Current trends, assessment and directions of digital economy development

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Abstract

The objective is to measure the level of the digital economy development in various countries, including the Republic of Belarus, the degree of their digital transformation and development of upcoming trends to improve efficiency of sector organizations activity information and communication technologies. At the present stage, the digital transformation of various countries is a global trend which enters all spheres of society. Digital technologies develop actively in the USA, China, South Korea, Japan and European countries. Each country develops and implements strategies and policies in the field of mobile communications and artificial intelligence in order to obtain competitive strategic advantages. Under these conditions, it is especially relevant and in demand to assess and create conditions for accelerating the pace of digitalization of national economies of various countries. The ICT sector of the Republic of Belarus plays a significant role in the introduction of modern technologies such as cloud computing, big data, the Internet of Things, digital manufacturing, mobility, and cybersecurity.

In the long view, the sustainable development of the domestic ICT sector is one of the main factors affecting the economic growth of the country as a whole. It allows to conduct a comprehensive trend analysis on the selected estimated indicators, taking into account external and internal factors, which expands the possibilities of monitoring, evaluating and forecasting the development of the digital economy of various countries in a competitive environment. The originality lies in elaborating methodological foundations for the formation and assessment of the digital economy of various countries and in establishing upcoming trends for its development in modern conditions.

Keywords: digital economy, development, ratings, assessment, Republic of Belarus, investments, innovations, Internet, export, forecast, prospects.

Introduction

At this stage, the digital economy is a system of social, cultural, economic and technological relations between the state, the business community and citizens, functioning in the global information environment, through the widespread use of digital network technologies, generating digital types and forms of production and advance of products and services to the consumer, which lead to continuous innovative changes in management methods and technologies in order to improve the efficiency of social and economic processes. There are three basic components of the digital economy: infrastructure, including hardware, software, telecommunications, etc.; electronic business transactions covering a business process...
implemented through computer networks within the framework of virtual interactions between the virtual market participants; e-commerce, which includes all financial and commercial transactions carried out using computer networks, as well as business processes associated with such transactions (Golovenchik, G. G., 2020).

The digital (electronic) economy is a set of relations that develop in the process of production, distribution, exchange and consumption, based on online technologies and aimed at satisfaction in life benefits, which involves the formation of new ways and methods of activity and requires effective methods of state regulation.

The digital economy is an economy that exists in a hybrid world, which is the result of the merger of the real and virtual worlds, characterized by the ability to perform vital actions.

The digital economy development is closely related to the development of information and communication technologies. The main directions for the development of the digital economy are the improvement of conditions that contribute to the transformation of various fields of activity under the influence of information and communication technologies (ICT), which are studied as a set of methods, production processes, software and hardware and their integration in order to collect, process, store, distribute, display, subsequent use of information in the interests of its users.

The use of digital technologies improves the investment and business climate by increasing the availability and efficiency of public services, effective management in companies, transparency of the business environment and the development of a digital ecosystem. Formation of a digital ecosystem is part of the strategy of companies (including establishing joint ventures, development of projects, partnership with a company in order to access resources, etc.), which is based on the creation of a digital platform in order to increase competitiveness.

Study methodology is a general form of scientific and cognitive activity arrangement, containing the principles of scientific knowledge elaboration, ensuring that its structure and content correspond to the objectives of the study, including its methods, verification of the results obtained and their interpretation. Methodology of the performed study is based on the application of quantitative and qualitative scientific methods. The official data of the National Statistical Committee of the Republic of Belarus was the information base for the study (Official website of the National Statistical Committee of the Republic of Belarus, 10.04.2022).

Material and methods

Methodology for establishing the rating of countries by the level of development of the digital economy consists of a layered three-level model: readiness of countries to introduce new digital technologies, intensity of the use of digital technologies in the economy and impact of digital technologies.

At this stage, there are many world ratings and indices for assessing the level of digitalization: Digital economy and society index – DESI; Global Innovation Index – GII; ICT Development Index – IDI; UN Global E-Government Development Index – EGDI; E-Participation Index – EPI; Global Connectivity Index – GCI, Huawei; GSMA Mobile Connectivity Index; Digital Evolution Index – DEI. At the same time, each of the indices has its own scope, assessment method and country rating in terms of the degree of implementation and digitalization (Stoma, N., 2020).

Digital economy and society index (DESI) is a comprehensive quantitative index of digital performance analysis that includes a study of connectivity, integration of digital technologies, e-commerce, trust, security and privacy, Internet use, human capital, digital government services, and digital control provision. The European Commission annually assesses the state of digitalization of the countries of the European Union according to this index (Index
digital economy and society, 11.04.2022).

