Digital economy: essence, approaches, elements, transformation

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Abstract
In the scientific sense, the "Digital Economy" means different areas and types of activities and, thus, different criteria are embedded in this concept. Many approaches to the definition of "Digital Economy" combine a number of distinctive features: self-management of production processes; communication between machinery; close connection of production processes with the use of the latest information and communication technology; the use of computer programs for the preparation and adoption of management decisions; apparent horizontal and vertical communications between various processes. Signs of the digital economy include: the role of social networks in formation of consumers' opinions about a product (service), the emergence of new technologies that allow the use of collective intelligence, the collaborative consumption of material goods, doing business without warehouses and stocks, based on demand, the use of new licenses for the right to intellectual property, etc. The approach to the digital economy as a set of new opportunities and prospects for the innovative development of various areas based on the active use of information technologies in order to increase the economic efficiency of activities and business capitalization was substantiated. The research methodology is based on the use of both qualitative (comparative, content analysis, analogue and generalization methods) and quantitative scientific methods (the method for determining the integral indicator). The official data of the National Statistical Committee of the Republic of Belarus was the information base for the study.

Keywords: digital economy, production processes, communication technology, connection, computer programs, information technologies, innovative development.

Introduction
At the present stage, the development of the digital economy in the Republic of Belarus is carried out in accordance with the regulatory documents: The Strategy for the Development of Informatization in the Republic of Belarus for 2016-2022; Decree of the President of the Republic of Belarus No. 8 as of December 21, 2017 "On the development of the digital economy", the State Program for the Development of the Digital Economy and the Information-oriented Society for 2016-2020, which create conditions for the transformation of the fields of human activity under the influence of computer information technologies, including the formation of the digital economy, the development of the information-oriented society and the improvement of e-government.

The goal of the State Program for the Development of the Digital Economy and the Information-oriented Society for 2016-2020 is the improvement of conditions contributing to the transformation of the fields of human activity under the influence of computer information technologies, including the formation of the digital economy, the development of the information-oriented society and the improvement of e-government.

There is a High Technology Park in the Republic of Belarus. In the context of digital transformation, this High Technology Park is a driver of economic growth and exports and it was created with the aim of creating favorable conditions for the development of software, information and
communication technologies aimed at increasing the competitiveness of the national economy.

At the present stage, the development of the economy in the Republic of Belarus is largely based on the processes of digital transformation, for which a methodological approach is distinguished with substantiation of the stages and areas: why, what and how it should be transformed?

Analysis and generalization of scientific literature confirms the relevance of various aspects of the problem of the digital economy development. Scientists are strongly focused on the formation of evolutionary views on the conceptual construct, the study of current trends, the assessment and identification of promising areas for the digital economy development. At the same time, the versatility, multidimensionality and controversial nature of individual approaches on this topic necessitates further scientific research.

Material and methods

In the scientific sense, the "Digital Economy" means different areas and types of activities and, thus, different criteria are embedded in this concept.

The performed review showed that there are many different approaches for defining the “digital economy” category in the economic literature: classical – an economy based on digital technologies and at the same time characterizing the field of electronic goods and services (Lapidus, L. V., 2019); systemic – a set of economic activities based on the use of digital technologies, and characterized by the active introduction and use of digital technologies for storing, processing and transmitting information in all fields of human activity; (Vasilenko, N. V., 2017); institutional – a system of institutional categories, which are based on advanced scientific technologies and achievements, primarily in the form of digital and information and communication technologies, aimed at increasing the efficiency of social production in order to improve the population living standards (Gasanov, T.A., 2017) and communication, a new institutional environment of economic activity, which is carried out through the Internet (Kaluzhskiy, M.L., 2014); resource-oriented – a part of the total production volume obtained using the digital production resources (Knickrehm, M., 2016) and the dominant role of information and knowledge as predetermining resources in the field of goods and services (Kuntsman, A.A., 2016); gnosiological – a single complex problem of finding a model of relations between individuals, which meets the requirements of the fourth industrial revolution (Bondarenko, V.M., 2017); transformational – implies the creation of new goods and services by way of the transformation of human mental activity into a production environment (Latysheva, A.I., 2018); social and economic – a complex of economic relations based on digital technologies in the process of manufacturing, distribution, exchange and consumption of products and services (Knyazeva, E.G., 2018) and a set of relations developing in the process of production, distribution, exchange and consumption, based on online technologies and aimed to meet the needs for the benefits of life, which, in turn, presupposes the formation of new ways and methods of economic management and requires effective instruments of state regulation (Lapidus, L. V., 2019); reproduction – a part of the total production volume created on the basis of digital technologies by firms whose business model is based on digital goods and services (Bukht, R., 2018); managerial – automated farm management based on advanced information technologies; a new economic set-up based on effective information management of the production system, which the modern world needs for economic growth, etc. (Evtyanova, D.V., 2017).

