DIGITAL TRANSFORMATIONS OF EDUCATION POLICY

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Abstract. The relevance of the digitalization process for policymaking is increasing every year, and it is the COVID-19 coronavirus pandemic that has highlighted the need for digital transformation, especially in education. Governments around the world are trying to minimize the negative effects of the COVID-19 pandemic and the forced transition to online learning. The global ambition to establish a continuous educational process. The digitalization process has its advantages and disadvantages, the process is scalable, and the field of education and policymaking covers virtually the entire population. The object of the study is the process of digital transformation of educational policy. The purpose of the study is to analyze and justify the directions of digitalization, modeling policy in education and science in Ukraine and abroad. The Organization for Economic Cooperation and Development of the European Union pays special attention to the digitalization of education. This process is being transformed through reflection in documents, policies, strategies, and more. The focus areas are the development and implementation of national digital skills strategies and the formation of national digital skills and digital jobs coalitions, according to the European Union Digital Skills and Jobs Coalition. In Ukraine, the development of digital skills of the population is one of the government's priorities in the process of digital transformation and is crucial for efficiency, stimulating the economy, creating jobs, and ensuring social progress. Over the past 5 years, several important documents have been adopted, projects and programs have been implemented to accelerate the digitalization process, and institutions responsible for the efficiency of digitalization have been created. Today, the main stakeholders in the implementation and implementation of the process of digitalization of educational policy are the Ministry of Education and Science of Ukraine and the Ministry of Digital Transformation of Ukraine – these are the founders and reformers in the formation of relevant programs, new directions in the education system, which are aimed at improving the digital literacy of the population.

Key words: digitalization, education, public policy, digital transformation, digital skills.

JEL Classification: I28, H75

1. Introduction

"Digital transformation of education and science is the formation of an ecosystem of digital solutions, including the creation of a secure electronic educational environment, providing the necessary digital infrastructure of institutions, increasing digital competence, digital transformation of processes and services, and automation of data collection and analysis" (Information of the Ministry of Education and Science of Ukraine, Digital transformation of education and science).

Digitalization, particularly the policymaking process, has been around for a long time, but it was the COVID-19 coronavirus pandemic that sharpened and highlighted the importance of digital transformation, especially in educational settings. Governments have sought to mitigate the effects of the shift to online learning and promote educational continuity for all.

The progress of digital technologies in recent decades has led to significant changes in the economy, society, ways of performing daily activities (Institute for Government, 2020). Policy options are developed mostly in institutions, usually with limited public consultation, and with superficial monitoring and evaluation of the impact of policies after implementation. Outdated in the digital age, the model does

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not justify high policy effectiveness. The use of new tools and technologies in politics is effective through the implementation of digitalization. Digitalization has three main directions:

1. Knowledge and people management. Digital technology improves politicians' access to up-to-date information, cooperation at all levels.

2. Data Analysis. Information and technology seeks to positively transform policymakers to understand issues, as well as empower them to test options, evaluate outcomes, and assess impact.

3. External engagement. More communication facilitates the use of knowledge and expertise outside of government, for validity and reliability, and increases the level of cooperation between government and other actors in society.

Digital technologies have unlimited potential for policymakers to effectively manage knowledge and improve interactions; fully analyze problems and possible solutions; and interact with external actors to model public opinion and harness the "collective intelligence" of society. The policy development process must adapt quickly so as not to slow down technological change, ethics, confidentiality, etc. remain important issues.

Digital transformation is the biggest driver of productivity growth in the public sector, which means that citizens have wide access to efficient and high-quality public services. Automated decision-making systems, software, artificial intelligence or machine learning, data-driven policies, increased cooperation and integration can improve the efficiency of the entire system (Tomovska, 2021). Digital transformation involves the gradual automation of public services and internal processes, as well as the digitization of resources (Warsaw Digital Transformation Policy, 2020).

The object of the study is the process of digital transformation of educational policy. The main purpose of the study is to analyze and justify the directions of digitalization, modeling policy in education and science in Ukraine and abroad.

