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DIGITAL TRANSFORMATION POLICIES TO DEVELOP AN EFFECTIVE ECOSYSTEM: THE CASE OF UKRAINE

The article analyzes the evolutionary development and implementation of the digital transformation policy on the way to building the digital economy of Ukraine. The need to carry out reforms, improve the investment climate, and economic recovery prompted the state to develop a legal basis for future digital transformations in the development of the national ecosystem. Along with this, the above-mentioned steps contribute to the further integration of Ukraine into the EU. Using advanced technologies, such as artificial intelligence, blockchain, analysis of large data sets, and others, digitalization becomes a key driver in the creation of innovative products and services, which in turn increases the competitiveness and efficiency of the socio-economic model of the state as a whole. But with the beginning of a full-scale military invasion of the russian federation into Ukraine, the state is forced to look for non-standard solutions for the continuation of the digital transformation policy. Currently, the question arises of the need to conduct an in-depth analysis of the key elements of the ecosystem of IT startups and determine the role of the state in the use of relevant tools and reforms on the path of further effective digital transformation in all sectors of the economic complex.

In the course of the research, it has been found that the scientific and technological potential in Ukraine continues to decline in the period after the signing of the Ukraine-EU Association Agreement. At the same time, the issue of innovative development of Ukraine has been in the center of attention of the government, a number of donor structures, and the expert-scientific environment of Ukraine for the past several years. The Government of Ukraine has launched a number of initiatives aimed at creating opportunities for the development of the domestic ecosystem of innovations, information and communication technologies (ICT) and startups, among which such promising and ambitious projects as: "E-residency" (creating conditions for non-residents to conduct business in Ukraine without a physical presence on its territory), "Diia.City" (a unique legal and tax space for IT business in Ukraine, which aims to give companies and startups effective tools for intensive development, scaling and capitalization), an online platform of the current status of the Ukrainian IT ecosystem (will provide an opportunity to search for business information about IT companies, professionals, investors and, in general, the entire technological ecosystem of Ukraine), development of the Concept of the Development of Artificial Intelligence in Ukraine (covers 9 fields: education and science, economy, cyber security, information security, defense, public administration, legal regulation, justice) and others.

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According to the results of the study, it becomes clear that in the era of rapid technological progress, the development of digital technologies has transformed the way of doing business, making it more dynamic and global. Management of digital ecosystems requires the state to develop adequate legal and regulatory frameworks. Intensive cooperation and financial support, even under martial law, will allow Ukraine to actively develop infrastructure, promote digital transformation, strengthen technological potential, sustainable economic recovery and deepen integration into the European digital market. Currently, there is no doubt about the need to strengthen efforts to implement current and prospective programs of digital reform of the ecosystem of Ukraine.

Keywords: digital transformation, ecosystem, IT sector, state policy, reforms, artificial intelligence, investments, startup

JEL classification: ***O33, O35, O38, Q56***

У статті проведений аналіз еволюційного розвитку та впровадження політики цифрової трансформації на шляху розбудови цифрової економіки України. Необхідність проведення реформ, покращення інвестиційного клімату, економічного відновлення спонукало державу розробити правову основу майбутніх цифрових перетворень у розвитку національної екосистеми. Поряд з цим вищевказані кроки сприяють подальшій інтеграції України в ЄС. Використовуючи передові технології, такі як, штучний інтелект, блокчейн, аналіз великих масивів даних та інші, цифровізація стає ключовим драйвером в створенні інноваційних продуктів та послуг, що в свою чергу підвищує конкурентоздатність та ефективність соціально-економічної моделі держави в цілому. Але з початком повномасштабного військового вторгнення Російської Федерації в Україну, держава вимушена шукати нестандартні рішення щодо продовження політики цифрової трансформації. Наразі постає питання необхідності проведення глибокого аналізу ключових елементів екосистеми ІТ-стартапів та визначення ролі держави в використанні відповідних інструментів та реформ на шляху подальшого ефективного цифрового перетворення в усіх галузях господарського комплексу.

