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Trends in the digital transformation of the economy of the Republic of Belarus as an innovative development instrument

Nowadays digital and technological innovations can be found in all spheres of economic life of society, they affect the very essence of the economy, cause qualitative and structural changes in it. As a result, a digital economy is emerging; unlike the traditional, the digital economy makes active use of digital technologies. The development level of the digital economy is closely connected with the country's competitiveness, which requires special attention of the state and business to its development. The article reviews the digital transformation of the economy of the Republic of Belarus and shows its modern manifestations. The authors also examine main sectors where innovations are most prevalent. Digitalization is taking root in social processes: the successful lives of people increasingly depend on it. Moreover, there is a large-scale introduction of digital technologies in the operation of public and private enterprises. The article also presents the patterns of the emerging digital economy of Belarus, identifies the challenges and potential uses of digital technologies to decrease the technological gap.

Keywords: *digital transformation of economy; automation; digitalization; information system; digital technology; infrastructure.*

The digitalization of the economy can be defined as the modern innovative stage of a country's economic development based on the integration of physical and digital resources in production and consumption. It is characterized by new methods of generating, processing, storing, transmitting information in all the fields of human activity. The digital economy development has already become a part of the national development strategy of Belarus. The draft programme of social and economic development of the Republic of Belarus for 2021–2025 [9] and the National Strategy for Sustainable Development of the Republic of Belarus until 2035 [5] provide the guidelines for the digitalization of the country's economy.

The digitalization vector is aimed at creating a digital state. With an objective of interdepartmental information cooperation, the Republic of Belarus has established a unified technological infrastructure for electronic cooperation among state bodies and other state organizations. This infrastructure is based on interdepartmental information systems, data-processing centers and the Unified Republican Data Network (URDN). Thus, a National Automated Information System (NAIS), which is the core of the e-government, has been created, as well as Belarusian Integrated Service and Settlement System (BISSS). There are already more than 112 electronic services for legal entities and natural persons and 796 organizations working in a «single-window system» mode. Furthermore, about 13,200 Belarusian organizations and departments work with the Interdepartmental Electronic Document Management System (IEDMS).

The issuance of biometric documents that will replace the traditional passport of a citizen of the Republic of Belarus will become an important addition to digitalization. The ID card will in fact become the key to citizens' access to government-generated information and electronic services in everyday life. Within the country, the ID card will acquire new features – the electronic identification of the owner and the use of electronic digital signatures. In the near future almost all services will be digitalized and the citizens of the Republic of Belarus will be able to use any of the state services without long queues and piles of paperwork. The digital transformation of the economy implies the improvement of the most areas of activity. The automation of the banking sector is a key element in the digital economy. Banks are actively implementing mobile applications that allow holders of bank payment cards to make payments via mobile devices - smartphones, smart watches, etc.

In addition, the Republic of Belarus is working on automation of other significant sectors of the economy. Over the past 10 years, such electronic learning resources as textbooks, manuals and other learning materials have been actively created and developed in the education field. A number of educational institutions use the «E-grade book/school diary» services, test access control systems to identify all school visitors in real time. At this point the software-methodical support of the Republican information and educational environment – «Electronic school» has been created. Computer equipment has been provided for 98 % of educational institutions.

The digital transformation of health-care institutions is under way as well. By the beginning of 2020, 592 health-care institutions were connected to the developed system «E-prescription» and 10 million electronic prescriptions were written. There is a cooperation between the public and private sectors. For example, EPAM implements a system of accounting and screening of organ and tissue donors. Automated waiting lists for

transplantation have been implemented at Minsk Scientific and Practical Centre for Surgery, Transplantology and Hematology. Telemedicine technologies (fluorography and mammography) are actively used and the unified telemedicine system of Minsk is constantly being improved. Furthermore, telemedicine technologies allow physicians to consult with each other. The main ways for further development of tele-health technologies are Internet health care and mobile health care.

In the field of science, this is the development of the State System of Scientific and Technical Information (SSSTI) [3] that includes almost all digital transformation of the science. Over the past five years, more than 40 research and development projects have been carried out. Within the framework of these projects, a network segment has been developed for the integration of the academic BASNET network into the regional electronic infrastructure of the European-wide scientific and educational network GEANT. This network has become the basis of the Unified Scientific and Information Computer Network of the Republic of Belarus, along with the networks of the Ministry of Education, which, as a part of the development of SSSTI, have been enriched by new model security policies and a virtual network infrastructure. Over the past year, more than 3,5 million requests were submitted to SSSTI networks by more than 230,000 scientists, specialists, government officials and other interested users. Within the framework of SSSTI, attention was paid to the development of the digital infrastructure of scientific and technological libraries, the introduction of data processing technologies and the creation of a virtual infrastructure for online visits. In addition, a variety of information and analytical systems for processing, storing, searching and transmitting information have been established. Currently, more than 80 information systems and resources are part of the SSSTI networks.

