Features of the Assessment of State and a Prospective for the Development of the Digital Economy

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ABSTRACT

In the digital economy, the requirements of business, society and the state for the data provided by official statistics are increasing. The purpose of this study is to determine the features of statistical research in the digital economy and form, on this basis, criteria for assessing the level of development of the digital economy.

There is a need for a statistical measurement of the development of the digital economy, while international standards in this area have not yet been formed. To solve this problem, it is necessary to develop a methodology for statistical observation, including for new processes and phenomena; optimize the collection and processing of primary data; to provide new forms of information presentation and the possibility of its flexible use by all interested users. The construction of an integrated system of statistical observations involves the full use of alternative data sources.

To identify patterns, assess the scale and dynamics of the development of the digital economy, a systematic approach to statistics is required, which involves the development of a conceptual apparatus, the formation of a local classification and a system of statistical indicators, a statistical observation program and data collection tools. The work proposes a number of promising areas of statistical measurement of the digital economy, on the basis of which it is necessary to develop a set of corresponding e-criteria. To increase the reliability, accuracy and reliability of data, it is advisable to combine them from various sources and ensure that users are provided with appropriate information in accordance with their quality requirements.

Keywords: Digital economy, statistics, measurement, e-criterion, digital technologies.

1. INTRODUCTION

Today, it is important to assess how the events of 2020 will change the tactics and strategy of digital transformation, and how they will affect the modernization of information and communication technology (ICT) infrastructure. Digital transformation is one of the main business priorities in Ukraine. Most of these companies turned out to be in medicine and pharmaceuticals, fuel and energy complex, transport and logistics. In production, analytics are being introduced with the aim of predictive maintenance of equipment, digital twins in railway logistics to optimize the transportation process, as well as machine vision systems and unmanned aerial vehicles for monitoring production and conducting technical inspections. All this helps the company to reduce costs and reduce industrial safety risks.

Digital transformation is the transformation of the economy through the revision of business strategy, models, operations, products, marketing approach, goals, etc., through the adoption of digital technologies. Its main purpose is to accelerate economic development. The digital transformation trend started a couple of years ago. Strategies were developed, new positions were introduced, but

not everyone clearly understood the essence of the digital economy. The pandemic gave a powerful impetus to digitalization and transformation of the economy, from a fashionable strategy it is turning into a survival tactic. Self-isolation forced enterprises to switch to a remote work format and quickly develop channels and services for building an online business. Where information technologies have already been introduced, processes have been digitized and online services have been implemented, the transition to work in the new environment was painless. A prediction that predicts the disappearance of about 40% of existing companies as a result of the digital revolution looks plausible.

The digital economy is currently undergoing a phase of active growth. Thus, the production of goods and services in the ICT sector in 2017 reached 15.5% of world GDP, and employment in this sector amounted to 100 million workers. Exports of ICT services in the sector increased in the period 2010–2015. by 40%. The global value of e-commerce is estimated by UNCTAD to have reached $ 29.4 trillion in 2017, which is equivalent to 36% of GDP [1].

In the budget of Ukraine for 2021, expenditures on digitalization reach almost 1.8 billion UAH or 0.1% of the total budget expenditures of the entire state. Meanwhile, European cities annually spend about 10-15% of their budget

on local initiatives. But compared to the spending on digitalization in the state budget for 2020, the budget for further digital development that Ukraine has received is unprecedented.

However, there are many unsolved problems in this area. Thus, despite the increase in the number of Internet users in the world by 60%, more than half of the world's population still lacks access to these services. At the same time, the number of Internet users, as an indicator of the degree of penetration of DE technologies into everyday life, cannot be interpreted as an unconditional indicator of social progress.

2. LITERATURE REVIEW

The problem of digitalization of the economy, the challenges facing business, the state and society in this regard, the challenges posed by the digital economy, and the opportunities it provides are the object of intensive reflection among specialists. The issues of interconnection of the digital economy from the standpoint of radical innovations of the 4th industrial revolution are actively discussed [2], [3], the formation of which was prepared by the development of mobile business [4]. Researchers pay attention to such important topics as the socio-economic consequences of the digitalization of the economy [5], [6]. The problem of processing large databases, which is the subject of active discussion among scientists, officials and businessmen [7]. However, the issues of assessing the level of digitalization of the economy as an indicator of the competitiveness of individual countries have not been sufficiently resolved and need further study.

