growth rate of crypto-assets in the world. In particular, the increase was approximately 7 times during 2021. A comparative analysis of the share of the top 3 cryptocurrencies established that at the stage of the emergence and spread of transactions based on blockchain technologies, the market share of Bitcoin during 2014-2017 was approximately 80%. However, in 2018 there was a sharp reduction in the share from 75% to 33%, and this is evidence not of the deterioration of the position of Bitcoin and the market situation, but on the contrary – of the expansion of the market (since 2018, such cryptocurrencies as Ethereum and Tether have been gaining popularity). In 2022, the market share of crypto-assets between the 3 leading cryptocurrencies is approximately Bitcoin – 40 %, Tether – 40 %, Ethereum – 20%. The industry is very dynamic and volatile.

The Nasdaq Digital Asset Team has been created at the American OTC market, which will offer fiduciary services to large investors for operations with two major cryptocurrencies. The second largest stock exchange in the world, Nasdaq, is focusing on the development of the digital asset sector. Nasdaq Digital Assets will initially launch depository services for bitcoin and ether only, according to a Bloomberg report (Nasdaq, n.d.).

If the NYDFS approves the application, Nasdaq will become a serious competitor to the companies like Coinbase and Anchorage Digital. Experts note that Wall Street is showing increasing interest in the cryptocurrency market, since more and more institutional clients invest their funds in crypto-assets, despite the collapse of their quotations this spring (Bloomberg, n.d.).

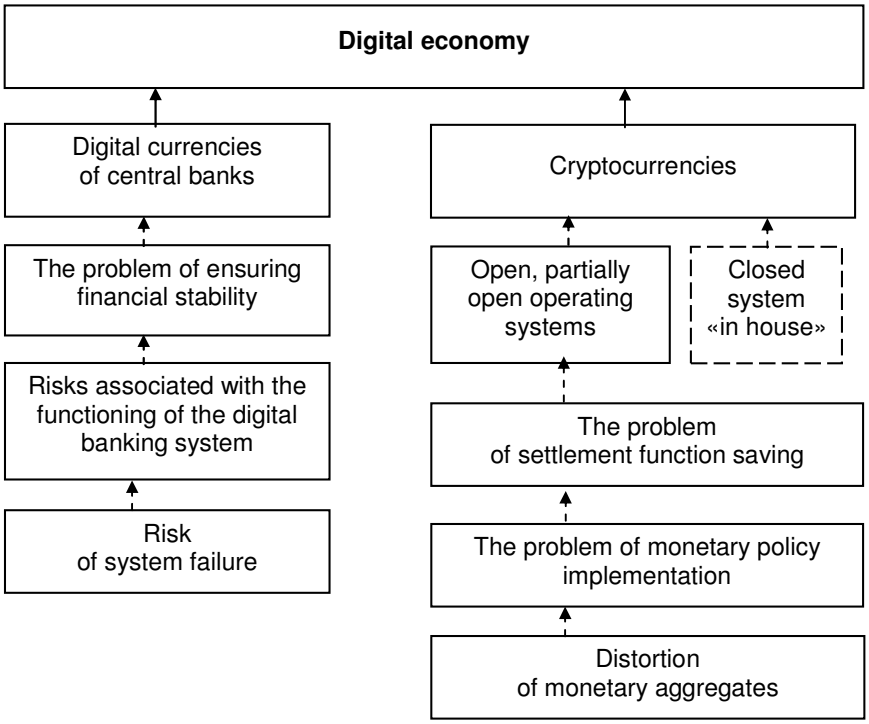
Different countries recognize the status of cryptocurrencies and operations with them in national economies in different ways. Some recognize the possibility of cryptocurrency operations in the national payment system and will develop a regulatory apparatus with the aim of integrating crypto currencies with the financial system (Italy, Australia, Belgium, Israel, the Czech Republic, etc.), while others restrict (India, China, Russia, Lebanon) or forbid (Egypt, Iraq, Vietnam, etc.) it. However, according to the data of the World Bank, about 90% of the surveyed central banks conduct programs for the development and implementation of digital currencies of central banks.

In our opinion, digital currencies or cryptocurrencies will take the leading positions in international settlements, transforming the global monetary and financial system into a digital one. In confirmation of this trend, we note that the use of blockchain technology and programs in the field of decentralized finance (DeFi) at the global level is supported by the CEO of JPMorgan Investment Bank, Jamie Dimon. JPMorgan's innovativeness is already characterized by the use of the latest Liink network in operational activities. This allows other financial institutions to share complex data. Also, as an example, the financial conglomerate is using blockchain to move dollar deposits tokenized with JPM Coin.