The following general and special methods and approaches were used in the article:
– morphological analysis – when clarifying the conceptual and categorical apparatus of the study;
– system-structural approach – in the study of theoretical and methodological foundations of digital transformation of policy in education;
– methods of observation – in the study of methodological approaches to provide analysis and justification of the directions of digitalization, modeling policy in education and science in Ukraine and abroad;
– comparative analysis to compare processes, objects, phenomena, identifying the common and the special, studying the causes of change, identifying trends in the digital transformation of educational policy.

2. Literature review

Issues of digitization of policy development are presented by many researchers. In research work "Smart governance through bigdata: Digital transformation of public agencies" (Sarker, et al., 2018) noted, that using volumetric information for intelligent management in the public sector can increase the efficiency and speed of public service delivery by increasing public sector transparency and reducing societal problems. The authors believe that the implementation of volumetric information for intelligent management plays an important role in the timely, error-free, appropriate and cost-effective delivery of services to citizens, leading to the sustainable economic development of the country.

Research results of "Digital transformation challenges: strategies emerging from a multi-stakeholder approach" (Brunetti, et al., 2020) emphasize that digital transformation consists of three main pillars:
1. "Culture, education and skills".
2. "Infrastructure and technology".
3. "Ecosystems" (availability of strategies, cooperation and collaboration of different stakeholders, quality of life, etc.).

This study confirms that individual measures are not sufficient to overcome the digital transformation from a systemic point of view. Moreover, the study emphasizes that digital transformation depends on the participation and potential contributions of all categories of stakeholders. This conclusion is confirmed by researchers in "Co-production in the Digital Transformation of Public Administration and Public Value Creation: The Case of Denmark", it is about the effectiveness of cooperation, with a particular emphasis on the need for co-financing of digital policy transformation. The financing scheme for the digital transformation of public policy in Denmark was created with the help of the government, which provided the initial funds, and gradually the budgets were replenished by the financial resources of all parties involved. Thus, public authorities at all levels of government are responsible for digitalization. As an example, the creation of broadband communication, which aims to reach the population with broadband at the national level. The implementation of this policy is co-financed by central, regional and municipal governments (authorities) (Ada, et al., 2022).

On Digital Government Transformation in the European Union "Shaping Digital Government Transformation in the EU" (2020) notes that COVID-19 revealed the unpreparedness of society to meet the challenges, but also confirmed the potential for real digital transformation of the public sector. Thus, the digital transformation of government is a dynamic, non-linear process, which in the short and

medium term can increase rather than decrease the cost of public administration. After the launch of new services, programs, projects in the country, there is a need for new investments and new iterations for improvement. The authors emphasize that legitimacy and trust are extremely important in the digitalization process. Given the positive effects of using technology to deliver public services and improve government efficiency, questions of trust and legitimacy arise. Analyzing the results of the study, we confirm the thesis that legitimacy and trust are important prerequisites for the process of digitalization, the digital transformation of governance systems and policy-making mechanisms. The thesis of an active civil society is relevant when using new technologies, but civic isolation and reduced political participation is a notable trend in developed democracies, because it is impossible to change through information and communication technologies – based on decisions or public data.

3. Generalization of the main statements

3.1. Modeling education and science policy abroad

Digital technologies have changed the way people interact, work, and learn (Shaping Digital Government Transformation in the EU, 2020). Before the COVID-19 crisis, the education sector was somewhat resistant to widespread digital transformation for a number of reasons: lack of funding, absence of technology and technological solutions; lack of ongoing technological support and quality additional education for teachers; negative attitudes toward technology, caused by inexperience or negative experiences with technology; concerns about increased screen time and its health implications; concerns about the possible influence of technology companies on curriculum and educational policy; the need to focus on student-centered education, distance learning reduces the level of control teachers have over applicants and the learning process, increases applicants' responsibility for their learning, which requires a new approach to teaching (Azorín, Reimer, Schleiche, 2020). The complete shift to online activities during COVID-19 is especially pronounced in institutions of higher education. The transition to digital education for higher education institutions has confirmed the possibility of ensuring continuity of activities, as well as changes in the educational process, digitization of technology, the direction of efficiency to improve quality. Developed countries pay special attention to the digitalization of education and policy.