Digitalization of various aspects of the functioning of the economy and human life entails the transformation of both- nature itself and the amount of data on socio-economic phenomena. The demand for statistical data is changing and at the same time new opportunities arise due to the development of digital communications and the emergence of large data sets suitable for statistical processing and analysis. In addition, there is a need to statistically measure the development of the digital economy, while international standards in this area have not yet emerged.

The purpose of this study is to determine the features of statistical research in the digital economy and form, on this basis, criteria for assessing the level of development of the digital economy.

3. STATISTICAL ASSESSMENT IN THE DIGITAL ECONOMY

The basis of any digitalization is a modern ICT infrastructure. The Internet makes it possible to continue to work, play sports, provide oneself with food and other essential goods, communicate and relax. The current situation in the economy has shaped new experiences and increased the penetration of digitalization in the lives of users. And "load testing" of IT models and systems revealed bottlenecks and clarified development priorities. Its main areas of development are cloud computing, digital workflow, and IT infrastructure security. It is the cloud model that provides a high degree of adaptability, which is important not only for efficient operation, but also for the survival of companies in the current environment. In general, as the experience of companies with a developed digital ecosystem shows, it is cloud technologies that underlie the rapid and successful implementation of innovations. They allow you to quickly launch new projects and scale existing ones. At the same time, the growing activity of the business in the implementation of digital projects is an important driver of the growth of the cloud services market.

According to representatives of the largest cloud providers [8], in the first half of 2020, the growth in demand for cloud services from the overwhelming number of segments of the economy continued. At the same time, due to the prevailing circumstances, first of all, the demand increased for solutions that allow:

- Organize remote work of employees;
- Build effective methods of personnel communication;
- Organize storage of a large number of documents, archives, databases;
- Implement fast provisioning of computing resources on demand.

The pandemic has demonstrated the bottlenecks of the IT infrastructure, its pain points. Companies will identify them and will develop services and infrastructure accordingly. IT infrastructure becomes critical for almost any business, and you need to think through all of its elements and servers, networks, end device performance. At the same time, the distributed edge infrastructure, supercomputers and blockchain turned out to be irrelevant for the respondents at this stage.

In the digital economy, the requirements of business, society and the state for the data provided by official statistics are increasing. To answer this request, it is necessary to develop a methodology of statistical observation, including for new processes and phenomena; optimize the collection and processing of primary data; to provide new forms of information presentation and the possibility of its flexible use by all interested users. The National Statistical Service should become a single methodological center for working with data, providing all interested users with up-to-date, methodologically reliable statistical information.

Already today, one of the serious problems of statistical observation is the discrepancy between the rules for collecting and processing statistical information with real

phenomena and processes taking place in the economy. The fact that the accounting of the parameters and results of economic activities of economic entities is carried out by state statistics bodies at the place of registration of a legal entity, and not at the place of actual implementation of economic activities, makes the information obtained unsuitable for statistical analysis of managerial decision-making. With the development of digital technologies and their more and more widespread implementation in all spheres of life, the share of the "virtual" sector of the economy will steadily grow - this refers to banking, legal services, insurance, accounting, management, consulting and audit, IT business, metrological support, healthcare and more. Taking into account the development of "cloud" technologies, accounting for the place of provision of "virtual" services is a rather difficult task even from a technical point of view. Avalanche development of the "virtual" economy sector. Big data observation should be the main form of statistical observation.

The organizational scheme for the collection and processing of statistical data should satisfy multidirectional requirements. On the one hand, data collection is designed to ensure that it temporarily receives information about current processes in full, on the other hand, it is important to minimize the burden on respondents. The simultaneous satisfaction of these requirements inevitably leads to the need to integrate data obtained from various sources and to form object-by-object time series. In this regard, it is necessary to more actively use data arrays generated in state information systems, including within the framework of administrative reporting, various registers and registers.