Taxes and Levies Ministry of the Republic of Belarus is actively involved in digitalization as well. In 2019, a new information system was established to collect, record, process and analyze information on income, tax benefits and income tax paid by individuals. State standards for the digital transformation of industry are being developed on an ongoing basis. Intelligent systems of digital traceability of production processes at all stages of design and technology preparation and virtual testing of new products are being created. As part of the digital transformation of industrial enterprises, the policy and main directions of development are formed within the framework of the «industry 4.0» concept. A substantial modernization of the production sector is to be carried out through extensive use of software and equipment based on artificial intelligence, 3D printing, robotic systems and complexes. Modernization would introduce an intersectoral paradigm of a new type – «smart industry» («smart production») in the industry of the republic that will become a key factor in enhancing competitiveness.

A system for the identification, registration and traceability of animals and animal products has been established and is operating now in agriculture. Efforts are being made for the development of agriculture; crop mapping, for example: modern combine harvesters are equipped with a system that can read from each square meter the yield, determine how much nutrients – potassium, phosphorus, nitrogen - are extracted from the soil. There's ongoing research into the process of differentiated application of mineral fertilizers with the justification of the dose control system in the process of working on the map task, as well as developing of a high-performance method for identifying and separating substandard potato tubers from the general pile by using technical vision systems and automatic inspection for external color defects: the presence of sprouts, cuts and cracks, etc. In addition, the urban structure, we are accustomed to, is also changing. The concept of building «Smart cities» is actively developed. Currently, the development of a full-scale automated system for the control and accounting of electrical energy is going on in the country. Innovations are also gradually being introduced into the public transport system: electronic displays are installed at public transport stops, at the entrances to Minsk metro stations there are validators for payments by non-contact bank cards. Among other services: self-service terminals for the processing of travel documents bought on the Internet, as well as terminals for the ticket purchasing; travel tickets are also available on the Internet. There is already a number of digital elements as part of the intelligent transport system of Minsk: an automated traffic management system, a system for photographic and video recording of traffic rules violations, a public transport management system, etc. The work is under way to ensure free access to the Internet in public places.

The development of digital technologies makes a significant contribution to the growth of the economy and exports of Belarus. By the end of 2019, the IT sector exported about \$2.4 billion. Over the past four years, this sector has shown the consistent high growth rates in services exports and their contribution to total exports. Total exports of information and communication technology services have more than doubled since 2015.

Belarus has created favorable conditions for the functioning of the IT industry. In 2017, the President of the Republic of Belarus signed Decree No. 8 «On the Development of Digital Economy» [6] that turned the High Technologies Park into the leading IT and high-tech cluster in Eastern Europe and the CIS. This document has significantly expanded the horizons for the development of the IT industry and for the first time in the world has legalized relations based on blockchain technology. In addition, the Decree gave Belarus considerable competitive advantages in the application of blockchain technology, artificial intelligence, unmanned transport and made it possible to conclude foreign economic transactions electronically. Belarus was the first country in the world to legalize smart contracts. The adoption of the Decree made the national IT sector 2,5 times more efficient than other branches of the Belarusian economy. About 90 % of the Park's income comes from foreign markets. Last year's export earnings were over \$2 billion [4].

Park management is currently working on Decree on HTP 3.0, which will increase the demand for IT personnel, especially in the regions. The main advantage of the 3.0 concept is that with the resources of the park each resident of the country will be able to obtain interest-free ruble loan for training for a job in the knowledge-based economy. Additionally, a new IT University is being established to implement experimental approaches in teaching, and the possibility of some schools entering the HTP to test various experimental programs is being considered. HTP 3.0 will contribute to the creation of legal conditions for the development of the investment system in the start-ups at early stages. There will also be contribution to the trend development of creating our own software products and the continuation of the implementation of international practices, a Belarusian-English law, in particular.

