

APPLICATION OF INFORMATION TECHNOLOGIES IN THE ECONOMY AND EDUCATION OF THE REPUBLIC OF BELARUS: CONDITION, PROBLEMS AND PROSPECTS

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Abstract: The article examines the level of development of the digital economy and information technologies in the Republic of Belarus from the global ratings point of view, identifies the problems of using information technologies in the country's economy and the prospects for the development of the digital economy. Regulatory and legal acts regulating the development of the digital economy and the information society in the Republic of Belarus and in the system of its higher education are considered. On this basis, the directions that presuppose the revision of traditional forms of organization of the educational process in a modern university, the change of content and teaching methods in higher education on the basis of modern information technologies are highlighted.

Keywords: digital economy, information technology, global ratings, digital transformation of education

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Introduction

The world community has marked the movement along the path of the development of the digital economy. The term “digital economy”,

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introduced in the mid-1990s by the scientist Nicholas Negroponte of the University of Massachusetts (USA), is now widely used throughout the world. In 2016, the World Bank published a report on the state of the global digital economy (Global information and communication technologies development rating, 2018). Although it does not contain a definition of this concept, one can assume that since a traditional economy is an economic activity of a society, as well as a set of relations developing in the system of production, distribution, exchange and consumption. Digital economy is the part of economic relations in which the main role is played by the use of computers, the Internet, mobile phones, as well as the storage, transmission and processing of information. Moreover a significant part of production, distribution, exchange, and consumption is transferred to the virtual environment. These processes are more and more widely covering the financial sector, due to the fact that many financial transactions have virtual nature. Digital computer technologies, new methods of generating, processing, storing, transmitting data play an significant role in the global economy. This fundamentally changes the existing market business models, value-added schemes, and methods for predicting the structure of labor and capital markets.

Despite the fact that the topic of digital economy is more and more brought up in speeches and publications, digital economy's share in global GDP is not yet large. In 2016, it was only 5.5%, varying from 12% in the UK to 4.9% in developing countries. To add up, while in China it was just over 6%, in Russia - according to various estimates – its share reached 2.8 up to 4%. However, the growth rate of the digital economy is increasing rapidly, that's why forecasts that information and data technologies will occupy 30–50% of the economy in the next 8–10 years seem quite realistic (Global information and communication technologies development rating, 2018).

There is a lot of talk in the Republic of Belarus that the digital economy is the future, about the mass introduction of advanced technologies in the work of government agencies (“e-government”), which allow creating a clear and understandable system of obtaining public services for both the population and economic entities. Other major areas of digital transformation of society are e-education and e-medicine. As for the search for new approaches to education, allowing to prepare specialists needed not only

today but also in the nearest and more distant (but foreseeable) future, their prospects are also associated with the need to use information technology in the learning process.

The Ministry of Education reports that the E-School project will work in all institutions of general secondary education in Belarus in the next 2–3 years. It is planned to consolidate all educational institutions of the country into a single electronic system with elements of statistical analysis. The Republic of Belarus has developed a concept for the development of the electronic environment in the education system, which should integrate all educational institutions into a single system, including pre-school, general secondary education, vocational secondary educational institutions, universities.

1. The state of development of the digital economy and the use of information technology in the Republic of Belarus

The formation of digital economy and information society is one of the most important tasks of the development of the Republic of Belarus. Financing of the State Program for the Development of the Digital Economy and the Information Society for 2016-2020, approved by the resolution of the Council of Ministers dated 23.03.2016 No. 235, increases annually. In 2017, 67.6 million BYN was allocated for the Program, not 56.3 million BYN as planned earlier (an increase of 20%). Larger funding for the development of the digital economy and the information society is planned in 2018 (75.3 million BYN instead of 72.5 million BYN) and in 2019 (70.5 million BYN instead of 64.65 million BYN) (State program for the development of the digital economy and information society for 2016-2020).

At the same time, the total amount of funds allocated for the state program will increase only by 11 million BYN, due to a decrease in funding in 2020 (from 70 million BYN to 60.6 million BYN).

The state program for the development of the digital economy and the information society in 2016–2020 has also been supplemented by measures aimed at informatization of the Investigative Committee, the

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Ministry of Taxes and Duties, the National Academy of Sciences of Belarus and the Ministry of Communications work. In addition, Resolution No. 235 expanded the list of customers of the state program. GosStandart, MART (instead of the Ministry of Trade), the Ministry of Culture, the Ministry of Emergency Situations, the Ministry of Industry, the Ministry of Agriculture and Food and the Investigation Committee were included to the customers list.

