Zeszyty Naukowe
Wyższej Szkoły Bankowej w Poznaniu
2020, t. 89, nr 2
DOI: 10.26349/zn.wsb.w.poznaniu.0089.04

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Trends in state policy with a view to improving structural characteristics of the digital economy

Abstract. *The article identifies the need for state regulation of the digital economy, which is mainly due to trends in digital technology development. The authors define and systematise tools (mechanisms, factors) of state regulation regarding the development of the digital economy sector. They describe the environment and factors affecting the digitalization of the Ukrainian economy and make comparisons with the neighbouring countries. They also identify priorities of state policy aimed at fostering the development of the digital economy, such as increasing the use and areas of application for artificial intelligence, implementing the Internet of things, creating digital platforms for user interaction (e-business), strengthening state support for digital transformation processes in basic economic activities, promoting business models based on the concept of the sharing economy, ensuring the virtualization of physical infrastructural IT systems and transition to service models. Finally, the authors describe the tasks of entities of the digital economy regarding the formation of systemic links between sector development and the country's economic growth.*

Keywords: *digital economy, public policy, digital technologies, economic growth*

1. Introduction

Ensuring the high effectiveness of state policy of the development and realization of the digital economy sector potential requires the awareness of its strategic priorities, which must be achieved. The effectiveness of state policy of the economy digitalization increases many times if it focuses not only on the activities of economic agents, but also on society and public administration, which simultaneously complicates the strategic planning process, significantly increases financial, institutional, organizational, resource, time and other components of cost capacity.

These and other features highlight the importance of both identifying strategic priorities and justifying the stages of their achievement, which allowed defining the next strategic stages of state regulation in the analyzed area – (1) formation of the potential of the national sector of the economy digitalization, (2) establishment and strengthening of its competitiveness, (3) implementation of the digital economy sector potential in the system of the development of the national economy and information society. It is this sequence of state design of the digital economy sector development in which it is possible to determine the structural characteristics of its future trends. In addition, the tasks for entities of the digital economy sector, which will be able to ensure the country's economic growth, should be set in the state system of economic regulation.

2. Research purpose

The study of the scientific research results on the development of the country's economy and strengthening in digital technologies has confirmed the importance and need for the interference of the executive branch with ensuring the necessary level of effectiveness of such trends. Accordingly, the tools should be implemented in the system of state regulation on the basis of which it will be possible to achieve the desired results. All this requires the development of state policy areas that will serve as guidelines for improving structural characteristics of the digital economy.

The purpose of the article is to substantiate the state policy trends to improve structural characteristics of the digital economy sector, taking into account the tasks of entities of the digital economy sector on forming systemic links between the sector development and ensuring the country's economic growth.

3. Research methodology

The study of the methodological principles and characteristics of the economy digitalization processes has provided the opportunity to identify and systematize the main mechanisms and tools of state regulation in order to influence the processes of creating an appropriate environment for the formation and development of a digital economy; resource provision of planning and implementation of digitalization processes; development of a related and supporting infrastructure of the digital economy; and the changes in the business climate are related to the state of the market of innovative and digital technologies in order to form and develop the digital sector and ensure the growth of the economy's competitiveness (Table 1).

Studying the experience of the world's leading countries on the methodology of formation and implementation of the processes of digitalization and development of the digital economy, the dominance and active use of legal, economic and administrative groups of methods should be noted. Thus, Great Britain became the first country to establish the Ministry of Digital Economy as a state institution responsible for managing the country's digitalization processes and to introduce a wide, large-scale use of "cloud technologies" with the creation of "Data centers", "G. Clouds" [Pilorget, Schell 2018: 55-71].

The important aspect of functioning of the Digital Single Market in the EU countries and around the world is digital integration, namely the compatibility of standards, protocols, interfaces. Today, EU and US standards are widespread throughout the world [Curran 2018: 210-215]. Accordingly, the introduction of unitary digital standards is an important and necessary condition for successful integration of countries into the European and world economic space.