The Hungarian government pays special attention to the digitalization of higher education, which is reflected in national strategies, including the Digital Education Strategy and the Medium-Term Higher Education Strategy (2016–2030). Strategies position digitalization as a key factor in the development of a modern, competitive and attractive higher education system. The Hungarian government is investing in digital infrastructure, especially in expanding access to high-speed Internet. Higher education institutions, staff, and applicants make the most of digital methods, but gaps remain in access to appropriate digital infrastructure and equipment (OECD, 2021).

In Estonia, since the restoration of independence in 1991, the digital transformation of all state processes has played a key role (Kushpit, Balashov, 2021). Today, Estonia is one of the most digitalized countries in the world: the country ranks third in the world according to the e-Government 2020 Index, and first according to the e-Participation Index. The national education system has a special role to play in such a massive digital transformation, including the responsibility to prepare society for digitalization by teaching citizens the principles of digital literacy. According to the latest PISA study in 2018, in addition to its high digitalization scores, the state has the highest quality of secondary education in Europe; among countries in the world, Estonian students are second only to students in China and Singapore. However, digitalization is not only the focus of education, but also a tool for its improvement. This is reflected in the introduction of information technology both in educational processes and in the mechanisms of state regulation of education.

An important stage in the development of education in the country is the introduction of EHIS – Estonian Educational Information System, created in 2005 on the initiative and with the assistance of the Ministry of Education and Science of the Republic of Estonia. EHIS is an electronic database containing information about the education system, managed, financed by the state and owned by the Ministry of Education and Research of the Republic of Estonia. The main purpose of the EHIS is to systematize factual data for easy use by the Ministry of Education and Research of the Republic of Estonia and other executive authorities and local governments.

The information contained in the EHIS is used in the formation of educational policy and management decisions (monitoring funding, quality control of education, calculation of allocations to municipalities and public educational institutions, calculation of budgets by municipalities of secondary schools, planning the development of the school network, etc.). Data from the system can be accessed by service agencies and researchers from the Organization for Economic Cooperation and Development and Eurostat, who can be granted extended access to detailed information for research purposes at the request of the Ministry of Education and Research of the Republic of Estonia. Some of the EHIS information is in the public domain. The public can access the data

through Educational Eye, a publicly available online platform containing data on all aspects of education covered by the EHIS.

The public has access to information about the number of students, teachers, researchers, and scholars. "Education Eye" contains detailed information about every school in Estonia. The introduction of digital technology in the education system not only improves management efficiency, but also creates additional mechanisms to improve the quality of secondary education, and allows the introduction of other forms of learning, such as distance learning. Even before the COVID-19 pandemic, most Estonian schoolchildren were using digital tools on a daily basis and their teachers had a high level of digital literacy. The development of digital skills and the necessary IT infrastructure for distance learning has been a national priority of the Republic of Estonia for many years. That is why Estonian schools were able to adapt quickly and efficiently to the changes during the pandemic.

In Ireland (OECD), 2021, the government developed 32 digital learning standards, including digital tools to improve teaching and learning, leadership, and governance. Schools choose a standard and develop a clear digital learning plan. In Wales, the government began providing free, centralized, universal access to digital tools and resources back in 2012. The government created the Hwb platform with over 2,800 educational resources from a wide range of providers (NGOs, media organizations, museums, etc.) that can be used both in and out of the classroom by students and faculty. A government pilot project was created to study the need for resources for higher education institutions. With the onset of the COVID-19 coronavirus pandemic, Hwb has become a reference platform for distance learning and student support, as it also includes, for example, guidance on digital literacy, security, and pedagogy.

3.2. Modeling education and science policy in Ukraine

In Ukraine, in December 2016, a project entitled "Digital Agenda – 2020" was created and presented, (Chamber of Commerce and Industry of Ukraine, 2016) which identified the main areas of digitalization as public administration and education. In particular, it is said that "world experience confirms that significant economic effect as well as increased transparency and efficiency of public institutions can be achieved through the unification and standardi-zation of business processes, as well as the outsourcing of non-core business functions".

