

Economy Digitalization in Paradigm of Reproductive Process

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Abstract: The aim of the work is an analytical study of reproducible phenomena and connections, that are manifested in the development of innovative economics of the digital type. The article reflects the importance of the digital economy for GDP growth, analyzes and gives an interpretation of the digital economy, identifies the prerequisites for the formation and development of the digital industry, proves the reproductive nature of business processes in order to create new value. The article uses such research methods as structural, logical and analytical methods for better understanding of nature and structure of the digital economy; method of comparative analysis and method of extrapolation for the formation of the reproduction model in digital economy; generalization method for making conclusions. The model of reproduction process transformation under the conditions of digital economy is offered. In addition features of digital economy reproduction are defined and priorities of digital economy development in Ukraine are substantiated.

1 INTRODUCTION

Formulation of the problem. Even under COVID-19 today's economy characteristic is the growing influence of a new type of economy, which is based on network services, as well as digital and electronic economy or economy of the virtual world. Depending on the methods of determining the size of the digital economy, its share ranges from 4.5 to 15.5 percent of world GDP (Digital economy report, 2019). In 2010, Boston Consulting Group estimated the amount of digitization at \$ 2.3 trillion for a group of top 20 countries, or about 4.1% of their GDP. And it predicts that the digital economy will have reached \$ 16 trillion by 2035 (World Bank, 2020). Digital business is also attractive and cost-effective at macro level. After all, the cumulative effect, the dollar invested into digital technology over the past three decades, has added an average of 20 dollars to GDP (Xaustov,

2019). Meanwhile, despite the rapid development of information technology and the formation of the digital economy on their basis it requires theoretical understanding of new realities, awareness and justification of the latest theoretical constructs of the digital economy.

Analysis of recent researches. It should be noted that in the scientific literature and in practice there is terminological uncertainty, differences in views on the essence and content of the new economy, as researchers often reduce its essence to the Internet or networks, platform or information technology, new business management methods or new virtual technologies. However, in the English-speaking environment, the theoretical aspects of the digital economy are considered by Becker L. (Becker, 2018), Gumerova G. I., Shaimiev E.Sh. (Gumerova & Shaimiev, 2019), Lapidus L.V. (Lapidus, 2018) in the context of the transformation of management decisions.

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Thus, the main determinant of the digital economy is determined by Podolchak N. Yu., Bilyk O. I., Levytska Ya. V. computer networks as the field of its activity: "Digital economy is a kind of economic market system, where one, several or all stages of economic processes are carried out through computer networks. Digital economy is one of the manifestations of economic freedom, innovation and the level of economic development" (Podolchak et al, 2019). It is true, but it is not enough to understand the depth of the processes, that take place in the system of productive forces and production relations in Industry 4.0.

In domestic and foreign literature the various prerequisites for the development of the digital economy are identified. Thus, Nureyev R.M., Karapayev O.V. determine the development of the Internet, network society as prerequisites for the development of the digital economy is called (Nureev & Karapaev, 2019). The main reason for the expansion of the digital segment of the economy is the growth of the transaction sector, which accounts for more than 70% of national GDP in the developed countries. This sector includes: public administration, consulting and information services, finance, wholesale and retail trade, as well as the provision of various utilities, personal and social services (OECD, 2017). However, we must note that the lack of scientific work on the methodology of digital economy such as the theory of factors of production, the value theory, the price theory, the expanded reproduction theory, the theory of capital movements, the competition theory and etc. Conflicting views on the conceptual and categorical apparatus, forecasting the effects of E-economy and E-government are also enumerated among them.

Objective setting. The aim of the work is an analytical study of reproducible phenomena and connections that are manifested in the development of innovative economics of the digital type. The work uses such research methods as structural, logical and analytical ones in order to understand the nature and structure of the digital economy; method of comparative analysis and extrapolation method for the formation of the reproduction model in digital economics; generalization method for making conclusions.

2 RESULT AND DISCUSSION

In our opinion, in terminological discussions, the position of the Polish scientist Mikhail Holinski, who believes that the pseudo-definition of the digital

economy should not be born in advance, is the most real. Moreover, considering the point of view of the scientific methodology, the interpretation of the economic category must contain measures of its state of development. Since these phenomena occur in our life and it is in the initial phase of development, we should not worry about finding a holistic definition of digital economy (Goliński, 2019). Foreign researchers have different views on the essence of the digital economy, pointing to the increased degree of connections and interaction of all authors of the reproduction process on a single electronic platform, including manufacturers, intermediaries, suppliers, consumers: "A form of economic people's activity, businesses, devices, data and processes. The basis of the digital economy is hyper connection. So, the growing interconnectedness of people, organizations and machines, formed through the Internet, mobile technology and the Internet of Things" (Deloitte, 2019).