According to the survey of 31 countries conducted by the OECD experts, the main tools for overcoming the "digital divide" during 2020-2023 will be: intensification of private investment; development of programs for digital transformation of public finances, active use of electronic payment systems, development of the implementation and regulation of state programs for the development of a digital economy [OECD Digital Economy Outlook 2017: 22-37].

Thus, the study of methodological tools for state regulation of the development of the economy's digital sector makes it possible to distinguish a key role of the state in initiating and developing such processes both at the level of adoption and implementation of state concepts, strategies and targeted programs of the digitalization of the country's industries and spheres of life and in creating a set of mechanisms and tools to overcome the "digital divide" between the

Table 1. Tools for state regulation of the digital economy

Mechanisms	Factors in the development of digitalization			
	Environment	Resource provision	Infrastructure	Conjuncture
Institutional and legal	Development and adoption of the Law "On Digital Economy", Strategies for Digital Development of the National Economy, targeted programs for digitalization of areas and sectors of the economy	Development and adoption of concepts: "Industry 4.0.", "Digital Production", "Internet in Industry", "Open Production"; changes in legislation on the recognition of crypto currencies	Creation of a body for coordination of actions on digitalization of economy; building institutions for the development of the digital economy	Development of the concept of industrial transformation and formation of a single digital space with the EU; ensuring intellectual property rights
Economic	Conducting analysis and research of industrial sectors in order to assess their competitiveness and development prospects; improvement of tax, customs, investment, innovation policy	Improving the instruments of tax and customs policy on the introduction of special import duties on machinery and technology; creation of special funds for joint venture investment; public procurement and procurement in the digital economy sector	Introduction of concession and service models of financing and management of investment projects of infrastructure development; lending for digitalization development projects	Liberalization of state policy in the field of non-cash payments, currency regulation, free access to the use of international payment systems
Administrative and organizational	Transition to e-government systems to expand access to broadband Internet; licensing of technologies and services	Development of regulations for the transition to electronic document management and digitalization of technical documentation; recognition of international Industry 4.0 standards; standardization and certification of technologies	Development and operation of innovation-industrial and digital infrastructure	Improving the legal framework for intellectual property, protection of private data, cyber security
Information and socio-psychological	Adoption and implementation of national digitalization projects, implementation of effective models of public-private partnership	Formation of educational programs with the definition of new educational (digital) competencies of staff; making changes to the classifier of professions with the development of a list of new professions	Connection to broadband Internet and mass use of digital platforms, tools and devices	Introduction of digitalization in the social sphere, public administration; improving digital education, skills of citizens
Technical and technological	Development and implementation of projects of gradual digitalization of industries, social sphere and public administration	Introduction of "cloud technologies" for information storage and resource allocation, transition to mass production of robotic production technologies	Stimulating the introduction of devices, mobile technologies for control and management of business processes	Development of e-commerce technologies, transition to sales via the Internet; introduction of e-business processes, digitalization of production

Sources: author's own research.

existing state of engineering and technology and ensuring the rapid development of fundamentally new (particularly in the technical and technological aspect) industries and economic activities.

4. Results

4.1. Comparative characteristics of the digital economy (on the example of Ukraine)

In today's world, the prerequisites for economic development increasingly depend on the level of digital technologies and development of the digital economy sector, which provides economic growth through the integration and positive impact of digital technologies on the quality and effectiveness of socio-economic processes [Ilyash, Dzhadan, Ostasz 2018: 317-318]. Assessing the potential of the digital economy and financial efficiency, scientists point out that the expected revenue from digitalization in the coming years by 2025 could reach $ 30 trillion USA [Richardson 2020: 318-320].

Regarding Ukraine, the formation of the digital economy sector at the current stage of development is in the focus of strategic priorities of state policy [Vasyltsiv, Lupak, Shtets 2020: 14-19]. Thus, according to the annual ranking of countries by the level of network readiness of the economy, Ukraine in 2019 ranked 67th out of 121 countries, i.e. the Ukrainian economy had the state of network readiness below average.