The main amount of funds (986 million BYN out of 1,341 million BYN, almost 70%) will be allocated to the subprogram "Further development of the national information and communication infrastructure and services provided on its basis". Next comes the subprogram "Transformation of business processes through information and communication technologies in all spheres of life of a modern society", for which 300 million BYN are provided. The subprogram "Introduction of e-government technologies and development of information infrastructure" will receive "only" 55 million BYN.

To fulfill the task to increase the country's GDP to 100 billion USD by 2025 set by the President it is proposed to pay special attention to the most dynamically developing export-oriented sectors of the economy. Prospects are associated primarily with the High-Tech Park and the transport and logistics industry. In 2017, the export revenues of HTP exceeded 1 billion USD, in the first half of 2018. Steady growth continues. Both incomes and the number of new residents of the Park are rapidly growing. This shows a significant influence of the signed by the President Decree No. 8 "On the development of the digital economy" on this industry (On the development of the digital economy, 2017).

Informatization is also among the priorities of the Program of Social and Economic Development of the Republic of Belarus for 2016–2020, approved by decree dated December 15, 2016 No. 466 (The program of socio-economic development of the Republic of Belarus for 2016 –2020), where it plays a role of a key component of the country's innovative development strategy. It is assumed that information and communication technologies (ICT) will become a tool ensuring the development of the high-tech sector of the economy. ICT will create the conditions for the transition to a digital economy, improve the institutional environment and create a

favorable business environment. In particular, the development of e-government will improve the efficiency of public administration, simplify the interaction of government, business and citizens, make this interaction more convenient and reduce the costs of administrative procedures. Realizing the potential of using ICT in various sectors of the economy and life will provide a significant contribution to economic growth, increase the competitiveness of basic industries and new sectors of the economy, quality of life of the population, and will also allow the country to achieve high positions in world rankings.

It should be noted that in the fundamental documents listed above, the development and use of ICT in the education system and their financing are not singled out in a special way as a significant area.

So far, the Republic of Belarus has not been included in the rating of the most technologically developed countries, compiled by the analytical department of the British magazine The Economist - Economist Intelligence Unit, which all Belarus neighboring countries are in. The first place in the ranking of technologically developed countries (Technological Readiness Ranking-2018) was shared by Australia, Singapore and Sweden. Lithuania is on the 26th position in the list of technologically developed countries, Poland is on the 27th, Russia is on the 32nd, Ukraine is on the 39th and Latvia took the 42nd place (Website of Belarusian researchers Thinktanks.by, 2018). The result was calculated based on the following criteria: use of the Internet (both by companies and country residents), infrastructure for the digital economy (online commerce, e-government, cybersecurity) and openness to innovation (in particular, research activity in the country and its interactions with developers in the rest of the world). In the latter category, issued international patents, research and development (R & D) and research infrastructure are studied.

In the global ranking of the level of penetration of information technologies and communication networks into everyday life, compiled by the International Telecommunication Union (International Telecommunication Union, ITU) the Republic of Belarus took the 32nd place in 2017 (out of 176). In this ranking such parameters as the number of fixed landline and

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cellular subscribers connected per 100 population; bandwidth of an external Internet gateway per user; the percentage of families with a computer at home and Internet access; the proportion of Internet users in the total population; the number of broadband connections per 100 inhabitants were measured. The Republic of Belarus is still the leader in the development of ICT in the CIS, and among the countries of the former USSR it is second after Estonia (17th place). As for the neighboring countries, Russia was placed 45th, Ukraine - 79th, Latvia - 35th, Lithuania - 41st, Poland - 49th (Website of the International Telecommunication Union).

However, the statistics shows that so far the level of digitalization of the domestic economy is rather modest. The share of spending of domestic organizations and the population on ICT has increased from 2% of GDP in 2011 to 3.1% in 2016, and the share of investments in the ICT sector decreased from 1 to 0.7%. During this period the share of ICT sector organizations in the total number of commercial organizations decreased from 3.6 to 3.4%, and the share of their staff in the list of employees of commercial organizations of the republic increased from 3% to only 3.2%. The share of the gross added value of the ICT sector in gross added value in the economy grew over 5 years from 3.2 to 5.2%, and the production of industrial goods related to ICT increased from 139.4 million BYN to 495.4 million, which is not much, taking into account inflation and the depreciation of the ruble. The share of investments in fixed assets in the ICT sector in total investment has increased from 3 to 3.5%. The proportion of R&D costs in the total costs of ICT sector organizations decreased from 0.6% in 2011 to 0, 5% in 2016, although in 2013 it reached 1% (Information Society in the Republic of Belarus, 2017).