In the countries of the European Union at this stage, the new industrial policy defines the key factors of industrial transformation and aims to maintain the global competitiveness of industry in external and internal markets; turning Europe into a climate-neutral part of the world by 2050 and achieving digital leadership in the world, which indicates a new quality of economic growth and new environmental model. The European Union is one of the world leaders in the entry of digital technologies into society and economy – namely three of the five EU countries: Sweden (3rd place), Denmark (4th place) and Finland (5th place). The digital economy has become a catalyst for trade in the EU and provided about a third of the growth in industrial production in recent years. In 2015, the countries approved a strategy for the establishment of the EU Digital Single Market. The concept of “Digital Europe” is part of the strategy for the development of a single digital market, which will create a “certified, secure and sustainable infrastructure”. The field of digital technologies (Industry 4.0, Artificial Intelligence (AI), Internet of Things (IoT)) has a huge potential for innovations, which has a huge impact on the development of industry and creation of business models on digital platforms (Khesin, E.S., 2020).

Development of the digital economy of various countries is influenced by various factors: level of supply – availability of access to the internet and the degree of infrastructure development; consumer demand for digital technologies; institutional environment (government policy, legislation, resources) and innovative climate – investments in R&D (Research and Development) and digital start-ups. Applying these estimates to 90 countries, the Digital Evolution Index is presented, revealing four categories of country economies: Stand-Out (USA, Singapore, Hong Kong, South Korea, Taiwan, Germany, Estonia, Israel, Czech Republic, Malaysia, Lithuania and Qatar), Stall-Out (Sweden, UK, Netherlands, Japan, Canada), Break-Out (Russia, China, India, Indonesia and Poland) and Watch-Out (Index digital economy and society, 11.04.2022).

The Republic of Belarus is located in the center of Europe and is one of the Eastern European states, the territory of which is 207.6 thousand square kilometers. In 2018, according to the results of data monitoring of digital economy and society of these countries, the Republic of Belarus was given a score of 4 (the maximum score is 5). One of the most important tasks in the implementation of the State Program “Digital Development of Belarus” for 2021-2025 is the development of digital economy tools in various sectors of the national economy, which provide for the use of advanced production technologies in production and processes of foreign economic activity, provision of the necessary conditions for maintaining and improvement of the competitiveness of Belarusian companies in the global market (State Program “Digital Development of Belarus” for 2021–2025, 04.04.2022).

According to a study by the International Telecommunication Union of the United Nations, the Republic of Belarus has risen to 32nd place in the ranking of the ICT development index (in 2017 – 34th place), which is equal to 7.59 (7.55 – in 2017). The Republic of Belarus has been included in the TOP-10 economies of the world for the fourth year with the highest growth dynamics of ICT indicators, describing both the technical level of development of modern information and communication infrastructure, and how the infrastructure is used by society, business and the state. According to the GSMA Mobile Connectivity Index in 2018, Belarus has 66.4 points out of 100 (mobile connection infrastructure – 60.8; availability (in economic terms) of devices and services – 64.0; consumer willingness to buy them – 85.9; availability of relevant content and services – 58) and 60th place in the ranking (35th in Europe). The Republic of Belarus has a high level of human capital development, ranking 53rd in this area in the world according to the UN assessment. According to the World Bank, Belarus ranks 45th out of 146 countries in the knowledge index and 30th in the education index. In the Global
Innovation Index for 2016-2020, the Republic of Belarus has risen from 78th to 46th place, and in this index it ranks 32nd in terms of “results of scientific and technological activities” and 15th in terms of “creation of new knowledge”. At the same time, in terms of the number of applications for patents and utility models from residents, the Republic of Belarus occupies 7th and 3rd places, respectively (8.9 and 6.3 units per billion dollars of gross domestic product) (Gnatiuk, S.N., 2020).

Results and discussion

A significant contribution to the sustainable dynamic development of the IT sector in the Republic of Belarus is made by the High Technology Park (HTP), which was established in 2005 in order to promote the favorable development of the economy using high technologies in activities, increase the export of information services, high-tech products and attract foreign investment. Nowadays HTP includes 1021 companies, which are involved in different types of activity: from advanced artificial intelligence solutions to the development of high-end software, engineering solutions, games and mobile applications, information technologies in the field of healthcare, agriculture, banking software, laser technologies, optics. Over 600 residents of the park are engaged in the development of software for various companies, including well-known global corporations: Coca-Cola, Microsoft, Intel, Amazon, Jaguar Land Rover, Bosch, Citibank, Bank of America, Deutsche Bank, Lufthansa, Oracle and others (Hi-Tech Park, 06.04.2022).