The low technological readiness of Ukraine's economy for the active development of the information sector has become both a consequence and a reason for the country's lag in the ranking of the Global Innovation Index. In 2019, Ukraine ranked 47th out of 129 countries analyzed. Although, in 2012-2019, Ukraine's position in the ranking improved: in 2019 compared to 2012 – by 16 rating positions, and compared to 2013 – by 24 rating positions, which is significant.

This shortcoming is exacerbated by still low values of high-tech exports in the structure of industrial exports of Ukraine compared to other countries (Table 2). Thus, in Ukraine in 2018 the share of high-tech exports amounted to slight 5.4% and over the past eight years the number has increased by only 1.1 p.p. (from 4.3% to 5.4%) and over the past year, on the contrary – has decreased by 0.9 p.p., which hinders the information and technological progress of the national economy.

It should be noted that the world average value of this indicator in 2018 was 17.9% (which was 13.5 p.p. more than for Ukraine), and the European average – 15.9% (by 10.5 p.p. more). The values of the analyzed indicator are much higher

Table 2. The share of high-tech exports in the structure of industrial exports of Ukraine and other countries in 2010-2018 [in %]

Countries	Years									Absolute deviations, ±	
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2018 / 2005	2018 / 2017
Ukraine	4.3	4.9	6.9	6.7	7.5	8.5	7.2	6.3	5.4	+1.1	–0.9
World	20.6	18.7	19.0	19.1	19.1	20.0	20.0	21.6	17.9	–2.7	–3.7
EU, including	17.0	16.3	17.0	17.1	17.2	17.8	18.0	16.4	15.9	–1.1	–0.5
Poland	7.7	6.6	7.9	8.8	10.2	11.0	11.0	10.9	10.6	+2.9	–0.3
Hungary	25.9	25.2	21.2	19.4	16.7	17.2	17.5	17.3	16.9	–9.0	–0.4
Romania	12.5	11.6	8.1	7.4	8.4	9.4	10.4	9.8	10.1	–2.4	+0.3
Slovakia	7.1	7.4	9.6	11.0	11.1	11.2	10.7	11.8	10.6	+3.5	–1.2
Russian Federation	9.6	8.5	9.2	10.7	12.1	16.4	10.1	11.6	10.9	+1.3	–0.7
Belarus	3.0	2.5	2.9	4.5	4.1	4.4	4.8	4.3	3.9	+0.9	–0.4
Moldova	9.7	7.4	5.1	2.7	5.3	4.6	3.4	5.3	2.5	–7.2	–2.8

Sources: compiled by IMD World Digital Competitiveness Ranking 2020.

for Ukraine's neighbouring European countries, and at the same time Ukraine is ahead of only Belarus and Moldova of the neighbouring countries.

As a result, these circumstances can be considered both a factor and a reason for the low digital competitiveness of Ukraine's economy. If in 2014 Ukraine ranked 50th out of 60 countries, by 2019 it had dropped to the 60th place out of 63 countries.

In other words, only three countries analyzed in 2019 in this ranking had the worst value of the integrated indicator of digital competitiveness, which directly proves the low level of development and competitiveness of the digital economy of Ukraine.

4.2. Substantiation of strategic priorities of the state policy of digital economy development

The strategic stage of state regulation of the digital economy sector development is to expand the sector's scale and increase the economic activity volume [Lupak, Kunytska-Iliash 2017b: 40-41]. This is facilitated not only by increasing the range of goods (services) with the content of information technology in most economic activities, but also directly by expanding the range of modern technologies used in the economy. It should be remembered that the information technology field is developing rapidly and the technologies which are leading today, in the near future may be considered obsolete and irrelevant [Varnaliy,

Onishchenko, Masliy 2016: 22-23]. Thus, it is necessary to work ahead, taking into account current trends in digitalization (Table 3).