On the other hand, information and communication technologies occupy an increasingly prominent place in the domestic economy (Table 1) (Information Society in the Republic of Belarus, 2017). But this still has little effect on the country's economic growth rates and the level of well-being of the majority of the population.

Table 1.
The use of ICT in the economy of the Republic of Belarus Indicators

Indicators	2011	2012	2013	2014	2015	2016
GDP, % of the previous year	105,5	101,7	101,0	102,3	97,4	99,4
Share in total quantity, %						
organizations using the Internet	94,6	96,8	97,5	97,3	97,2	97,4
organizations having a website	50,2	51,2	57,0	62,2	59,7	62,2
organizations using electronic digital signature	87,9	90,0	94,7	96,5	98,0	98,6
organizations providing workers with technical means for mobile Internet access	26,4	30,0	34,2	34,6	36,5	33,5
organizations that use the Internet to place orders for the necessary organization of goods (services)	39,5	44,3	52,3	56,4	57,5	59,2
organizations using the Internet to receive orders for goods (services) produced	30,8	34,4	39,9	41,6	40,8	42,9
organizations using electronic document management systems	14,7	15,3	17,6	21,1	18,0	25,1
retail turnover through online stores in retail trade turnover	1,0	1,3	1,5	1,3	2,0	2,8
organizations that use the Internet to obtain information from the government agencies or to provide the government agencies with information	76,5	81,5	88,8	90,6	92,4	93,4
Weighted average share of documents sent (received) in electronic form when interacting with government bodies and organizations	21,4	25,3	29,0	33,6	38,2	41,6

The core of the digital transformation of the economy is the digitalization of industry. The future image of the digitalization is most clearly described within the framework of the German concept Industry 4.0. It is based on a set of elements of cyber-physical systems controlling technological processes in real-time, as well as the Internet things, industrial

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Internet and additive manufacturing. These elements make it possible to respond flexibly to consumer demands owing to a quick changeover and an increase in quality. The Ministry of Economy of the Republic of Belarus encourages domestic the introduction of elements of Industry 4.0 in our country.

According to the Ministry of Economics, thanks to the established regulatory framework in Belarus, the prerequisites for the transition to a new stage of development have been established (<http://www.belarus.by/en/about-belarus/education>). But digital transformation requires solving a number of problems. For example, new informational principles of industrial management based on the key competences, cluster model of development, restructuring of individual enterprises should be introduced. Gradually this experience shall be used to improve the efficiency of the entire sector. It is necessary afterwards to develop new technological standards, preferably on the basis of a national standardization development strategy (which is yet to be created). Next goes the development of a technical base for implementing the concept of Industry 4.0, which includes cybernetic systems, equipment, materials for 3D printing, infrastructure for the Internet of things. Finally, it is necessary to develop the market of scientific and technical products, the settlement of parallel imports and counterfeit products issues.

In order to work out a comprehensive solution of these tasks an integrated body, concentrating the functions, authorities and resources to regulate the innovation sphere, industrial development and digital transformation, is needed. This will help achieve unity of purpose, subordinate the activities of science, industry and communications to the idea of digital transformation, which will increase the efficiency of public administration and the competitiveness of the national economy. Furthermore, the formation of a regulatory framework, the involvement of international technical assistance to study the experience of digital transformation, the preparation of the concept of new industrialization on a modern technical base are implied.

Another requirement is the development of public-private partnership, in which the key element should be the development of the private sector competencies associated with the implementation of the

elements of Industry 4.0. According to The Ministry of Economics, the initiative of the private business to create such industries will allow to build a new technological base of domestic industry.

An integrated state body that should be created will manage the industry in a new way. It will comprise several departments within itself, aiming at the unification of science, industry and communications for the implementation of digital transformation projects. Hence, the idea of industrial policy will be filled with specific content and will turn into a complex of measures to ensure digital transformation. According to the experts, the dominating share of the state sector in the current industrial structure of the republic is not ready to work on new organizational principles.

However, according to the representatives of The Ministry of Industry, there is no opportunity to implement Industry 4.0 in Belarusian enterprises (state-owned or private) today. The proposals of The Ministry of Economics do not reflect the real situation in the sphere of the digital economic transformation and the concept of Industry 4.0, which cannot be applied at every industrial enterprise in the country. Firstly, one needs to restructure the business processes. Moreover, there are no resources in the industrial sector, and The Ministry of Economics is not yet offering where to get them. For many enterprises, the use of this concept is generally unrealistic, in particular, for those who work in space and the military-industrial complex, MIC.