В процесі дослідження було виявлено, що в Україні продовжується зниження науково-технологічного потенціалу в період після підписання Угоди про асоціацію Україна-ЄС. Разом з тим питання інноваційного розвитку України протягом останніх кількох років було в центрі уваги уряду, ряду донорських структур та експертно-наукового середовища України. Урядом України розпочато ряд ініціатив, спрямованих на створення можливостей для розвитку вітчизняної екосистеми інновацій, інформаційно-комунікаційних технологій (ІКТ) та стартапів, серед яких можна виділити такі перспективні та амбітні проекти як: «Е-резидентство» (створення умови для нерезидентів вести бізнес в Україні без фізичної присутності на її території), «Дія City» (унікальний правовий та податковий простір для ІТ-бізнесу в Україні, який має на меті дати компаніям та стартапам дієві інструменти для інтенсивного розвитку, масштабування та капіталізації), онлайн-платформа поточного статус у української ІТ-екосистеми (надаватиме можливість для пошуку бізнес-інформації про ІТ-компанії, професіоналів, інвесторів та загалом всієї технологічної екосистеми України), розробка Концепції розвитку штучного інтелекту в Україні (охоплює 9 галузей: освіта та наука, економіка, кібербезпека, інформаційна безпека, оборона, публічне управління, правове регулювання, правосуддя) та інші.

За результатами дослідження стає очевидно, що в епоху швидкого технологічного прогресу розвиток цифрових технологій перетворив спосіб ведення бізнесу, зробивши його більш динамічним та глобальним. Управління цифровими екосистемами вимагає від держави розробки адекватних правових та регуляторних рамок. Інтенсивна співпраця та фінансова підтримка, навіть в умовах воєнного стану, дозволять Україні активно розвивати інфраструктуру, сприяти цифровій трансформації, зміцненню технологічного потенціалу, стійкому економічному відновленню та поглибленню інтеграції до європейського цифрового

ринку. Наразі необхідність посилення зусиль щодо реалізації поточних та перспективних програм цифрового реформування екосистеми України не викликає жодних сумнівів.

Ключові слова: *цифрова трансформація, екосистема, IT-сектор, державна політика, реформи, штучний інтелект, інвестиції, стартап*

JEL classification: ***O33, O35, O38, Q56***

Statement of the problem and its connection with important scientific or practical problems. The role of government in the global digital transformation is multifaceted and critical. Digital transformation refers to the integration of digital technologies into various aspects of society, economy, and governance, and it has the potential to drive innovation, economic growth, and improve public services. Governments play a key role in facilitating and regulating this transformation, in particular, in creating a conducive environment for entrepreneurial ecosystem and innovation by investing in and maintaining robust digital infrastructure, which, in turn, attracts investment in startups and fosters economic growth. The development of the digital economy in Ukraine became possible thanks to targeted government policy. In the early 2020s, the priority of the Cabinet of Ministers and Deputies was the structural transformation of the Ukrainian economy, where innovation and digitalization became key drivers. The Strategy for the Development of the Digital Economy was adopted and the basic conditions for its development were created – working legislation, access to a sufficient amount of capital, in particular venture capital, an education system that allows graduates of higher educational institutions to be competitive and meet the challenges of the current technological system. Digital transformation is playing an increasingly important role in economic recovery and the implementation of reforms in Ukraine in all areas of the economic complex. Digital transformation is also driving progress in Ukraine's accession to the EU and plays an important role in the development of the national ecosystem of innovation, information and communication technologies and start-ups. This happens because digitalization makes technology more accessible to a wider range of people and organizations. This creates new opportunities for startups that can use these technologies to create new products and services. Increasing innovativeness occurs through the ability of startups and enterprises to use advanced technologies such as artificial intelligence, blockchain, Internet of Things and data analytics. Creating innovative products and services increases competition and promotes innovation.

Before the war, Ukrainian startups were the driving force of the state's IT community. Today they are forced to seek help to continue their work. During 2023, in the context of a full-scale military invasion of the russian federation, Ukraine continues to work on the digital transformation of the economy based on the introduction of innovations, optimization and transfer of government business regulation instruments into electronic form, as well as the integration of the Ukrainian innovation ecosystem into the European network. The future of the entire Ukrainian technological ecosystem will depend on the effectiveness of these processes today. Therefore, today it is very important to explore the state and legislative trends in the ecosystem of innovation, information and communication technologies and startups in Ukraine and determine whether domestic digital transformations and their institutional conditions correspond to external challenges and the European agenda.