The project notes that the "digital economy" and the rapid spread of "digital" technologies make digital

skills (competencies) relevant to citizens among other skills. "Leadership of Ukrainian politicians and state profile institutions in this area, creation and coordination of initiatives, provision of resources – are a sign of active policy in the industry. "Digital" literacy (or "digital" competence) is recognized by the European Union as one of the 8 key competences for a full life and work. The authors of the project emphasized that the sphere of "digital" skills and competencies in Ukraine is developing piecemeal, chaotic, and separate from academic (so-called formal) education. Outdated teaching methods, lack of teaching standards, trained teachers, and the unavailability of digital technologies for the educational process have led to extremely low levels of digital literacy in all existing segments of the state education system (preschool, primary, secondary, higher) … today there is no state initiative, program, strategic document, vision aimed at creating a comprehensive national system for the development of digital literacy. This component is present in some legislation, but it is not properly implemented... the key solution is a combined strategy, in which there are long-term measures and scale inherent in the public education system, and short-term rapid measures, which are more relevant for implementation in the segment of commercial education".

In 2018, the government approved the Concept and Action Plan for the development of the digital economy and society of Ukraine for 2018–2020 (The Verkhovna Rada of Ukraine, 2018). Digital trans-formation in Ukraine has been identified as a priority policy. Recognitions in the implementation of Prozorro and e-Health systems, in the introduction of 4G mobile coverage and the launch of electronic services in the public and private sectors are recognized among the European expert community (Polissya Foundation for International and Regional Studies, 2020).

In 2019, the Ukrainian government presented a rather ambitious plan for the development of the country's digital economy, which provides for accelerated development to convert the Ukrainian economy to digital format. The Ministry of Digital Transformation sets priority goals until 2024.

The first steps included passing a legislative framework for basic digital rights for citizens, including the right to access broadband Internet, making technology more affordable for consumers to reduce the cost of software, computers, and other equipment.

The Concept states that "sectors of the economy that use digital technology develop faster, cheaper and better. Areas of life such as education, medicine and transportation, which are modernized through digital technologies, become much more efficient and create new value and quality". The concept focuses on the digitalization of public administration, various

spheres, including education. "Increasing the level and quality of knowledge, the formation of modern skills and competencies, the ability to obtain information, learn foreign languages, individual programs of study, preparation for the professions of the future – this is the main task of education reform in a competitive country and society. Digital technologies modernize the learning process, mobilize, differentiate, and individualize. The formation of a sound national policy of digitalization of education as a priority part of education reform is a priority".

The main stakeholders that currently implement and realize the process of digitalization of educational policy are the Ministry of Education and Science of Ukraine and the Ministry of Digital Transformation of Ukraine. They play a decisive role in shaping the relevant curricula and shaping new trends in the education system aimed at improving digital literacy of the population.

The development of digital skills of the population of Ukraine is now identified as one of the government's priorities in the process of digital transformation, which is crucial for increasing the efficiency and stimulation of the economy, creating jobs and ensuring social progress in Ukraine. The Law of Ukraine "On Education" recognizes information and communication competence as one of the key competencies necessary for every modern person for successful life. One of the tools is the digital literacy platform "Diia: Digital Education". The goal of the project is to teach digital literacy to 6 million Ukrainians in 3 years. The project includes an online component – a platform for free online digital literacy courses, and an offline component – a network of partner hubs of digital education, where one can get access to the Internet and digital gadgets. Currently, hubs are being created based on libraries and youth centers. In addition to the project "Diia. Digital Education" launched and implemented a number of initiatives aimed at developing this area (Polissya Foundation for International and Regional Studies, 2020).

1. SMB Hub Ukraine (2020) – free and interactive online learning center for small and medium enterprises. The project was launched by the Ministry of Digital Transformation of Ukraine together with Facebook. The training program was developed by Facebook experts and covers the topics of effective presentation of business projects online, brand building in social networks, building relationships with clients, creating content using free mobile applications. The platform covers a range of videos and writing to help entrepreneurs in a time of digital transformation.

2. "University of Entrepreneurship" (2020), covers the discipline "Innovative Entrepreneurship and Startup Project Management", which is integrated into the bachelor's or master's degree program and

introduced in 76 universities of Ukraine. The goal of the initiative is to create universities with a strong business culture and startup infrastructure. The program is implemented by the network of startup incubators YEP together with the Ministry of Digital Transformation of Ukraine, the Ministry of Education and Science of Ukraine, the Ukrainian Startup Fund, with the support of the USAID Program "Competitive Economy of Ukraine".