The improvement of conditions contributing to the transformation of various fields of activity under the influence of information technologies are the main areas of the development of the digital economy and the information-oriented society. Information and communication technologies (ICT) are a set of methods, production processes and software and hardware tools that are integrated with the aim of collecting, processing, storing, distributing, displaying and subsequent use of information in the interests of its users. Information and communication
technologies are information processes and methods of working with information, carried out using telecommunications and computing machinery. Digital technologies mean information and communication technologies and other new and cutting-edge technologies, including technologies in the field of robotics industry, technologies in the field of computing, fiber-optic hardware and office equipment, artificial intelligence technologies, adaptive technologies, etc. (Information-oriented Society in the Republic of Belarus, 2021).

In a digital economy, information resources unite all factors of production, increase the organization and orderliness of the functioning of the economic system, and ensure the coordination of actions of economic entities. Information resources are an organized collection of documented information, including databases, other collections of interrelated information in information systems. Information resources are used to obtain reliable information in a wide variety of areas of knowledge and practice, which are specific. Information resources are characterized by the problem of scarcity on the one hand and by the possibility of multiple replication on the other hand. The differentiation of access to information and the possibility of its use is a feature of information resources, since the latter are determined by the cognitive abilities of the subject (On information, informatization and information protection: Law of the Republic of Belarus, 2017).

Results and discussion

The analysis showed that the modern transition to the digital economy is a key factor in the growth of gross domestic product and gross value added, which is due to the economic effect obtained from the automation of processes, and from the introduction of modern business models and digital technologies (creation of digital platforms and digital ecosystems, the use of Industry 4.0 technology and "smart factory", the implementation of the "cyber physical system" concept as an unified complex of information resources, systems and physical processes, etc.). Table 1 - shows the dynamics of the main indicators of the organizations' activities in the ICT sector of the Republic of Belarus for 2016-2020.

<table>
<thead>
<tr>
<th>Table 1. Dynamics of the main economic indicators of the organizations’ activities in the ICT sector of the Republic of Belarus</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
</tr>
<tr>
<td>Number of organizations (NO), unit</td>
</tr>
<tr>
<td>including Mogilev region</td>
</tr>
<tr>
<td>Gross Value Added (GVA) (at current prices), million RUB</td>
</tr>
<tr>
<td>including Mogilev region</td>
</tr>
<tr>
<td>Share of gross value added (GVA) in gross domestic product (GRP), %</td>
</tr>
<tr>
<td>including Mogilev region</td>
</tr>
<tr>
<td>Share of gross value added in the gross value added of the economy of the republic (region), %</td>
</tr>
<tr>
<td>including Mogilev region</td>
</tr>
<tr>
<td>Net profit (NP) of organizations,</td>
</tr>
</tbody>
</table>
The data given in Table 1 show that the growth rate of the number of organizations in the ICT sector was 34.8%, including in the Mogilev region - 2.9% in the Republic of Belarus in 2020 compared to 2016. The growth rate of gross value added for this period amounted to 153.6%, including 89.3% in the Mogilev region. There was a trend towards an increase in the share of gross value added in gross domestic product by 2.9 percentage points, including in the Mogilev region - by 1 in 2020 compared to 2016. The net profit of organizations in the ICT sector for the studied period increased by 2.6 times, including in the Mogilev region - by 1.3 times.

Figures 1 and 2 show the dynamics of the main economic indicators of organizations in the ICT sector of the Republic of Belarus as a whole and the ICT sector of the Mogilev region, which indicate the activation and increase in the efficiency of their activities in 2019-2020.

The data presented in Figure 3 show that in 2020 the largest share in the structure of the organizations’ total costs for the development, implementation and use of digital technologies was occupied by the costs of purchasing machinery and equipment related to the development, implementation and use of digital technologies, as well as their maintenance, modernization, routine and overhaul repairs carried out on our own - 26.8%. The share of expenses for the purchase of machinery and equipment related to the development, implementation and use of digital technologies, as well as their maintenance, modernization, routine and overhaul repairs performed on our own was 25.7%. A high share in the structure is occupied by other costs for the development, implementation and use of digital technologies - 22.7%.

<table>
<thead>
<tr>
<th>million RUB</th>
<th>7,0</th>
<th>17,4</th>
<th>8,2</th>
<th>6,5</th>
<th>9,7</th>
<th>138,6</th>
</tr>
</thead>
<tbody>
<tr>
<td>including Mogilev region</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: build by the author

Table 1. The growth rate of the number of organizations and gross value added

Figure 1. Dynamics of the main economic indicators of the organizations’ activities in the ICT sector of the Republic of Belarus

Source: suggested by the author

Digital transformation stimulates the application of innovation and innovative technologies in business models, products, services and internal business processes, which requires corresponding expenses.

The structure of organizations’ expenses for the development, implementation and use of digital technologies is shown in Figure 2.
Next, let us carry out the forecast of the share of the gross value added of the ICT sector in GDP (GRP) for the period up to 2025. Let us construct a trend equation, in order to do that we choose a linear growth curve, since it more accurately reflects the dynamics of the original time series (Figure 3).