Despite this pragmatism, we must note that more expanded vision of the digital economy is provided in the government document "Ukraine 2030E is the country with the developed digital economy": digital economy is a type of economy, where the key factors and means of production are digital data (binary, information, etc.) and network transactions, as well as their use as a resource, which can significantly increase efficiency, productivity and value for products and services (Ukrayina, 2020). However, it is difficult to imagine economies without workers and digital competencies.

Analysis of legal and regulatory acts showed, that the world's leading developed countries in the context of technological and civilization challenges responded by adopting strategies for the development of information communities: Poland in 2013 (Długookresowa Strategia, 2013), Russia in 2017 (O Strategii, 2017), the European Union in 2015 began to implement a digital agenda, a kind of road map, but with strategic guidelines (Europejska agenda, 2017), Ukraine since 2019 (Ukrayina, 2020). It has happen since 2015.

The European Commission has launched the digital single market by promoting e-commerce, digitizing copyright protection, electronic privacy, harmonizing the digital rights of market participants and the state, harmonizing tax rules and cyber security (Komunikat, 2015).

The digital single market strategy will be based on three pillars:

better access for consumers and businesses to online goods and services across Europe. It requires that the most important differences between the virtual

and real worlds must be quickly removed in order to remove barriers to cross-border online activities;

creating the right conditions for the development of digital networks and services. It requires fast, secure and reliable content infrastructure and services, as well as the right legal conditions for innovation and investment, as well as fair competition and a level playing field;

maximizing the economic growth generated by the European digital economy. It requires the investment into ICT infrastructure and technology, such as cloud computing and large database sets, as well as research and innovation that will increase the competitiveness of industry, will improve utilities and expand the circle of people, who use digital economy and improve their skills (Komunikat, 2015).

Funding of the European Structural and Investment Funds in the amount of more than 21.4 billion Euros is only provided for the development of EU digital infrastructure and single market services, as well as for research and innovation startups (Komunikat, 2015).

Analysis of the development of the digital economy indicates the preconditions for its formation. It is believed that a number of factors contribute to the development of the digital economy. The first is determined by the abrupt growth of technical capabilities of information processing and transmission. According to the UN report on the development of the digital economy, the evolution of global Internet traffic from 2002 to 2022 has increased. It will continue to grow in 10 and 20 years, respectively, in 230 and 1507 times! In 2002 it will grow to 100 Gb / s. In 2007 it will grow to 2000 Gb / s. In 2012 it will grow to 46000 Gb / s, in 2022 it will grow to 150700 Gb (Digital economy report, 2019).

The intensive development of the economy platform is another factor in the development of the digital economy. The strength of the digital platform is reflected in the fact that seven of the top- eight world's companies use business models on the platform through market capitalization. Five companies were IT manufacturers, which were the top- five at market value in 2019. The total value of platform companies with market capitalization of more than 100 million US dollars was estimated at more than 7 trillion dollars in 2017, what is 67% higher than in 2015 (Digital economy report, 2019).

Digital platforms provide mechanisms for combining a set of counterparties to interact via the Internet. A distinction can be made between transaction platforms and innovation platforms. Transaction platforms are bilateral or multilateral markets with a network infrastructure that supports the

exchange between numbers of different agents. They have become the main business model for large digital technology corporations, such as Amazon, Alibaba, Facebook and eBay, as well as for those, who are developing digitally supported market segments (e.g. Uber, Didi, Chuxing, Airbnb). Innovative platforms create an environment for encoding and producing content by developing applications and software in the form of operating systems such as Android or Linux.