Dynamics of the main indicators of digital transformation is shown in Table 1.

| Table 1. Dynamics of the main indicators of digital transformation, % |
|---------------------------------------------------------------|
| Indicators | 2016 | 2017 | 2018 | 2019 | 2020 | +, -, percentage points, 2020 / 2016 |
| The share of products (works, services) of own production shipped by high-tech park (HTP) resident companies in the total volume of shipped products | 32.9 | - | 40.7 | - | 55.9 | +23.0 |
| The share of exports of ICT services of HTP resident companies in the total volume of exports of ICT services | 70.4 | 69.8 | 75.9 | 82.2 | 88.9 | +18.5 |
| Share of innovative and active HTP resident companies in the total number of HTP resident companies | 6.1 | 4.4 | 5.9 | 6.2 | 5.3 | -0.8 |
| Share of innovative products (works, services) shipped by HTP resident companies in the total volume of products shipped by HTP resident companies | 1.5 | 0.9 | 0.8 | 1.0 | 0.5 | -1.0 |
| Share of innovative and active resident companies of the Scientific and Technological Parks (STP) in the total number of STP resident companies | 60.0 | 60.0 | 60.5 | 63.4 | 65.3 | +5.3 |
| Share of innovative products (works, services) shipped by STP resident companies in the total volume of products shipped by STP resident companies | 29.6 | 49.4 | 33.1 | 28.6 | 39.8 | +10.2 |
| Share of retail turnover of online stores in the retail turnover of trade companies | 2.8 | 3.4 | 3.7 | 4.1 | 5.4 | +2.6 |

Source: build by the author
The data in Table 1 show that in 2020, compared to 2016, the share of shipped products (works, services) of own production by high-tech park (HTP) resident companies in the total volume of shipped products increased by 23%. Over this period, the share of exports of ICT services by HTP resident companies in the total volume of exports of ICT services increased by 18.5%. There is a 0.8% decrease in the share of innovative active HTP resident companies in the total number of HTP resident companies and 1% decrease in the share of shipped innovative products (works, services) of HTP resident companies in the total volume of products shipped by HTP resident companies.

It should also be noted that in 2020, compared to 2016, the share of resident companies of Scientific and Technological Parks (STP) that are active innovation-wise in the total number of STP resident companies increased by 5.3% and the share of innovative products (works, services) shipped by STP residents in the total volume of products shipped by STP residents increased by 10.2%. During the study period, there is 2.6% increase in the share of retail turnover of online stores in the retail turnover of trade companies.

Development of the digital economy is a key factor in the growth of gross domestic product, gross value added and obtaining a synergistic effect through full automation of processes, introduction of modern business models and digital technologies.

Dynamics of the main estimated indicators of the national ICT industry is shown in Table 2.

| Table 2. Dynamics of the main estimated indicators of the national ICT industry |
|---|---|---|---|---|---|
| Indicators | 2016 | 2017 | 2018 | 2019 | 2020 |
| Number of companies, units | 3962 | 4492 | 4996 | 5202 | 5341 |
| Payroll of employees of the ICT sector company, persons | 85405 | 92193 | 100655 | 111316 | 118778 |
| The volume of production of products (works, services) of companies in actual prices, million RUB | 5862.7 | 7233.4 | 8576.8 | 10878.1 | 13352.9 |
| Share of the volume of production of products (works, services) of the companies in the total volume of production of products (works, services), % | 4.3 | 4.6 | 4.7 | 5.5 | 6.3 |
| Gross value added (GVA) of the ICT sector at current prices, million RUB | 4265.5 | 5539.6 | 6792.6 | 8725.3 | 10816.8 |
| Share of GVA in the overall structure of GVA, % | 5.2 | 6.0 | 6.5 | 7.4 | 8.4 |
| Share of GVA in the overall structure of gross domestic product, % | 4.5 | 5.2 | 5.6 | 6.5 | 7.4 |
| Growth rate, % (or +, -, percentage points), 2020 / 2016 | 134.8 | 139.1 | 227.8 | +2.0 | +3.2 |

Source: build by the author

The data given in Table 2 show that in the national ICT industry in 2020, compared to 2016, the number of companies increased by 34.8%, and the payroll of the company’s employees – by 39.1%. Over this period, the gross value added (GVA) increased by 153.6%,
the volume of production (products, works, services) of companies increased by 127.8%, the share of GVA in the total GVA structure increased by 3.2% and the share GVA in the overall structure of the gross domestic product is 2.9%.

Dynamics of attracting investments for the development of ICT is shown in Table 3.