3. IT-nation educational program (2020), aimed at increasing the number of qualified IT specialists in the eastern region of Ukraine. The program was implemented under a memorandum between the Ministry of Digital Transformation of Ukraine and the Global Compact Network in Ukraine with the support of the United States Agency for International Development within the USAID Project "Economic Support for Eastern Ukraine".

4. In the context of developing digital competencies of the IT industry, the Ministry of Digital Transformation of Ukraine, the State Employment Center, the IT Ukraine Association, and the IT Academy have launched a pilot project in Kyiv – the Pathfinder test (Official website of the State Employment Service, 2021). Its goal is to help choose a profession in a promising field. Based on the user's information, the Pathfinder artificial intelligence chooses the most suitable profession from the list of current IT directions (earlier, the project developers collected information on what specialists Ukrainian IT companies need). At the second stage, project participants must pass a second test, which determines the general abilities and potential of candidates. Based on the results of the second test, candidates who will be able to study at the IT academies participating in the project are determined. The training must be paid for by the State Employment Center.

3.3. Digital transformations of education policy in European Union in the context of cooperation with Ukraine

"Digital" literacy (or "digital" competence) is recognized by the EU as one of the 8 key competences for a full life and activity. In 2016, the EU introduced an updated Digital Competence framework (EU Science Hub. DigComp 2.0), consisting of the main 5 blocks of competencies containing 21 competencies, namely:
– information literacy and data literacy;
– communication and interaction;
– digital content;
– security;
– problem solving.

EU policy on digital skills development in the Eastern Partnership countries (Armenia, Azerbaijan, Belarus, Georgia, Moldova, Ukraine) is reflected in the Joint Working Document "Eastern

Partnership – 20 Expected Achievements by 2020: Focusing on Key Priorities and Real Outcomes", developed by the European Union in December 2016 and updated in June 2017. The document proposed another attempt to define development vectors that would be based on the real progress of reforms and democratic transformations in the partner countries, supported by the European Union. Among the goals set until 2020 for the harmonization of digital markets related to digital skills, the following were highlighted:

– formulation and implementation of national strategies for digital skills (in line with similar strategies of the European Union);

– formation of national coalitions for digital skills and creation of digital jobs based on the Coalition for Digital Skills and Jobs of the European Union.

These steps have already been partially implemented in Ukraine: the Coalition of Digital Transformation (which focuses more on the full range of areas of development of the digital market in Ukraine) and began work on the development of the Concept of digital competencies in Ukraine for 2020–2027.

At the beginning of 2021, the Directorate of Digital Transformation was created in the Ministry of Education and Science of Ukraine, which is responsible for policy making in this area.

In 2021, the following steps were planned to implement the digital transformation of public policy in the field of education (Ministry of Education and Science of Ukraine, 2021):

– approve the Concept of digital transformation of education and science of Ukraine;

– provide participants in the educational process with electronic educational resources;

– create conditions for professional development of pedagogical staff of educational institutions in information and digital competence;

– ensure the functioning of the software and hardware complex "Automated Information Complex of Educational Management" (PJSC "AICOM");

– launch an information system for the management of vocational (technical) education (EMIS);

– modernize the Unified State Electronic Database on Education (EDEBO);

– create an online platform for communication between participants in the innovation process ("Science and Business");

– launch of the SELFIE project in pilot schools and vocational education institutions – a platform for educational institutions to self-assess the state of their digital readiness;

– join the process of creating and building the European Open Science Cloud (EOSC);

– improve and fill the content of the platform "All-Ukrainian school online".

3.4. The concept of digital transformation of education and science in Ukraine

The concept of digital transformation of education and science in Ukraine until 2026 was published in May 2021. The draft states that "the creation of a single digital environment uniting all subjects of educational and scientific activities, providing a space for communication and data exchange, wll significantly reduce the bureaucratic burden on the education and science system and simplify management processes. The education and science system must undergo radical digital changes and comply with global trends in digital development in order to successfully realize the potential of every individual. More and more professions require a high level of digital skills and mastery of new technologies. This need is exacerbated by the effects of the COVID-19 coronavirus pandemic, which has exacerbated the challenge of developing and adopting technology in the education system to ensure the rights of citizens to a quality education.