In our opinion, the beginning of the digital economy development is the result of more global processes than technical innovations, the development of the Internet and so on. In this sense, we agree with the opinion of Polish scientists that technological change is not a determinant of the digital economy ... in contrast to social, economic, cultural factors (Cyfrowa gospodarka, 2017). Indeed, the globalization of the economy, accompanied by the concentration of social communities, leads to the development of cities and the concentration of the population of countries around large cities, the share and importance of which will only increase. Thus, since 1950, the number of people living in cities has increased almost six fold, from 751 million to more than 4 billion people in 2018, which is more than half of the world's population. Over the next three decades, the cities are projected to grow another 2.5 billion people (The comprehensive smart environment, 2016). These processes form the demand for business and government for an effective system of management, control infrastructure development, provision of services and production of innovative products. So, we believe that this entropy is leading one in order to understand the development of infrastructure for metropolises and agglomerations: from transport and financial hubs, to the development of information technology, big data management for urban administration and other technologies, including the digital economy in response to the new system of population settlement.

The digital economy is operationally represented at all stages of the product reproduction cycle. It is essentially Industry 4.0, which makes the economic and technological basis of the fourth industrial revolution. Today digit law is an artificial intelligence, robotics, web money, industrial biology, processing of large data arrays Big Data, 3D industrial printing, unmanned vehicles, drones, block chain and crypto currencies, 4G communication, e-government and servicing of state and municipal government and administrative services ("Action" service), etc. In business management, modern digital technologies are mostly used to solve supply chain management problems to optimize and control the cycle of

procurement of raw materials, production of material goods and their further distribution, as well as enterprise resource planning and customer relationship management (OECD, 2017).

The digital or virtual economy is mostly represented in the Internet in the form of information and communication technologies. Network is a system of centralized management, where network benefits are endowed with four properties:

1. Complementary, compatibility, standardization.
2. Significant production scale of economy.

3. External network effects. B. Metcalfe's law indicates that the value of any network for the consumer is equivalent to the square of the number of connection nodes.

4. Effects of the trap: customers of network are caught by the terms of contracts and agreements; network operating conditions; the effects of loss of loyalty when the customer loses the preferences that the consumer had in the network (Osnoy, 2018).

It is must be noted that in scientific research it is important to distinguish the concept of digital economy, which in fact remains complementary, terminologically. In this sense, the position of American scientists, who distinguish the following components of the digital economy, is clear:

- a) the main digital sector,
- b) digital economy,
- c) digitalization of the economy (Digital economy report, 2019).

Another position is held by Head of Ukraine Innovative Development Association, who identifies two components of digitalization. They are digital economy and the IT sector (Ukrayina perexodyt, 2018).

Guided by this approach, we would like to define the peculiarities of the functioning of the digital economy from a theoretical point of view.

1. The main means of production as a set of objects and means of labor, which are used by people in the production of material goods and service, are divided into tools and objects of labor.

Tools are a thing or a set of things that a person acts over labor objects in order to transform them according to their needs. Hence, in the digital economy they are earns of information processing and operations with it via a computer and its software, means of connections and communications such as mobile devices, the Internet as a virtual network of information space. In contrast to the material economy, where the main resource of wealth is land, these functions are performed by the Internet in the information economy.

Comparative analysis allows us to establish certain semantic parallels. Land is known to perform three functions: a place for cultivation (agriculture), a place for extraction (mining), a place for location (location of productive forces). The Internet also shows its purpose as a place for activity. Services are created and goods are designed there. In this case there is a process of writing a scientific product. The location feature exponentially grows as a platform for running your own business. The quarantine, caused by the spread of COVID-19, confirms a similar conclusion, when a number of service organizations are mostly switched to the platform of Internet representation and activities. Finally, the parallels with the place of extraction are obvious. Users of the platforms and the general public use a huge amount of information to ensure the activities. They are involved in its "drawing" on a paid or free basis. The literature represents quite different opinion: the Internet has the properties of communication as a source of communication, media as a source of information and production as a basis for business (Kudryavceva & Kolos, 2005; Shmygol, 2021; Pulina, 2021).

2. Labor objects are the objects, which a person influences in the process of labor. They are the objects, which are given by nature, or they have undergone primary processing. They are positioned as raw materials. In the digital economy, the main object of labor is the intangible form of the product – information, data, databases and data banks. In the digital economy, the main object of labor is the intangible form of the product such as information, data, databases and data banks.

3. Man as a basic element not only of the economy but also of society in terms of digital transformation also acquires specificity. Modern research indicates the dynamic processes of social reproduction: the growing tendency of the weight of human capital in relation to physical capital in the overall structure of total capital (tabl.1).

Table 1: Structural changes in total capital in Western countries, % of the total.