### Table 3. Dynamics of attracting investments for the development of ICT

| Indicators | 2016 | 2017 | 2018 | 2019 | 2020 | Growth rate, % (or +,-, percentage points), 2020 / 2016 |
|------------|------|------|------|------|------|--------------------------------------------------------|
| Investments in fixed capital of the ICT sector in actual effective prices, million RUB | 650.3 | 668.5 | 775.7 | 756.0 | 723.5 | 111.2 |
| Share in total investments in fixed assets, % | 3.5 | 3.2 | 3.1 | 2.6 | 2.5 | -1.0 |
| Foreign investments, received by the ICT sector companies, million USD | 366.7 | 509.9 | 585.8 | 715.4 | 642.8 | 175.3 |
| Share of foreign investments in total amount of foreign investments, % | 4.3 | 5.2 | 5.4 | 7.1 | 7.4 | +3.1 |

*Source: build by the author*

The data given in Table 3 show that in the development of the national ICT industry in 2020 compared to 2016, investments in fixed assets increased by 11.2%, and foreign investments increased by 75.3%. During this period, the share of foreign investments in the total volume of foreign investments increased by 1.9%.

Going forward, more than half of investments in IT solutions will be associated with digital transformation. Digitally transitioned companies will ensure sustainable operating models by shifting 70% of all technology and service spending to as-a-service and results-based models. Investments will be required to support a variety of customer acquisition scenarios and data-driven operations. Approximately 70% of companies will see twice the value of investing in technologies that enhance the professional experience of employees and customers compared to investing in automating individual processes. Synergies derived from collaborative efforts to expand experience and decision-making activities for various customers (Mickiewicz, B., 2021, Mickiewicz, B., 2018).

One of the conditions for ensuring the effective development of the ICT sector is their innovative activity. Digital transformation drives innovation in business models, products, services and internal business processes. Dynamics of the main indicators for assessing the innovative development of the national ICT industry is shown in Table 4.
Table 4. Dynamics of the main indicators for assessing the innovative development of the national ICT industry

| Indicators                                                                 | 2016 | 2017 | 2018 | 2019 | 2020 | Growth rate, % (or +, -, percentage points), 2020 / 2016 |
|----------------------------------------------------------------------------|------|------|------|------|------|-------------------------------------------------------|
| Share of internal costs for research and development of the ICT sector companies in the total volume of these costs, % | 4.1  | 6.0  | 4.3  | 4.5  | 5.1  | +1.0                                                  |
| Share of innovative and active ICT sector companies in the total number of companies in this sector, % | 16.4 | 15.7 | 12.3 | 9.8  | 8.3  | -8.1 p.p.                                             |
| Share of innovative products (works, services) shipped by ICT sector companies in their total volume, % | 4.6  | 4.1  | 4.5  | 4.3  | 3.8  | -0.8 p.p.                                             |

Source: build by the author

The data given in Table 4 show that in 2020, compared to 2016, the share of internal costs for research and development of the ICT sector companies in the total amount of these costs increased by 1%. At the same time, during the study period, there is a decrease in the share of innovative and active ICT sector companies in the total number of companies in this sector by 8.1% and the share of innovative products (works, services) shipped by the ICT sector companies in its total volume decreased by 0.8%.

Today, more than five billion consumers interact with information every day, and by 2025 this number will increase to six billion (75% of the population). Each Internet user will interact with digital data approximately once every 20 seconds. Ultimately, given the number of digital data sources and the speed of their processing, the structure of the economy of various countries, the principles of activity, including the requirements for participants of the European and world market, will change.

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 of the population for Internet services, which encourages manufacturers to expand their presence in virtual markets through the Internet. Mobile communications, Internet, social networks, scientific research, technologies, etc. contribute to the effective development of digitalization.

Dynamics of use of information and communication technologies in the companies is shown in Table 5.

Table 5. Dynamics of use of information and communication technologies in the companies (in % of the total number of the studied companies)

| Title                                | 2016 | 2018 | 2020 | Growth rate, % (or +, -, percentage points, 2020 / 2016) |
|--------------------------------------|------|------|------|-------------------------------------------------------|
| Companies using:                     |      |      |      |                                                       |
| e-mail                               | 96.8 | 96.2 | 98.4 | +1.6                                                  |
| local computer networks              | 82.1 | 79.8 | 78.3 | -3.8                                                  |
| Internet                             | 97.4 | 96.8 | 98.7 | +1.3                                                  |
| Intranet                             | 23.6 | 26.6 | 27.6 | +4.0                                                  |
| Extranet                             | 9.3  | 13.5 | 14.7 | +5.4                                                  |
| Companies with a website             | 62.2 | 67.2 | 70.4 | +8.2                                                  |

Source: build by the author
The data in Table 5 shows that in 2020, in general, the level of use of information and communication technologies in the companies is high, including companies using e-mail – 98.4%, higher by 1.6% compared to 2016; companies using local computer networks – 78.3%, lower by 3.8% compared to 2016, and companies using Internet – 98.7%, higher by 1.3% compared to 2016. It should be noted that over this period, the number of companies with a website increased by 8.2%.