The construction of an integrated system of statistical observations presupposes the full-scale use of alternative data sources - big data. At the same time, at present, overestimated expectations have been formed regarding the possibility of using this data source in order to form state statistics. In the wake of the excitement that has arisen, there are calls to replace the traditional methods of collecting statistical information with the analysis of big data, which, in the absence of a single methodological framework, can lead to the formation of a distorted view of reality and incomparability of data. So, in Ukraine in 2019, an attempt was made to estimate the number of the country's population using big data technologies. The results obtained were controversial. The state did not dare to use them for making managerial decisions in the social and economic spheres. The problem of conducting a classical population census in Ukraine is still relevant.

The integration of big data into statistics should be based on a unified system of definitions and classifications, harmonized with the internationally recognized methodology of statistical observations. The formation of the digital economy is associated with the emergence of new phenomena, caused, in particular, by the replacement of traditional - "analog" - digital processes.

To identify patterns, assess the scale and dynamics of the development of the digital economy, a systematic approach to statistics is required. To do this, it is necessary to form a conceptual apparatus, develop local classifications and a system of statistical indicators, a statistical observation program and data collection tools (Figure 1). Priority should be given to the quality of the classifications, as this will ultimately determine the quality of statistical information and the possibility of its analysis in various aspects. In particular, an adequate classification of digital technologies is required, excluding duplication and overlap.
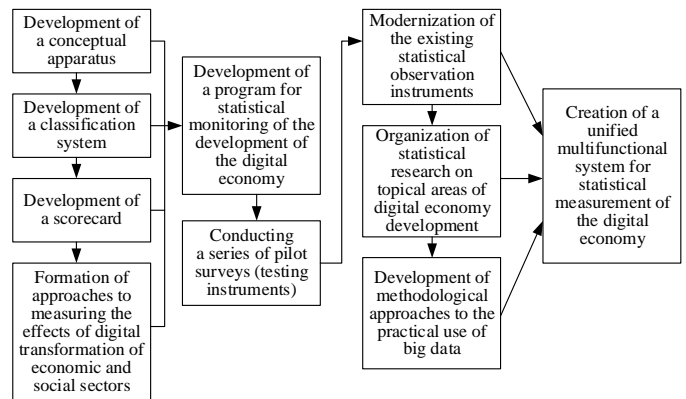

Figure 1 Statistical assessment system in the digital economy

Official statistics must respond quickly to new challenges by providing evidence-based answers to questions such as:

- Implementation and demand for digital technologies;
- Availability and demand for products and services related to digital technologies;
- The dynamism of the development of the digital economy and its contribution to economic growth and the well-being of society;
- The impact of digital technologies on the efficiency of doing business, employment, labor productivity and other socio-economic parameters;
- The effectiveness of the state in the digital economy, including the impact of digital technologies on the quality of public services provided, relations between the state, society and business;
- Assessment of the effectiveness of budgetary expenditures on the implementation of state policy measures in the field of the digital economy;
- Assessment of the advantages and constraints on the competitiveness of countries in the global digital world.

4. OVERVIEW OF DIGITAL ECONOMY IN-DICES

A separate issue is the statistical assessment of the digital economy itself, its impact on macro- and microeconomics. To increase the reliability, accuracy and reliability of data, it is advisable to combine them from various sources and ensure that users are provided with appropriate information in accordance with their quality requirements. To this end, it is necessary to coordinate the efforts of various actors involved in solving this problem.

There are more than twenty international e-indices in the world, but the most used are: International Digital Economy and Society (I-DESI), ICT Development Index (IDI), Digital Opportunity Index (DOI), Digital Access Index (DAI), Information Society Index (ISI). A number of consulting companies have already formed approaches to the statistical assessment of the development of the digital economy. economy and social sphere

The DESI index is used as a tool for assessing the state of digitalization in the countries of the world, which takes into account 5 main groups of indicators: telecommunications, human capital, the use of the Internet, the integration of digital technologies, and digital public services. The International Digital Economy and Society Index (I-DESI) extends DESI using a dataset of 24 indicators. It is calculated for 45 countries of the world.

Along with this index, there is an index of development of information and communication technologies IDI. It is an integrated indicator comprising 11 indicators characterizing access to ICT, the use of ICT and practical ICT skills. Composite e-indices based on sets of ICT indicators are used as an integrated characteristic of the level of development of the digital society or its structural elements. At the same time, the set of indicators and the method of constructing the index largely depend on the selected priorities.