Total capital	1800 year	1860 year	1913 year	1950 year	1973 year	1990 year	2020 year
Physical capital	78-80	77-79	67-69	52-53	43-44	31-33	19-20
Human capital	20-22	21-23	31-33	47-48	56-57	67-69	80-81

Compiled by the authors based on (ShchetinV, 2001)

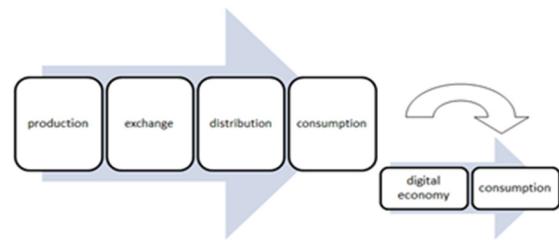
Data analysis of table 1 represents the prerequisites for creating a new model of economic development. Its basis is formed on ethical norms and environmental standards by directing investments in renewable natural capital, including per person and reducing the non-renewable flow of natural resources.

If Adam Smith spoke of the economic man, then in the economy of numbers the main productive force is the "digital man". At this stage of scientific development and technology, a "digital person" is qualified personnel, who have digital competencies such as knowledge, skills and abilities to use them in specific production or management situations to solve specific problems. The content of professional competencies of the "digital man" correlates the factors and product of knowledge in economy.

4. The production process is considered through the prism of the reproduction process. In this case, it does not matter about the narrowed, simple or extended reproduction it will be discussed, because it is the prerogative of the study of quantitative parameters and values. Although the scientific and civic competencies and views of the authors of the article are close to those researchers, who are considered questionable and even harmful economic policies, aimed at ever-increasing rates of social production. It does not lead humanity and dwellers to individual quality of life, happiness index and so on.

The digital economy is operationally represented at all stages of the product reproduction cycle; it is essentially Industry 4.0, which is the economic and technological basis of the fourth industrial revolution. Digital today is artificial intelligence, robotics, electronic money, industrial biology, processing of large data arrays Big Data, 3D industrial printing, unmanned vehicles, drones, block chain and crypto currencies, 4G communication, e-government and servicing of state and municipal government and administrative services ("Action" service), etc. In a reproductive perspective, the most appropriate is the interpretation of the digital economy as "activities for the creation, dissemination and use of digital technologies and related products and services", presented by scientists from the Higher School of Economics in Moscow (Gokhberg, 2019). It is here that the digital platform, as can be seen from (Fig. 1), allows reducing the traditional reproduction process from the model: production – exchange – distribution – consumption (PECD) to the model production: digital economy – consumption (PDC).

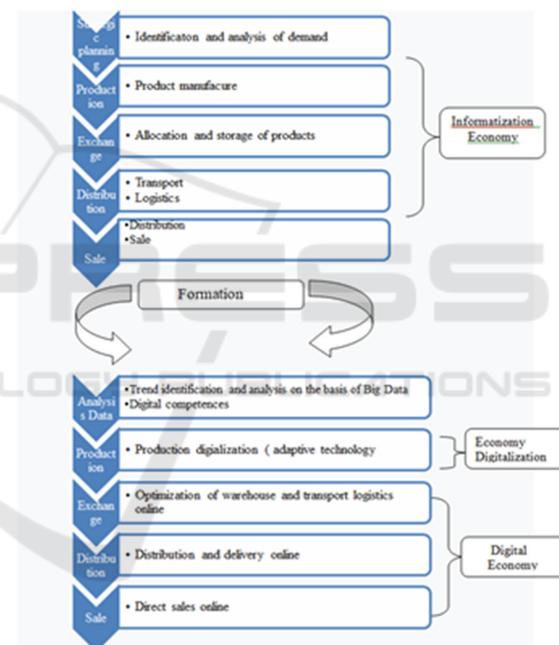
In our opinion, the transformation of the traditional economy into a digital one, based on the theory of the reproduction process, can be represented graphically (Fig. 2).



Source: DLF Attorneys-at-law, 2021

Figure 1: Changing the economic model of reproduction.

In the reproductive phase of the digital economy, the stage of production is not only the use of information technology, software products at the stage of design, construction, but also the intellectualization of the product, tangible know-how, design, but also the production process.



Compiled by the authors

Figure 2: Transformation of reproduction process in digital economy.