Over the past four years, a positive development in the field of information and communication took place. Its contribution to GDP has increased steadily from year to year, reaching 6,2 % in 2019, an increase of 14,8 % over the 2018, and of one third compared to 2016. The number of national organizations active in the field of information and communication has also increased. On January 1, 2020 the number of legal entities amounted to more than 4,500 – an increase of 6 % over 2018. More than \$700 million is invested in this industry each year, 7 % of the total amount of foreign investment. Belarus had always paid particular attention to the development of a national information and communication infrastructure, which was an important factor in creating and establishing a digital economy. The UN review published [7] that by 2020 the Republic of Belarus ranked 40th in the e-government readiness index, maintaining its position as a country with a high index. In 2020, the index in Belarus increased by 5,8 % compared to 2018, and the Republic was ahead of Belgium (41), Greece (42), Latvia (49), China (45), Kuwait (46), and Malaysia (47). The high level of development of the information and communication infrastructure in Belarus is confirmed by the country's leadership on this index in the Eastern European region, whose sub-index has increased by 20,3 % in two years. These good results demonstrate the effectiveness of activities in the development of information and communication infrastructure and the progress of the work carried out within the framework of government programs and the currently implemented State Program for the Development of the Digital Economy and Information Society for 2016–2020 [2]. Each year these rankings mark a high level of human capital development, the development of open government data as well as e-services.

However, no matter how promising the process of digitalization of organizations is, it has many difficulties and challenges. One challenge is the digital transformation of industry, which is currently not as dynamic as other sectors. Such circumstances stem from the need to modernize the production base itself (the technical aspect) and transition to new technological standards, they also require significant financial resources. As a result, the digital transformation is now more explicit in the service sector owing to the lower cost and faster impact of projects in this area than in manufacturing. Digital literacy of population is another challenge. The introduction of new technologies affects the lives of every human being in one way or another. Therefore new knowledge and skills are needed for all segments of the population. In addition, a negative result of digitalization has been the loss of jobs, mainly in low-skilled professions. In order to mitigate the negative effects on the labour market, it is necessary to ensure the possibility of requalification and the acquisition of the required skills, while at the same time establishing a system of support for the unemployed during the period of training and finding a new job. Besides, new digital competence centers are established, for example, the Competence Center for Digital Transformation of the Construction Industry of the Republic of Belarus and the Competence Center for Digital Transformation of Industry of the Republic of Belarus. There are various digital skills courses for adults and senior citizens.

Interdepartmental fragmentation is also a problem with regard to the digitalization of state bodies. This issue is being addressed by the formation of the conceptual bases for digital transformation - preparation of the State Programme «Digital Development of Belarus» [8] for 2021–2025 and the State Programme for Innovative Development of the Republic of Belarus for 2021–2025 [10]. In accordance with these programmes the main solution is the transition to the digital platforms, including the microservice architecture, which makes it possible to form general requirements for information systems and digital data. It also allows to avoid «Digital feudalism» that consists of the constant modernization of departmental information systems and the eradication of archaic and clearly lagging technologies. The work packages of these programs together with state, republican and sectoral scientific and technical programs create a powerful innovation base – they allow for the creation of new products and technologies, as well as developing an innovative infrastructure.

In addition to the national digital infrastructure, there is a problem of fragmented markets. The European Union has over 400 million Internet users, but its market is still fragmented. In this regard, the leaders of the EU countries are actively working to create a single digital market for this integration association. The Republic of Belarus, for its part, is actively cooperating with EEA and is jointly working on an integrated information system for the Eurasian Economic Union, which ensures the exchange of data and electronic documents between States.

All these factors have made the integration of public information systems a major and complex task. In this regard, the methods for assessing the overall level of digitalization of the national economy should be revised and a more comprehensive approach should be tested. Finally, the common challenges and risks in the digital transformation process should be taken into account. Objective assessment of challenges and development of risk prevention measures will intensify the positive results of digitalization. It should be noted that there are four important factors in the development of the digital economy: artificial intelligence, broadband link, cloud services and the

Internet. The Republic of Belarus is actively developing and modernizing broadband link and cloud computing technologies. At present, the Fourth Generation Cellular Service (LTE) is accessible to 81,3 % of the population and is actively used by about 4.5 million subscribers, which is almost half of the population [1]. Third generation (3G) networks cover more than 97 % of the country. The infrastructure operator beCloud launched a pilot project to establish a 5G network in Belarus. The artificial intelligence will contribute to the introduction of advanced technologies and the accelerated development of different sectors of the domestic economy. The Belarusian scientific and production sectors now face an important goal of full-scale introduction of digital technologies, which constitute the technological core of the intellectual economy. Another goal is the development of the neo-industrial complex. This demonstrated that the country has almost passed the key stages of widespread computerization and automation, which means that the current challenge is to move to advanced digital technologies. Going forward Belarus will face the challenges of forming digital sectoral platforms and, ultimately, the state platform.