Acquisition of digital competencies is becoming a basic need for everyone, so the Ukrainian education system should ensure the formation of digital com-petencies of students, teachers and scientific-peda-gogical workers, the development of digital infra-structure, electronic services in educational insti-tutions in general. The implementation of the Concept enables the digital transformation of educational institutions in which teaching and research staff, as well as students, have digital competencies, are equipped with digital, modern workplaces, and have access to digital content for personal development, lifelong learning. The formation and implementation of public policy, in particular the distribution of state security, is based on real personal data, which will be centralized and protected. Scientists will have access to research infrastructures, fair access to competitive funding".

The concept contains 2 areas "Effective use of digital technologies in the educational process" and "Optimization of management, regulation and monitoring processes", which, respectively, have 3 and 2 strategic goals:

1. Digital educational environment is accessible and modern.

2. Education workers have digital competencies.

3. The content of education in the field of ICT meets modern requirements.

4. Services and processes in the field of education and science are transparent, convenient and efficient.

5. Data in the field of education and science are accessible and reliable.

The Concept contains both proposed and planned ways to achieve the goals. Proposals for the project have been sent by several different institutions and stakeholders, and it has been submitted for further work, but this Concept has not yet been adopted.

In 2021, the Ministry of Education and Science of Ukraine, the Ministry of Digital Transformation of Ukraine with the support of the Swiss-Ukrainian project DECIDE, the International Renaissance Foundation, and UNICEF created a web platform for distance and blended learning "All-Ukrainian School Online". It consists of video lessons, notes, and test assignments for students in grades 5-11.

In 2022 the Ministry of Education and Science of Ukraine together with the Ministry of Digital Transformation of Ukraine and the Pension Fund of Ukraine for the first time monitored the employment of graduates of higher and vocational higher education. Monitoring is carried out by establishing information exchange between the Unified State Electronic Database on Education and the State Register of Compulsory State Social Insurance.

An accessible list of digital projects in education and science is available on the website of the Ministry of Education and Science of Ukraine. In particular, 1) SELFIE (Self-reflection on Effective Learning by Fostering the Use of Innovative Educational Technologies) is a free, easy-to-use online tool for self-assessment of educational institutions, aimed at helping to assess the effectiveness of innovative digital technologies in education process, to find out at what stage of digital development is the educational institution; 2) All-Ukrainian online school is a web platform for distance and blended learning of students and methodological support for teachers; 3) Unified State Electronic Database on Education (hereinafter – EDEBO) – an automated system, the functions of which are the collection, verification, processing, storage and protection of information about the education system; 4) Software and hardware complex "Automated information complex of educational management" (PJSC "AICOM") – EMIS class system (Education Management Information System, electronic education management system), which is a modernized system DISO, designed to process state electronic information resources and personal data in the field of education within a single integrated environment; 5) The National Electronic Scientific Information System (URIS) (hereinafter – the System) was to become a center for combining data on the results of professional scientific and scientific-technical activities of Ukrainian scientific institutions, institutions of higher education and directly scientists; 6) Unified interdepartmental information system (Unified system) on the recruitment of foreign entrants to higher education institutions of Ukraine.

4. Discussion

The widespread digitalization of education during the COVID-19 crisis confirmed that at this scale, the process poses a number of significant risks, including unequal access to education due to the digital divide; differences in applicant skills and available support systems; the limited resources available to educational institutions in general and educators in particular to provide a quality distance learning process; the readiness of educational institutions and educators to move to an entrant-oriented learning process, which is the foundation of distance learning; the standardization of curricula and the potential influence of technology companies on education; security risks, such as data breaches, copyright, grades, etc. However, the digitalization of education also has undeniable benefits: the ability to indivi-dualize the learning experience, the ability to develop independent learning and digital skills, providing access to learning when it would not be possible, etc. (Rubene, et al., 2021).

For education and science digitalization policy to be effective, it is necessary to create a systematic mechanism for monitoring and evaluating data on digitalization in educational institutions, and to form a digitalization strategy and other regulatory documents on digitalization in education. Data collection is extremely important for policymakers to improve the quality and accessibility of educational services.