It is manifested in technological innovations of 3D, 4D, 5D-technologies of manufacturing materials, semi-finished products, parts, assemblies, etc. The formed new values indicate for evolutionary and favorable for the economy cycle to the producer: benefits of saving resources; ease of scaling; reduction of Time2market; expansion of the sales network. It is believed that during and after the economic crisis determined by the global COVID-19 pandemic, the transformation of all sectors and markets, in particular in the form of digitization, can

contribute to the production of higher quality goods and services at reduced costs.

The exchange and distribution phase is related to the distribution and logistics relationships and connections of market agents.

That is, the digital economy is characterized by the movement of market processes of exchange and distribution of the product to the network space. That is, the digital economy is characterized by the movement of market processes of exchange and distribution of the product to the network space. This creates a new configuration of the economic space and the market as a whole.

Such a pattern of economic relations is not artificially created, as it may seem at first glance. The benefits are also obvious for business intermediaries. They are the following: speed of transactions, resource savings, improving the efficiency of logistics operations. The digital economy allows greater control over the creation of value chains in different business models on a digital platform.

The components of the operational process of the digital economy are technological and information blocks: IoT Monitor – Marketer – OBL (Omni bulk messaging). IoT and M2M connections around the world provide full visibility, event management and control from the network to end devices, with priority security. Omni bulk messaging is Omni channel marketing technology. Omni messaging platform is for business network. Different operators provide different mobile communication channels to really connect and communicate with the target audience, as well as effectively reach potential customers.

The stage of consumption to a lesser extent, but associated with the paradigm of the digital economy. The consumer saves time on the choice and purchase of goods and services, has a more balanced choice of consumer solutions, determined by information support, and so on. In addition, the digital economy is creating new jobs in digital services, especially for high-skilled professionals, as well as new forms of digital activity for smaller skilled workers. In business management, modern digital technologies are mostly used to solve supply chain management problems in order to optimize and control the cycle of raw material procurement, production of goods and their further distribution, as well as to plan enterprise resources and customer relationship management.

5. Property relations. In an industrial economy, the relationship of ownership (possession, appropriation and disposal) of means of production is associated with the object of ownership for a specific material object: land, real estate, etc. In the digital economy, there is a theoretical construct that characterizes the new relationships between right to property and property. To conduct and control business means of production in the classical sense in

such a system of relations are superfluous. Instead, ownership of a brand, trade mark, business creates and sells conditions for other businesses. The sale or use of which by a business or individual is a profitable part of a digital business. For example, Uber corporation does not have its own cars to provide passenger and freight services. Didi does not have its own retail space to sell goods and services to customers. Chuxing does not have self-service in automotive technology, based on artificial intelligence. Airbnb does not have its own hotel fund to provide accommodation services.

The digitalization of the economy is characterized by the impact of information and communication technologies on other sectors of the economy in comparison with the digital economy, which directly creates added value in production, logical, distribution and sales chains. In this case, digitalism plays the role of locomotive for accelerating economic growth (Table 2).

Table 2: Average annual values of additional contribution of growth factors to the value added of sectors of the economy as a result of digitalization for the period from 2019 to 2030.

Sector of the economy	Annual average cost of fixed asset (OPF) %	Capital contribution, %	Labor contribution, %	Total, %
Financial sector	0,92	1,20	0,93	3,04
Transport	1,29	1,20	0,55	3,03
Construction	0,98	1,02	0,88	2,88
Education	1,00	1,20	0,57	2,77
Chemical industry	1,64	1,40	-0,43	2,61
Engineering	1,52	1,48	-0,46	2,54
Other services	0,93	0,79	0,24	1,95
Health care	0,81	0,58	0,25	1,65
Light industry	1,02	0,96	-0,65	1,32
Power Industry	0,32	0,83	0,04	1,19
Trade	0,60	0,36	0,04	1,00
Agricultural Complex	0,78	0,69	-0,56	0,91
Public Administration	0,58	0,24	-0,40	0,41
Timber industry complex	0,31	0,14	-0,53	-0,08
Metallurgy	0,25	0,10	-0,55	-0,21
Mining industry	0,08	0,04	-0,46	-0,35

Compiled by the authors based on (L. M. Gokhberg, 2019)

Data analysis on the average annual values of the contribution of growth factors to the added value of sectors of the economy as a result of digitalization for the period from 2019 to 2030 (Tab. 2), performed by Russian scientists at the Higher School of Economics, confirms the trend of the global economy about the accelerated growth of digitalization in science and education, the financial and banking sector, transport and construction, as well as in the service sector. In the forecast period, digitalization will provide from 3.04 to 2.77% growth in value added in these sectors. Thus, the digitalization of the economy becomes a structural factor in economic growth.