![Figure 3. Forecast of the share of the gross value added of the ICT sector in GDP (GRP), %](source: suggested by the author)

Let us calculate the predicted value using the equation obtained in the diagram (Table 2).

<table>
<thead>
<tr>
<th>Indicators</th>
<th>2021</th>
<th>2022</th>
<th>2023</th>
<th>2024</th>
<th>2025</th>
<th>Growth rate, 2025/2021, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Share of the gross value added of the ICT sector in GDP of the Republic of Belarus</td>
<td>7,9</td>
<td>8,7</td>
<td>9,4</td>
<td>10,1</td>
<td>10,8</td>
<td>136,7</td>
</tr>
<tr>
<td>Share of the gross value added of the ICT sector in GRP of the Mogilev region</td>
<td>3,6</td>
<td>3,8</td>
<td>4,0</td>
<td>4,2</td>
<td>4,4</td>
<td>122,2</td>
</tr>
</tbody>
</table>

*Source: build by the author*

The data given in Table 2 showed that the growth rate of the share of the gross value added of the ICT sector in the GDP of the Republic of Belarus by 2025 will amount to 36.7%, in the GRP of the Mogilev region - 22.2% compared to 2021, which reflects the positive dynamics of indicator growth.

Let us carry out a forecast of the net profit of organizations in the ICT sector of the Republic of Belarus for the period up to 2025. Let us construct a trend equation, in order to do that we choose a linear growth curve, since it more accurately reflects the dynamics of the original time series (Figure 4).

![Figure 4. Forecast of the net profit of organizations in the ICT sector of the Republic of Belarus, million RUB](source: suggested by the author)

Let us calculate the forecast of the net profit of organizations in the ICT sector using the equation obtained in the diagram, (Table 3).

<table>
<thead>
<tr>
<th>Year</th>
<th>Net Profit (million RUB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2016</td>
<td>997,41105</td>
</tr>
<tr>
<td>2017</td>
<td>1451,7</td>
</tr>
<tr>
<td>2018</td>
<td>1956,7</td>
</tr>
<tr>
<td>2019</td>
<td>2666,7</td>
</tr>
<tr>
<td>2020</td>
<td>y = 419,03x + 378,27</td>
</tr>
<tr>
<td>2021</td>
<td>R² = 0,9294</td>
</tr>
</tbody>
</table>

*Source: suggested by the author*
The data given in Table 3 showed that the growth rate of the net profit of organizations in the ICT sector of the Republic of Belarus by 2025 will be 57.9%, compared to 2021.

The development of the domestic IT industry in the Republic of Belarus is aimed at meeting the growing demand of the population, state and business entities for various services of the IT sector based on digital technologies. This is due to the growing demand for Internet services, which pushes manufacturers to expand their presence in virtual markets through the Internet.

Table 4 shows the selected estimate indicators (parameters) of the level of digitalization of organizations in the Republic of Belarus: the number of organizations that had a website, the use of fixed broadband Internet access, the use of wireless Internet access, the use of the Internet in the field of procurement, the use of the Internet in the field of sales, the relative share of ICT specialists and the relative share of the payroll number of employees who used personal computers in the payroll number of employees.

Let us assess the level of digitalization of organizations in the Republic of Belarus, taking into account the regions. In order to do that we determine the maximum (reference) value \( \text{max } a_i \) for each of the selected estimate indicators. We determine the normalized value of the studied indicator, which is the most developed in terms of the degree of digitalization as the reference standard. Then we calculate the indices of estimate indicators of the level of digitalization of organizations using the following formula:
\[ Y_i = \frac{a_i}{\max a_i}, \]  
(1)

where: \( Y_i \) is the \( i \) index of the indicator;  
\( \max a_i \) is the reference value of the \( i \) indicator;  
\( a_i \) is the calculated value of the \( i \) indicator.

Applying an integral estimate, based on the obtained index values, we calculate the digitization factor (DF) according to the geometric mean formula:

\[ DF = \sqrt[7]{Y_1 \cdot Y_2 \cdot Y_3 \cdot Y_4 \cdot Y_5 \cdot Y_6 \cdot Y_7}, \]  
(2)

The calculated value of the digitization factor is presented in Figure 5.

**Figure 5. Digitization factor of the Republic of Belarus, 2020**

*Source: suggested by the author*

Conclusions

Thus, Digital Economy is a set of new opportunities and prospects for the innovative development of various areas based on the active use of information technologies in order to increase the economic efficiency of activities and business capitalization. Innovative development of entrepreneurship, the enhancement of the business environment and investment climate by increasing the availability and efficiency of the production of goods, works, services, increasing the transparency of the business environment, and developing an ecosystem of business services are the priority areas for the digital economy development in the Republic of Belarus. The fourth industrial revolution (Industry 4.0) assumes a new approach to industrial production, based on the massive introduction of modern information technologies, large-scale automation of business processes and the expansion of artificial intelligence, which will allow organizations to significantly increase innovativeness, competitiveness and efficiency.

References