The growth rate of the digital transformation can be estimated using the BDI index. The Baltic Dry Index (BDI) integrates five private indexes:

- Channels of transmission and storage of information - use of cloud technologies, corporate mail, messengers, automation systems;
- Integration of digital technologies - the level of implementation in the company of such technologies as artificial intelligence, Internet of Things, 3D printing, use of online documents, electronic document management;
- Use of Internet tools to promote and develop the company;

- Information security - introduction of culture of protection of digital information, use of specialized anti-virus programs;
- Human capital - involvement of management in self-development and development of personnel in the field of digital technologies.

The development of digital culture in the business processes of companies takes time and therefore, despite the growth of the index of digitalization of business, a value of 50 points indicates that the business is only half ready for the figure. At the same time, only 11% of companies have a high level of digitalization. Among medium-sized companies, the share reaches 20%, among individual entrepreneurs - 10%, among micro and small enterprises - 12-1%. [9].

In our opinion, the most rational approach seems to be the approach based on the use of comparative analysis for a set of existing indicator models, determination according to the chosen criterion and its refinement in order to take into account the peculiarities of the development of the digital economy in Ukraine.

Comparative data on the level of digitalization of the economy and society as a whole in various countries, which are contained, in particular, in the Rating of Global Digital Competitiveness, are also of interest. The comparative assessment of countries in this ranking is based on their ability to perceive and effectively use digital technologies as a means of transforming regulatory practices, business models and society as a whole. This assessment is based on three complex factors that have received the following generalized names: knowledge, technological environment, openness to the future.

Each of these factors is further broken down into three sub-factors, which, in turn, are detailed using six indicators. The knowledge factor is understood as a system of knowledge that is necessary for understanding and creating new technologies and which are subdivided into the following three sub-factors: talent, education and retraining, scientific concentration. The technology environment factor is subdivided as sub-factors into regulatory framework conditions, capital and technological framework conditions. Openness to the future is detailed through the subfactors of adaptive capacity, business agility and IT integration.

According to this rating, the top ten countries in terms of digitalization in 2019 included the following (from first to tenth places, respectively): USA, Singapore, Germany, Sweden, Hong Kong (SAR), Switzerland, Netherlands, Korea, Norway and Finland. As for Ukraine, according to this rating, it took 58th place out of 63; for comparison, Poland - 32, Russia - 43 [1].

The position of Ukraine is characterized by instability, not showing a positive progressive trend (see Table 1). A

positive point is the situation with respect to individual assessment elements: Digital / Technological skills (27 place), Total public expenditure on education (11), Pupil-teacher ratio (11), Graduates in Sciences (28), R&D productivity by publication (21) and Investment in Telecommunications (7).

Table 1 Dynamics of the level of digitalization in Ukraine, assessed on the basis of a set of key indicators [10]

	2016	2017	2018	2019	2020
Overall rating	59	60	58	60	58
Knowledge	44	45	39	40	38
Technology	60	62	61	61	59
Future Readiness	61	61	61	62	61

The worst situation is with the Technology criterion, which is explained by Ukraine's lag in terms of Scientific research legislation (61 place), Intellectual property rights (61), Mobile Broadband subscribers (63) and Wireless broadband (62). This information should be used in the development of the state digitalization program [10].

5. CRITERIA FOR STATISTICAL ASSESSMENT OF THE DIGITAL ECONOMY

However, in the process of forming indicators for assessing the level of development of the digital economy. It is necessary to take into account the main technological trends, the development of which made it possible to maintain the sustainable functioning of society in conditions of quarantine and forced isolation during a pandemic and may have a longer-term impact on the global economy after the end of COVID-19. Let's consider the main technological trends of the DE.

1. Online trading and robotic delivery. COVID-19 has transformed online selling from an added value to an absolute necessity for businesses around the world. Online sales must be supported by a reliable logistics system. At the same time, courier delivery is not safe from the point of view of the threat of virus transmission. Therefore, many companies have launched contactless delivery services, in which the transfer of an order is not carried out from hand to hand, but in a specific location, without direct contact between people. Chinese e-commerce companies are stepping up the development of robotic delivery systems.