It should be fairly added that the digital economy is not a panacea for solving social problems. At the Thieß Petersen and Falk Steiner, the effects of progressive digitization in the labor market are contradictory, as digital technological progress has both the destruction of jobs and job creation. However, in the short run in 10-15 years significant net job losses are unlikely happen to be in contrast to the long run in 2040/50, when the effects of job cuts may outweigh the pace of job creation (Thieß Petersen, 2019). At the same time, 375 million workers, what covers about 14% of the global workforce, will be forced to change their profession from 2019 to 2030 (McKinsey, 2017). The digital economy provides more opportunities to test the economic security of counterparties for corporate manufacturers and agents in general.

The analysis of the roadmap adopted by the Government of Ukraine for the implementation of the strategy for the development of the digital economy, despite its pioneering and positive content, indicates the lack of tools to achieve specific goals for the development of digital economics. According to domestic experts, the share of the digital economy in Ukraine fluctuates within 3-4% of GDP, and by 2025 may double. Weak nature of the development of the components of the digital economy is confirmed by the results of foreign studies. Thus, according to the Networked Readiness Index, it is an indicator that characterizes the level of development of information and communication technologies in 139 countries, Ukraine ranked 64th in 2016. So we are not enlisted to the world map of the digital economy.

A number of scientists, based on the research of foreign research centers and scientists, state the state of factor support for the development of the digital economy in Ukraine as weak, at the initial stage. Thus, the weaknesses of the development of domestic digital economics are: low protection of intellectual property rights, underdeveloped banking and financial services, high investment risks, small

number of mobile broadband subscribers, inefficient cyber security, advanced software piracy, insufficient funding for technological development, low digital consumer competences. Instead, the pros are: positive dynamics of investment in telecommunications, revitalization in the IT business sector, the speed of Internet connections, e-democracy, the use of big data and the quality of education (Xaustov, 2019). According to these indicators, Ukraine is on the sixtieth position among 139 countries studied, which refers it to marginal digital countries.

Indeed, Ukraine still has an underdeveloped infrastructure of information markets, the Internet, network communication channels, low technological education of consumers and a general syndrome of "outdated technologies". But the situation of low adaptability to information change is not unique to the domestic economy: according to a study by ESG commissioned by Dell EMC, 95% of large companies do not meet the requirements of the new digital business. However, 96% of those companies, which have transformed into digital standards, have almost doubled their revenue earnings next year (ESG, 2017). It's a clear illustration of the effectiveness of change management at the corporate level.

The policy of catching up provides for a planned increase in the share of Ukraine's digital economy in total GDP from 3% in 2021 to 65% in 2030 (Ukrayina, 2020). The declarative nature of the forecasts is evidenced by the fact that the program document "Ukraine 2030E - a country with a developed digital economy" does not contain specific financial, tax, customs, banking instruments to influence business (supply) or citizens (demand) that would stimulate development, implementation, production of technologies of SMART-economy, increase of digital competences at citizens and their capitalization which could and should provide achievement of ambitious purposes on the way of digitalization of domestic economy as a competitive model of development in modern types.

4 CONCLUSIONS

According to the results of the study, it can be generalized that the digital economy in the reproductive sense is a constantly recurring activity for the creation, exchange, distribution and use of digital technologies and complementary with goods and services aimed at efficiency and greening of social production. The peculiarity of the reproduction process under the conditions of digitalization is its transformation from the traditional model

"production – exchange – distribution – consumption (PEDC)" to the production model "digital economy – consumption (DEC)".

In terms of digitalization, Ukraine is among 139 surveyed countries, what makes it marginal. Thus, the infrastructure of information markets, the Internet, network communication channels remains underdeveloped in Ukraine, low technological education of consumers and the general syndrome of "outdated technologies" are noted. To intensify the development of the digital economy, it is necessary to develop specific financial, tax, customs, banking instruments to influence business (supply) and citizens (demand), which would accelerate the development, implementation, production of SMART-economy technologies, and increase and capitalize digital competencies.

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