Conclusions. At present, the Republic of Belarus is diligently implementing the concept of creating the digital economy; advanced information and telecommunication technologies are being actively introduced, «smart cities» and networks are being established. Free access to the best information bases of the world is an integral part of the education and health systems, business communications and interaction. Elements of e-government have been created to improve the quality of services for citizens and businesses. The Belarusian IT industry has received worldwide recognition. The top 100 world leading businesses include seven IT companies that have their major representative offices in the Republic of Belarus. Therefore, there are all the reasons to conclude that business operation in the digital age is a new reality, and the Republic of Belarus is on its way. This reality is distinguished by the continuous nature of technological changes, supplemented by constant rethinking of existing business processes and their reengineering, this reality makes us to adapt to new dynamic conditions.

References:

1. A1 i beCloud razvernuto v Belarusi 4G-set' po vsej strane, [Online], available at: <http://www.belmir.by/2019/12/12/a1-%D0%B8-becloud-%D1%80%D0%B0%D0%B7%D0%B2%D0%B5%D1%80%D0%BD%D1%83%D1%82-%D0%B2-%D0%B1%D0%B5%D0%BB%D0%B0%D1%80%D1%83%D1%81%D0%B8-4g-%D1%81%D0%B5%D1%82%D1%8C-%D0%BF%D0%BE-%D0%B2%D1%81%D0%B5%D0%B9/>
2. Gosudarstvennaya programma razvitiya tsifrovoy ekonomiki i informatsionnogo obshchestva na 2016–2020 gody, Utverzhdena Postanovleniem Soveta Ministrov Respubliki Belarus' ot 23.03.2016, No. 235, [Online], available at: www.government.by/upload/docs/file4c1542d87d1083b5.PDF
3. Gosudarstvennaya sistema nauchno-tekhnicheskoy informatsii, [Online], available at: <http://www.gknt.gov.by/deyatelnost/gosudarstvennaya-sistema-nauchno-tekhnicheskoy-informatsii.php>
4. Natsion. stat. komitet Resp. Bel. (2017), *Informatsionnoe obshchestvo v Respublike Belarus'*, stat. sbornik, in Medvedeva, I.V. (pred. red. kol.), Natsion. stat. komitet Resp. Bel. (Belsat), Minsk, 105 p.
5. Ministerstvo ekonomiki Respubliki Belarus' (2018), *Kontseptsiya Natsional'noy strategii ustoychivogo razvitiya Respubliki Belarus' na period do 2035 goda*, Ministerstvo ekonomiki Respubliki Belarus', Minsk, 82 p.
6. Prezident Respubliki Belarus' (2017), *O razvitiu tsifrovoy ekonomiki*, Dekret Prezidenta Respubliki Belarus' ot 21 dekabrya 2017 g., No. 8, Minsk, [Online], available at: http://president.gov.by/ru/official_documents_ru/view/dekret-8-ot-21-dekabrya-2017-g-17716/
7. Obzor OON po elektronnomu pravitel'stvu, [Online], available at: [https://publicadministration.un.org/egovkb/Portals/egovkb/Documents/un/2020-Survey/2020%20UN%20E-Government%20Survey%20\(Full%20Report\).pdf](https://publicadministration.un.org/egovkb/Portals/egovkb/Documents/un/2020-Survey/2020%20UN%20E-Government%20Survey%20(Full%20Report).pdf)
8. Proekt Kontseptsii Gosudarstvennoy programmy «Tsifrovoe razvitie Belarusi» na 2021–2025 gody, [Online], available at: https://www.mpt.gov.by/sites/default/files/proekt_koncepcii_gosudarstvennoy_programmy.pdf
9. Proekt programmy sotsial'no-ekonomicheskogo razvitiya Respubliki Belarus' na 2021–2025 gody, [Online], available at: <http://www.economy.gov.by/ru/pser2025-ru/>
10. Sovet Ministrov Resp. Belarus' (2020), *Razrabotka proekta Gosudarstvennoy programmy innovatsionnogo razvitiya Respubliki Belarus' na 2021–2025 gody*, Postanovleniye Soveta Ministrov Resp. Belarus', 29.01.2020, No. 53, [Online], Natsional'nyy pravovoy Internet-portal Respubliki Belarus'.

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Scientific interests:

– innovation; automation; information system; state development.

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Scientific interests:

– innovation development; digital technologies; development of the digital economy.

The article was sent to the editorial board on 24.09.2020.