As a result of summarizing modern research results in the digital economy field, a number of conclusions can be drawn related to the specialization of state policy aimed at increasing the economic activity volume in the sector. This is, firstly, the popularization of the idea that information (digitalization of goods and services) is increasingly becoming a key factor of competitiveness, because it increases the level of the enterprise product accessibility and improves its quality characteristics [Ilyash et al. 2020: 96-101]. Along with popularization, it is important to work on leveling the existing barriers to the spread and use of digital technologies, in particular by institutionalizing norms, rules, standards, procedures, regulations for working with information data; elimination of imperfections of the system of protection and defense of intellectual property; increasing the level of cyber-security; development of competencies of the population, as well as employees of enterprises regarding the work with digital data [Kutsyk, Protsykevych 2018: 141-143; Vasyltsiv, Lupak 2016: 53-57].

Table 3. Staging of digital technology development trends

Stages	Current digital technologies
Trends of the beginning of the XXI century	• a personal computer; • smartphone; • high speed internet; • cloud information databases; • social networks
Current trends	• virtual reality / augmented reality / mixed reality; • portable devices; • smart homes; • connected cars; • drones; • sensors, sensors; • nanotechnology; • big data analytics
Landmarks in the development of trends	• implant technology; • Artificial Intelligence; • robotics; • blockchain and cryptocurrencies; • 3D printing; • distributed calculations; • self-driving machines; • shared economics; • new technologies in energy

Sources: author's own research.

The use of artificial intelligence can be considered a promising trend for the development of the digital economy market and increasing its capacity [Manyika 2016: 50-71]. Today, artificial intelligence technologies are becoming more widespread in robotics, machine and tool engineering, image visualization techniques, complex and in-depth research, and natural language processing. The development of this segment of digitalization market will take place naturally, but it is possible to significantly accelerate necessary processes through the participation of state regulation, aimed at supporting educational programs to train specialists, creating a favourable environment for investment attraction in the sphere of the artificial intelligence use, development, financing and implementation of programs with clearly defined projects for the artificial intelligence development in basic economic activities, in particular at the level of regions with high potential for innovation and technological development, IT and staffing, coordination of directions and parameters of IT development and digitalization infrastructure in accordance with the needs of artificial intelligence segments.

Another important trend in this area concerns the development of the Internet of things [Gorbulin, Kaczynski 2010: 105-116]. It involves connecting to the Internet and digitalizing almost all physical things and objects, which can then be accounted for and exchanged, bought/sold, consumed, etc. in digital form. The formation of the Internet of things market today is one of the global trends and it is expected that in the near future this market can almost completely displace the market of traditional goods and services. Accordingly, it is also important for businesses to develop in this direction, digitizing more and more of their own products.

From the point of view of the public administration system, it is important to promote such initiatives, in particular, to develop the awareness of business representatives on the benefits of using technologies of the Internet of things, to support and stimulate various initiatives of innovation and technology, as well as start-ups in the Internet of things to train specialists and engineers in the field of operational technologies.

Such digital platforms as so-called virtual environments of user interaction for communication and business cooperation (e-business) use no less potential for development in the world practice today. The peculiarity of their operation is that the interaction takes place not on a specially created information platform, but on the basis of users' resources – participants of such a system, when each user creates so-called utility (network effect) for others, which together becomes a development resource [Vasyltsiv et al. 2019: 315-318]. The economic advantages of such systems are the improvement and digitalization of business processes (not only internal but also inter-subjective ones), obtaining synergy effects due to building up both vertical (from the producer to the consumer) and horizontal (between enterprises of one area) information relations and electronic interaction.

The strategic advantage of the formation and development of digital platforms is the ability to create digital clusters, where their participants stay within a closed (partially closed or open) internal electronic and digital system [Kutsyk, Protsykevych 2019: 6-10].

In the future, the prospect leads even to the formation of a single digital domestic market with not so much traditional structuring of the economy into economic activities and industries, but into digital segments of the domestic market, vertical and horizontal systems, local production and trade complexes, corporate structures [Lupak, Kunytska-Iliash 2017a: 118-121].