2. Electronic and contactless payments. In a pandemic, electronic payments, both with bank cards and with electronic wallets, are the recommended payment methods to prevent the spread of the virus. Electronic payments allow you to make online purchases, pay for goods, services, utilities, and even issue tax deductions. Direct access to electronic payments depends on the coverage area of the Internet and the availability of the necessary devices for clearing money.

3. Remote work. Remote work requires technologies such as VPN, VoIP, virtual conferencing, cloud computing, collaboration tools, and even facial recognition technologies to use virtual backgrounds to protect home privacy. At the same time, remote work saves time spent on the road and provides more flexibility for the employee's work schedule. At the same time, teleworking can create additional difficulties for both employers and employees. Information security, privacy protection, and timely technical support can be challenging. Conflicts related to labor legislation can be aggravated: ensuring the safety of the workplace or issues of taxation of employees. There may be psychological problems associated with loneliness of workers, lack of balance between work and private life. More psychological research is needed to understand the impact of teleworking on people.

4. Distance learning. By mid-April 2020, 191 countries announced the suspension of school and university education, affecting a total of at least 1.57 billion students [11]. Many educational institutions began to conduct online training in order to avoid disruption of educational processes by quarantine measures. The technologies involved in online learning are similar to those used in telecommuting, and also include virtual reality, augmented reality, 3D printing, and the use of AI robots as teachers.

5. Telemedicine can be an effective way to prevent the growth of morbidity, while fully maintaining the primary care processes. Wearable personal IoT devices can track vital signs. Chatbots can make initial diagnoses based on the symptoms provided by the patient. However, its implementation requires a certain level of technical literacy as well as a stable internet connection. The regulations governing the medical field do not provide for the possibilities and specifics of telemedicine.

6. Online entertainment: Cloud raves and online concert broadcasts, online movies, museums and cultural heritage sites offer virtual tours. Since the start of the epidemic, online video game traffic has skyrocketed.

7. International Supply Chains - Big Data, Cloud Computing, IoT and Blockchain are creating a more sustainable supply chain management system by improving data accuracy and stimulating data exchange.

8. Robotics and drones. The pandemic has made the world realize how much we depend on human interactions in all

processes. Businesses most affected by labor-intensive processes such as retail, food processing, industry and logistics. All this was the impetus for more active use of robots and research in the field of robotics. In recent months, robots have been used in all sorts of processes, from disinfecting surfaces to delivering food to people in quarantine. Drones have also been used for dog walking and delivering goods.

6. CONCLUSIONS

All of the above technological trends are based on stable, high-speed and affordable Internet. Addressing issues in ensuring universal access to the Internet will continue to be a challenge. Thus, the criterion of the country's readiness for digitalization should also be statistically assessed.

In our opinion, among the promising areas of statistical measurement of the digital economy, the following criteria should be taken into account:

- Costs for the development of the digital economy;
- Creation and dissemination of digital technologies, including research and development in the field of digital technologies;
- Protection of intellectual property rights and transfer of digital technologies;
- Innovations related to digital technologies;
- Digital engineering;
- Human capital and labor market, including the acquisition and development of digital skills; employment, including such new forms of it as distance and platform employment;
- The use of digital technologies in sectors of the economy and the social sphere (in education, healthcare, social services for the population);
- State and municipal administration;
- Production of digital content (digital products and services: images, video, audio, texts, games, etc.);
- Electronic commerce;
- Foreign trade in digital technologies and related goods and services;
- Trust in the digital environment (cyber security, personal data protection);
- Digital equality and inclusion of socially unprotected (vulnerable) groups of the population (with disabilities, living in remote areas, pensioners, etc.);
- Creation of a single information space for all business entities and management entities.

However, the current practice of statistical observations in Ukraine is limited to the field of ICT and the development of the information society, providing for the measurement of parameters for the development of the ICT sector and the IT industry, employment and training,

information infrastructure, the use of ICT tools in organizations and the population, the spread of certain types of digital technologies in enterprises. The composition of the currently available statistical information only partially characterizes the development of the digital economy. The development of the methodology for assessing the digital dynamics in the country can form the basis for the development of an integral indicator of the development of digital dynamics in the country. And here there is a big problem of how to combine indicators with a functional statistical system.

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