Meanwhile, in Russia, according to the forecast of the Institute of World Economy and International Relations of the Russian Academy of Sciences, in case of a favorable scenario, the contribution of Industry 4.0 to the GDP growth rate will be 0.25% by 2035. At the same time, Digital Twin, the creation of digital production twins, is becoming the main trend in industrial digitization. Digital Twin offers assistance in managing models from fairly simple ones that allow to track the main parameters of key production stages to a full-fledged three-dimensional images of the entire enterprise, modeling of the main processes of the production cycle.

2. State regulation and directions of digital transformation of education

In the Decree of the President of the Republic of Belarus No. 8 dated December 21, 2017 "On the Development of the Digital Economy", the main goal of which is to create conditions for the global IT companies to come to Belarus, open their representative offices, development centers and create a product in demand in the world, among the important goals stands the investment in the future (IT-personnel and education) (On the development of the digital economy, 2017).

Improving the competitiveness of the national education system and its integration into the international educational space is based on such strategic documents as the National Strategy for Sustainable Socio-Economic Development of the Republic of Belarus for the Period up to 2030, approved by the Presidium of the Council of Ministers of the Republic of Belarus on May 2, 2017 (National Strategy for Sustainable Socio-Economic Development of the Republic of Belarus until 2030), and the State Program "Education and Youth Policy" for 2016-2020, approved by the Resolution of the Council of Ministers of the Republic of Belarus of March 28, 2016 No. 250 (The state program "Education and youth policy" for 2016-2020), which implies:

- organization of high-performance ongoing education through the formation of multi-level training for specialists;
- strengthening the integration between production, science and the system of higher education through the creation of university educational, scientific and industrial complexes taking into account the innovative development of the economy;
- development of the National Qualifications System, the introduction of professional and new generation of educational standards.

The formation of innovative professional competencies is possible within the framework of the new organization of higher school activities based on the implementation of three main missions: educational (training and education), scientific, and entrepreneurial. It is they who define the work of higher education institutions as "University 3.0", which implies a transition

from broadcasting to the action based education using the following promising technologies:

- flexible, intensive, modularly built educational programs that provide learning mobility;
- active and interactive education technologies;
- educational resources (educational texts, video lectures, multimedia materials) with remote access via the Internet;
- educational technologies that take into account the psychological characteristics of adults.

These innovations imply a revision of the usual forms of organization of the educational process in a modern university, a change in the content and teaching methods in higher education, and the search for new approaches to education in general. Thus, at present, The Ministry of Education is experimentally introducing the practice of the universities transition to a new model. Its focused on innovational and entrepreneurship activity, promoted by the commercialization of the university scientists (Major economic spheres of Belarus, 2020).

Therefore, the idea of digital transformation of education gives the following reasons for the need to use information technology in the learning process:

- the introduction of information technologies in education significantly speeds up the process of passing the knowledge and the accumulated scientific, technological and social experience;
- modern information technologies, improving the quality of training and education, allow a person to adapt more successfully and quickly to the environment and the ongoing technological and social changes. This gives everyone the opportunity to gain the necessary knowledge in the information society (IO).
- active and effective implementation of these technologies in education is an important factor in creating an education system that meets the requirements of the IO and the process of reforming the traditional education system in the light of the new Society 5.0 development strategy. This strategy is a consequence of the development of the information society, in which computerization and development of technologies determine the development of the industry and manufacturing sector of the

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economies of developed countries (“Industry 4.0”). In Society 5.0, physical and cyberspace become a single entity for solving social problems and ensuring a sustainable economic growth (Naked Science, 2020).

Experts believe that the present Belarusian education system is not suitable for “digital people” entering universities. They suggest the following directions for the system’s improvement so that it meets the spirit of the times and can compete with leading educational institutions in Europe and North America (Kovalev, 2018).

1. Adaptation of the education system to the labor market changes

Digital transformation will require changes in the structure of training and retraining of personnel for the future professions. The example of leaders - Denmark, Sweden, Finland - shows that the number of new jobs for the future economy (requiring a high level of IT culture) has exceeded the number of the reduced ones.

Problems of digital transformation are at the junction of almost every specific science and modern information technology. Therefore, issues of digital transformation of education are considered in the framework of such a transition and awareness of the need to use information. Therefore, it is advisable to open a whole range of master's programs: digital industry transformation (by industry), digital logistics, digital tourism, digital agriculture, digital health care, digital banking, etc. Experienced engineers, logisticians, farmers, bankers, etc., as well as programmers specializing in specific industries could have study them.