In the EU, such processes are already developing. This is a Digital Single Market project, organized to establish e-business interaction between companies from different countries of the Euro-zone. Each country has a chance to join this system and, thus, not only accelerate European integration aspirations, but also reach a better stage of development of the digital economy sector, in particular – e-business. To do this, we should work now on the implementation of e-IDAS regulations, joining the programs: Interoperability Solutions for European Public Administrations 2, e-CODEX, e-Invoicing, Single Digital Gateway, harmonization of digital interaction with EU customs services on the basis of a single unified document (SAD) and goods movement monitoring systems (NCTS).

The state support of digital transformation processes in basic economic activities is also important. The question is primarily about the development and implementation of state and regional strategies and programs to intensify activities in the digital economy in various industries, sectors of the economy, economic activities at all the levels – macro-, meso-, sectoral, micro- [Havlovska et al. 2019: 2217-2221]. The implementation of such programs allows further developing the infrastructure of the digital economy, stimulating businesses to use digital tools and solutions, creating new industries, cooperating with the research sector, development and implementation of technological innovations, promoting the development of digitalization from the bottom up, including from school to business.

The spread of business models that belong to the ideology of a sharing economy is becoming increasingly important [Alcácer, Cantwell, Piscitello 2016: 501-205]. It is a question of digitalization and transfer of various kinds of relations to the information field, such as joint use of office and warehouse premises, fixed assets, financial, human and other resources, technologies, business operations, etc. To develop this area of the digital economy, it is necessary to implement a number of institutional and organizational tools aimed at improving the legislation in terms of functioning of economic agents within a sharing economy, accession to international legal practices regulating financial and economic relations (including international), the sharing economy, simplification of business conditions in the system of relations of a sharing economy, stimulation

of the creation and development of new marketplaces and participation of business entities in projects within the limits of commercial digital globalization.

The most promising areas of the development of the digital economy sector and expansion of its capacity should also include the virtualization of physical infrastructural IT-systems and transition to service models [Willcocks, Lacity 2006: 77-101]. This business direction can be fully attributed to elements of the digital economy infrastructure, as it concerns the creation of an appropriate service for users, which they use for a certain period of time. At the same time, a sufficient level of the cyber-security of data is guaranteed. The project of the virtualization of physical infrastructural IT-systems and service models is based on the use of cloud technologies and software-defined architecture.

Within the framework of state regulation of the development of this segment of the digital economy sector [Vlasiuk et al. 2016: 144-152], it is necessary to discuss the formation of relevant legislation regulating relations and rights in the field of cloud technologies, initiating and implementing pilot projects on the virtualization of physical infrastructural IT- systems and creating service models