In the UK (OECD, 2021), information about the use of digital tools for teaching and learning during the pandemic was collected and analyzed to create a ten-year strategy for higher education based on digital technologies. This digital quality roadmap is based on the experiences of thousands of faculties and alumni. It can be used to develop a common understanding of how digital technologies are used in higher education, respectively, to help inform the digital education strategies of institutions (Maguire, et al., 2020).

In Ireland, the National Forum for the Improvement of Teaching and Learning, supported by government and public funding, developed a national survey on the digital experience in higher education, with the active participation of higher education stakeholders in the design and implementation of the survey. More than 30,000 responses were collected from students, faculty, librarians, and other stakeholders. The infor-mation from the survey provided a common under-standing of the needs and challenges and formed the basis for the development of a shared vision for digital higher education by state agencies and all higher education stakeholders (National Forum on Improving Teaching and Learning in Higher Education, 2020).

It is important to strengthen the financial base for digitalization of education and create a strong digital infrastructure.

The spread of information and digital technologies leads to qualitative changes in all important areas,

including education and science. In order to maximize the potential of information and digital technologies, it is necessary to clearly formulate the tasks of developing digital solutions and services, to adapt technological support to the tasks of the participants in the educational process – scientists, scientific and pedagogical workers, administrative staff, applicants and others.

The digital transformation of education and science in this direction should provide a coordinated solution of all key tasks (Kilchenko and Shynenko, 2021).

Researchers believe that the digitalization of education depends on the objective conditions and current trends in the information society, which include the following (Bykov et al., 2020):
– development of artificial intelligence, machine learning, artificial neural networks;
– ensuring the mobility of information and communication activities of users in the information space, further development of mobile-oriented tools and ICT access to electronic data;
– maximum introduction of blockchain and cryptocurrencies technologies;
– development of cloud computing and virtualization, private, public and hybrid clouds, ICT infrastructures, fog computing technology;
– development of telemedicine;
– development of new functions of added reality and availability of equipment for virtual reality and devices of mixed reality;
– widespread introduction of chat bots and virtual assistants;
– accumulation and processing of significant amounts of Digital data, formation and use of electronic information databases and systems (Big data, Data mining, Data bases), in particular, electronic libraries, repositories and Scientmetric data bases;
– development of characteristics of Internet of People (IoR) users, deployment of Broadband Communication Channels, systems of formation of ICT spaces of wireless access of users to electronic data (Cordless Access to Digital Data, WiFi, Bluetooth, Cellular Networks);
– formation of the Internet of Things (IoT), development of its software and hardware, including Micro-processor and integration platforms, to ensure the configuration, management and monitoring of electronic devices using modern telecommunications technologies;

– development of robotics, robotic systems, in particular, 3D printers and 3D scanners;
– development of the software development industry, in particular the publication of electronic educational resources;
– ensuring the compatibility of ICT tools and ICT applications created on different software and hardware platforms;
– development of market of ICT outsourcers, primarily cloud services, and the computing center network;
– development of Data Security and Counteraction of Cybercriminality.

5. Conclusions

The digital transformation of education involves the formation of a systematic approach to the creation and implementation of educational policy, involving experts both in education and from among IT specialists, as well as students, teachers, and management personnel.

The effectiveness of digital transformation can be tested through three main approaches – the availability of appropriate digital technologies and public policies that support digitalization of education; student and faculty use of technology and changes in teaching and learning practices in a digital environment; and the impact of digitalization on improving the effectiveness, quality, and equity of education.

Policy making is a rather complex and ambiguous process. In times of uncertainty, crises, pandemics and abrupt changes (the process of policy making) requires special attention and flexibility. In times of crises and uncertainty, trust in government and the ability to synthesize information from many sources, analyze information, and communicate with the public in a prompt, high-quality, and timely manner is important.

Effective communication, the establishment of clear rules and norms, and compliance with them, builds public trust in public policy. Digitalization creates such an opportunity and opens new perspectives for education, because digital technologies, contributing to the transformation of society, management processes, economy, etc., require the expansion of digital skills of the population, that is, the expansion of opportunities in education.

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