Cryptocurrencies and digital currencies are a promising transformation of the world financial order, with some features (Fig. 3) that will displace, in our opinion, other possible scenarios of transformation of the global monetary and financial system (multipolar system, monopolar system, status quo of the dollar).

Figure 3

Problems of implementing digital currencies and cryptocurrencies into the modern digital economic system



Source: created by the authors based on Pyshchulina (2020).

The trend of global digitization is also confirmed by the recent *Juniper Research Retail Banking: Digital Transformation & Disruptor Opportunities 2020-2024* study, which shows that by 2024, the number of digital banking users in the world will reach 3.6 billion, which is 50% more than in 2020. Bank of America,

BBVA, and JPMorgan are recognized as leading banks in digital transformation (Juniper Research, 2020).

As for the domestic banking sector, according to a study by Ernst & Young within the framework of the USAID project *Transformation of the Financial Sector (October 2016 – December 2020)*, the trend of its development is completely contrary to the global trend of fintech solutions of banks, that is, Ukrainian banks perceive digital transformation not as a possibility, but as a «parallel world» (Fursova et al., 2020). Thus, currently domestic banks have a low level of participation in the capital of fintech companies (85.7% of banks do not have shares in fintech companies), bank participants have limited experience in the fintech industry (only 28.6% of surveyed banks, in addition, have at least one board member with knowledge of the fintech industry), only 50% of banks have a developed digital strategy.

Today, four digital banks (neobank – a bank without branches) have been launched in Ukraine, created according to the principle of «bank within a bank», that is, an independent structure that develops digital products under a separate brand. Among them: «O.Bank» (Idea Bank), «Monobank» (Universal Bank), «Todobank» (JSC «Megabank»), «Izibank» (Universal Bank). The most optimal tariffs are offered by O.Bank (the maximum grace period and cashbacks for any online purchases, as well as for subscriptions to Google and Apple paid services), but for operations such as transfers, withdrawals or top-ups, these tariffs are valid during the first four months from the moment of card registration. As for mobile applications, according to the Ministry of Finance, they are currently available in 39 banks out of 76, the services of which work on both Android and iOS.

Since the beginning of the war in Ukraine, business has been significantly affected, but the IT sector has suffered less than other industries, as it is quite mobile and most of the teams can work remotely. The IT manager of the Traffic Devils company O. Slobozhenko emphasized that the IT sphere has now completely switched to remote work mode, and in this case, the war does not harm digitalization, but on the contrary – stimulates the transformation of the economy, acting as an effective tool.

In order to determine the prospects for the development of digital banking in Ukraine, as well as the risks, the SWOT analysis revealed a number of advantages, namely: access to banks 24/7, increased labor productivity and its improved quality, improved operations and increased efficiency of bank operational management, etc. The main disadvantage of digital transformation is its high cost, which the majority of bank managers point to. On average, banks' IT expenses are distributed as follows: 60.3% of the IT budget is spent on maintaining the existing infrastructure; 18.7% – for the development of new software infrastructure; 14.1% – for new hardware infrastructure; 6.9% – for strategy, development of business processes and planning.

The further development of digital banking will primarily depend on the improvement of IT technologies that make the digital transformation of banking institutions cheaper, the search for new ways to protect data in the face of increasing cyberattacks, as well as the reduction of the digital division between the city and the countryside (Slozko & Pelo, 2014). It should be noted that currently Ukraine has the necessary potential for the deepening of digitalization of its economy according to a number of indicators and domestic resources.

Conclusions

The research systemized theoretical and methodological provisions for the development of digitalization of the world economy and established the features of modern trends of this process. Thus, the following conclusions from the study were obtained.

Digitization acts as a modern powerful tool aimed at finding new opportunities for improving the structure of production and tackling some unresolved economic issues. The theoretical foundations of digitization research are based on the theories of the information society, the theory of economic cycles and globalization. In addition, digitalization as a tool is a means of solving some economic dilemmas (the Mundell-Fleming dilemma).

Digitization is a growing trend in the global economy, especially in digital banking. In our opinion, the main trends of the transformation of the world financial order in the conditions of global digitalization include the introduction of digital currencies of central banks, the determination of the legal status and peculiarities of the regulation of operations with cryptocurrencies both at the national and international levels, as well as the use of cryptocurrencies and/or digital currencies in international settlements.

Taking into account the Ukrainian development trend, it should be recognized that it completely contradicts the global trend of banking fintech solutions, that is, Ukrainian banks consider digitalization not as an opportunity to develop, but as a «parallel world». Domestic banks currently have a low level of participation in the capital of fintech companies. Moreover, only 50% of banks have a developed digital strategy, but this trend has been increasing. We recommend further involvement of Ukraine into global economic relations based on digital transformation, which should lead to an improvement of the external and internal balance.

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