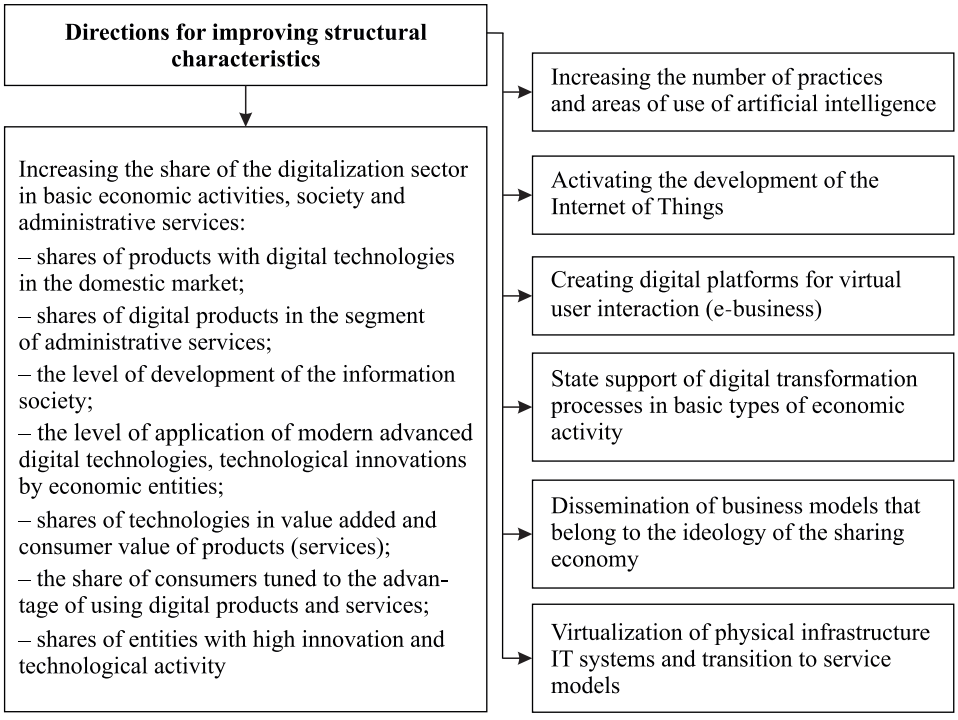

Fig. 1. Directions of state policy to improve the structural characteristics of the digital economy sector

Sources: author's own research.

in public administration, functioning of establishments of social infrastructure, consumer services, improving the business environment and implementation of a number of incentives for cloud service providers.

The implementation of the above mentioned directions of the development of the digital economy sector will objectively contribute to the formation and strengthening of its competitive position. At the same time, trends should be further developed which have the effect of improving structural characteristics of the national economy sector and increasing its share in the economy [Vasyltsiv et al. 2020: 3175-3179]. This is the next of the strategic priorities of state policy, defined by the authors.

It should be understood that the rational structure of the digital sector has two interrelated components: 1) internal – development and expansion of activities in the priority areas of the national economy digitalization, 2) external – posi-

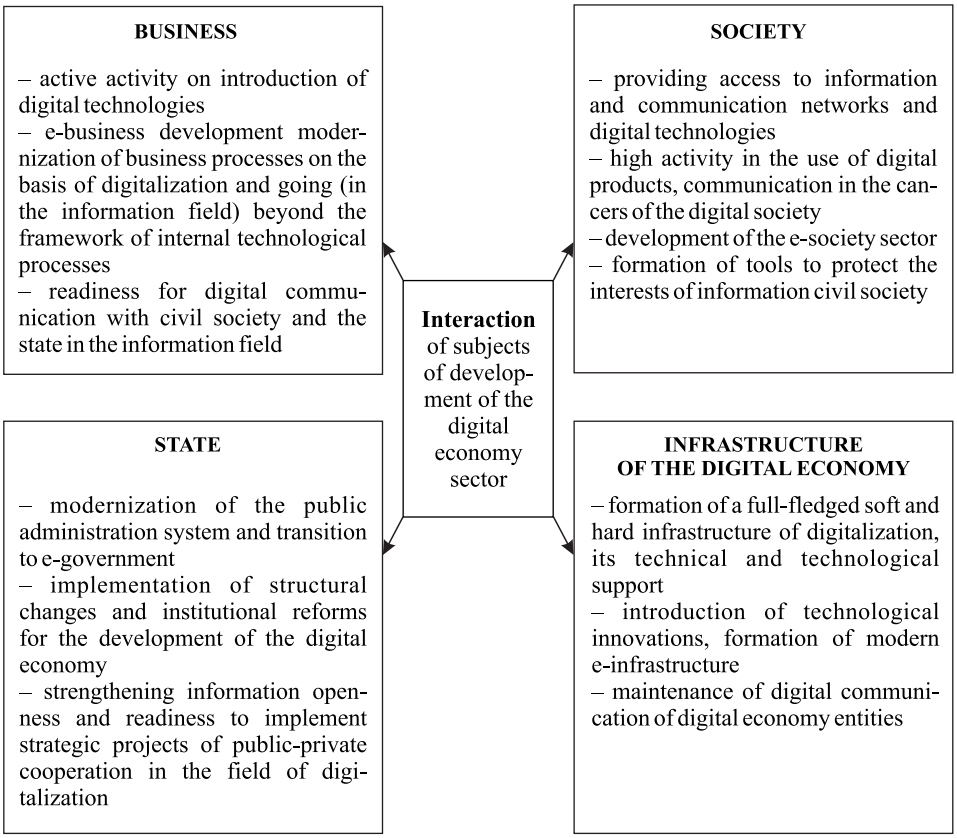

Fig. 2. Tasks of subjects of sector of digital economy in the context of formation of system communications of development of sector and maintenance of economic growth of the state

Sources: author's own research.

tive impact and contribution of digitalization to increasing the share of digital technologies in traditional economic activities in particular basic economic ones (Fig. 1).