Dynamics of ICT sector companies by the method of Internet connection is shown in Figure 1.

![Figure 1. Dynamics of ICT sector companies by the method of Internet connection (in % to the total number of studied companies having access to this network)](image)

Data in Figure 1 show that in 2020 the share of companies using Internet through the fixed broadband access is 89.3%, which is by 10.2% lower than in 2018; through wireless access is 62%, which is by 16.2% higher than in 2018.

Dynamics of the main indicators of assessment of the Republic of Belarus ICT sector companies activity efficiency is shown in the Table 6.

### Table 6. Key performance indicators organizations activities in the ICT sector of the Republic of Belarus

| Title                                                      | 2016   | 2017   | 2018   | 2019   | 2020   | Growth rate, % (or +, -, percentage points), 2020 / 2016 |
|------------------------------------------------------------|--------|--------|--------|--------|--------|----------------------------------------------------------|
| Companies’ net profit, million RUB.                        | 997.4  | 1105.0 | 1451.2 | 1956.7 | 2666.7 | 267.3                                                    |
| Profitability of company sales, %                          | 18.6   | 19.4   | 18.7   | 18.1   | 18.7   | +0.1 p.p.                                                |
| Share of ICT goods in total exports of goods, %            | 1.1    | 1.0    | 1.0    | 1.1    | 1.4    | +0.3 p.p.                                                |
| Share of ICT services in the total export of services, %   | 16.8   | 18.4   | 21.0   | 25.0   | 30.7   | +13.9 p.p.                                               |

Source: build by the author

The data given in Table 6 show that in the Republic of Belarus in 2020, the growth rate of net profit of the ICT sector companies amounted to 167.3%, compared to 2016. In 2020, the return on sales was 18.7%, which is 0.1% higher than in 2016. During the study period, the share of ICT
goods in the total export of goods increased by 0.3%, and the share of ICT services in the total export of services increased by 13.9%.

Let’s make a forecast of the share of ICT services of the Republic of Belarus in the total volume of services exports for the period up to 2025. Let’s construct a trend equation; in order to do it, we choose a linear growth curve, since it reflects the dynamics of the original time series more accurately (Figure 2).

Using the equation obtained in the graph, we calculate the forecast for the share of ICT services in the total export of services (Table 7).

### Table 7. Forecast of the share of ICT services in the total export of services

| Indicators                          | 2021 | 2022 | 2023 | 2024 | 2025 | Growth rate, 2025/2021, % |
|-------------------------------------|------|------|------|------|------|--------------------------|
| Share of ICT services in the total export of services, % | 32.7 | 36.1 | 39.6 | 43.0 | 46.5 | 142.2 |

Source: build by the author

Calculations showed that the growth rate of the share of ICT services in the Republic of Belarus in the total volume of exports of services in 2025 compared to 2021 will be 42.2%, which reflects the effective development of the digital economy.

### Conclusions

The upcoming trends of the digital economy of European countries are: 1) development of national infrastructure; 2) development of the state system for the provision of electronic services, the use of mobile electronic digital signature; 3) implementation of projects in e-education, healthcare, employment, logistics, trade and other areas, creation and implementation of the concept of Industry 4.0 and “smart city”. The concept of Industry 4.0 is determined by the implementation of the following areas: digitalization and integration of vertical and horizontal value chains, digitalization of products and services, digital business models and customer access. By 2025, professional digital sustainable development teams will be formed in various countries, the tasks of which will be: assessment, certification, coordination of the use of data and analytical platforms for the sustainable development of business and information technology.

As a result of analysis of world rankings, statistical data and performed study, the Republic of Belarus can be attributed to a promising group of countries in terms of the level of digital transformation of the economy and society. A developed data transmission network that meets international standards, data storage and processing centers, identification mechanisms, online payment systems, modern electronic services and information security tools have been created. The results of the assessment showed that ICT companies in the Republic of Belarus are mainly focused on exports and the provision of services to order (outsourcing model). It is necessary to transfer IT companies to a product model, that is, to the initiation and creation of domestic IT products, including for the domestic market. In general, the digitalization of the economy of the
Republic of Belarus is a continuous process of introduction and progressive development of ICT and digital technologies, in which intellectual work, information goods and services play a predominant role.

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