2. Re-training of teachers in modern learning technologies

It is necessary to take measures aiming at the professional development of the teaching staff in the field of digital transformation.

It is obvious that it is impossible to teach modern students without embedding online lectures, cases, tests in the learning process. Since the online training is designed by teachers, the ability to organize it qualitatively depends on the teachers proficiency in the modern Internet technologies. Therefore, the universities should focus on changing the work of institutes and centers of advanced training for teachers. They should concentrate on the transfer of just such knowledge.

The most important elements in the implementation of the advanced training courses are cycles of online lectures, seminars, tests, for example,

based on blockchain technology created by the joint efforts of the training teachers. Similar initiative was brought forward by the Russian Economic University. Its Digital University site integrated teachers from various universities. Online courses, operating on the basis of the cloud platform, raise the technological level of all participating teachers and create a common distance course. In addition, it is necessary to teach all teachers to use open high-quality educational resources, especially in the world-class universities.

3. Online & traditional combined learning:

It is necessary to continue reducing the number of the classroom lectures and their duration. They should include discussions of the independent tasks in the format of presentations, and answers to questions on the topic. The topic should be opened by a short online video lecture (10–20 minutes) of the professor from either the same or a different university. Such a video should be embedded with drawings, graphs, cases, and a task for students. Mandatory for every lecture are a forum on each topic of the course, knowledge control and grading. This learning way is called flipped. Courses (modules) should contain approximately 10 specific and clear topics.

4. An integration of the corporate and university education

Dissatisfaction with university education forced many corporations to create their own modern universities (Sberbank of Russia, in Skolkovo, etc.). Later due to digital transformation of the economy the training centers were opened by some IT companies (in Minsk- the HTP Administration, EPAM, BelHard, IBA, and many others).

Both of them have shortcomings. Corporate educational institutions provide super-modern, but not sufficiently systemic and fundamental knowledge, while classical universities are far from modern education, and especially from new teaching technologies. The first step to integration may become the recognition by the higher education institutions of the courses run during the students internships in corporate training centers.

5. Increasing the digital and entrepreneurial literacy of all students

One should strive to ensure that all students during the years of study can prepare themselves for working in the environment of a market economy and digital society transformation, i.e. be ready to lead a modern business in

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their field. Universities should be responsible for turning students into active “digital” citizens, teaching them not only the correct use of technology, but also the etiquette of networking, digital rights and skills of cybersecurity, critical assessment of network information.

6. Overall informatization of education

IT education should be in every discipline, because today there is no science that does not use information technology. But in order for such advanced solutions to be implemented in all disciplines by every teacher, students must be prepared for this. A sufficient amount of modern discipline should be provided in the first year of study, including the Internet of things, cloud computing, big data, and the blockchain, etc. In the United States a project like this was launched in 2016. 4 billion USD was allocated for the initiative. Primarily the funds were directed to the training of 50 thousand teachers of the new subject.

Conclusion

The development of the digital economy and the information society is one of the most important tasks of the development of the Republic of Belarus.

This raises questions about who will be able to achieve the planned milestones, what resources will be needed for this, where to get them. At the same time questions about the social consequences of the digital economy and education transformation arise. New technologies will lead to the elimination of a number of professions and jobs, though they may create the new ones. However, there are no guarantees that this replacement will take place in the same spheres and will not lead to serious social problems and conflicts. Even larger and more complex changes are may occur in the relations between the state, business and society. On the one hand, digital technologies have established many trade and financial operations that do not fit into the framework of the existing legislation, which makes government regulation almost unnecessary. In some areas the regulators were on the verge of losing control over the movement of goods and services, capital and income. As a result, the authorities of different countries are trying to solve

these problems either by prohibitions or by trying to urgently create a legal environment for the new phenomena. On the other hand, information and communication technologies open up new opportunities for the state to control business, society and various resources. And it causes wariness towards the development of the digital economy and the information society.

Belarus has made many steps towards the development of the e-economy and the use of information and ICT. However, taking into account the global perspective and the high speed of changes in this area, considerable efforts to build digital systems and manage them are needed.

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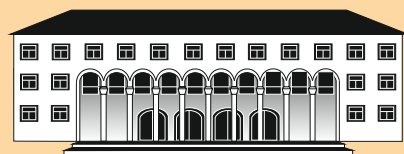
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