The implementation of the above defined measures will contribute to the formation and strengthening of competitive positions of the digital economy sector, which will allow moving to the next strategic stage of state regulation. This is the realization of its economic potential in the national economy and the information society development.

And this can be possible only as a result of achieving such a strategic priority of state policy in this area as the formation of systemic links and a strong contribution of the digital economy sector to economic growth. Such relationship and contribution are possible when the initiative comes from both the top and bottom, from key entities – business, the public and state, based on the model (Fig. 2).

5. Conclusions

Given the implementation of the identified tasks and inclusion of the main entities in a single system of functioning and development of the digital economy sector, full conditions will be created for the implementation of large-scale national projects in the field of the country's social and economic development. Accordingly, it is necessary to take advantage of this, having achieved such a strategic priority of state regulation in the analyzed area as the effective implementation of strategic national projects in the digital economy.

Without resorting to the disclosure of instruments and means of state regulation, the specialization of such projects should relate to:

– building up a hard and soft national infrastructure for the digital economy development;
– digitalization of social infrastructure facilities;
– e-government development;
– creation of "smart" cities;
– modernization of customs on the basis of the formation of electronic customs;
– transition to Industry-4.0;
– full-scale digitalization;
– creation of high-tech clusters;
– stimulating inter-corporate electronic interaction and creation of branch digital platforms.

This list of national projects is not exhaustive and should be developed, changed, supplemented as the digital economy develops, as well as taking into account globalization trends, features of functioning and the state of use of the

economic potential of development of the economy's certain sectors, territories. But, under any circumstances, the vector of state policy for the development and the widest possible use of opportunities of the digitalization sector should be strategic. To do this, public administration bodies need to remove all institutional barriers, form a proper regulatory framework, and introduce a system of measures to stimulate the digitalization of economic and business sectors, initiate and complete a number of large-scale national and local public and private partnership projects.

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Kierunki polityki państwa w celu poprawy cech strukturalnych sektora gospodarki cyfrowej

Streszczenie. *W artykule wskazano na potrzebę państwowej regulacji gospodarki cyfrowej, która wynika głównie z trendów w technologii cyfrowej. Zdefiniowano i usystematyzowano narzędzia (mechanizmy, czynniki) państwowej regulacji rozwoju sektora gospodarki cyfrowej. Przeprowadzono analizę otoczenia i czynników wpływających na przebieg cyfryzacji gospodarki na Ukrainie oraz dokonano porównania z krajami sąsiednimi. Opisano priorytetowe kierunki polityki państwa mające na celu zapewnienie rozwoju gospodarki cyfrowej w zakresie zwiększania obszarów wykorzystania sztucznej inteligencji, wdrożenia Internetu Rzeczy, tworzenia cyfrowych platform umożliwiających interakcje użytkowników (e-biznes), wsparcia transformacji cyfrowej w podstawowych rodzajach działalności gospodarczej, rozpowszechniania modeli biznesowych w ramach ekonomii współdzielenia, wirtualizacji infrastruktury fizycznej systemów informatycznych i przechodzenia do modelu usługowego. Określono zadania podmiotów sektora gospodarki cyfrowej w kontekście tworzenia powiązań systemowych między rozwojem sektora a zapewnieniem wzrostu gospodarczego kraju.*

Słowa kluczowe: *gospodarka cyfrowa, polityka publiczna, technologie cyfrowe, wzrost gospodarczy*