Analysis of recent studies and publications, which laid the foundation for solving the problem under study, and highlighting previously unresolved parts of the general problem, which are the subject of the article. The importance of the state in the development of the Ukrainian ecosystem of innovation, information and communication technologies and startups stimulates interest in considering this issue in the scientific community of both domestic and foreign researchers.

The work of P.T. Roundy, M.A. Bayer, A. Patnaik, S.S. Pasumarti, B. Nayak explores the main aspects that government and local government policies should take into account when shaping the startup entrepreneurship ecosystem. Among domestic scientists, the issue of developing the ecosystem of the business environment was considered by O. Kotko, O. Gumenna, L. Hanushchak-Efimenko.

Sytnik, Kravchenko & Gazaryan, Boyarynova & Kopishynska highlight the features of the formation of the domestic ecosystem of startup entrepreneurship, which began to actively take shape after 2010 [1-3]. Litvin studies the history of creation and the current state of the startup entrepreneurship ecosystem in Ukraine [4]. Bedrynets conducts research into the ecosystem for the development of small businesses in Ukraine and the possibilities of its financial support [5].

The role of the state in stimulating the development of the startup ecosystem using the example of Western European countries was studied in the work of Kurchenko [6]. Scientists Pedchenko et al. determine the directions for adapting international experience of state support for the digitalization of small and medium-sized businesses [7].

Kulinich cited the main results and advantages of the digital transformation process for domestic enterprises, and noted the obstacles to its implementation [8].

At the same time, despite the presence of studies on the features of digital transformation of business in war conditions more emphasis should be placed on government support for business under martial law by providing them with experience in business digitalization in modern conditions with the aim of further developing the ecosystem of innovation, information and communication technologies and startups in Ukraine [9].

Statement of the objectives of the article. The article presents a case study showing how policies for digital transformation have contributed to the development of ecosystem of innovation, information and communication technologies and startups in Ukraine. The purpose of this article is to provide a detailed analysis of the key elements of the IT startup ecosystem, including the role of governmental programs.

Presentation of the main research material with full justification of the scientific results obtained. During a full-scale war, the IT sector and Ukrainian government technology are already demonstrating their resilience, being one of the few industries in Ukraine to show real economic growth, demonstrating that IT is the key to Ukraine's economic recovery. Starlink communications, the growing performance of leading IT export companies in Diia.City, the Ukrainian Cyber Army, the Drone Army, the national GIS or Geographic Information *System* and the state crypto fund are just a few examples that make IT one of the basic pillars of Ukrainian resilience online and offline. In 2022, despite the full-scale invasion of russia, the IT industry provided the Ukrainian economy with $7.3 billion export earnings [10]. Before the full-scale war, the national IT market generated more than 4% of GDP. Currently, Ukraine is one of the most progressive digital states in the

world, and its IT sector - one of the largest exporters of IT services in Europe and the second largest export in Ukraine - shows high resilience in war conditions and remains the only export industry of Ukraine that is fully operational in wartime.

Thus, Ukraine is indeed emerging as a notable player in the global startup ecosystem. Several factors contributed to the growth of Ukraine's startup scene (Table 1).

Table 1

Factors that contributed to the growth of Ukraine's IT startup ecosystem

1	Skilled IT Workforce	Ukraine has a well-educated and technically proficient workforce, particularly in the fields of software development and IT. Many Ukrainian IT professionals have strong English language skills, which is important for working with international clients and collaborating with teams worldwide. IT workforce has experience in remote work, which became even more important during the COVID-19 pandemic. Ukrainian IT professionals are accustomed to working with clients and teams from different time zones.
2	Cost-effective labour	While offering highly skilled professionals, Ukraine remains cost-competitive compared to many Western countries, which makes it an attractive destination for IT outsourcing.
3	Strong Technical Universities	Technical Education: Ukraine has a strong emphasis on technical education, with many universities and institutions offering high-quality computer science and engineering programs. This results in a steady supply of well-educated IT professionals.
4	Government support	Ukraine collaborates with international organizations and governments to access expertise and resources for startup development. This includes cooperation with the European Union and participation in international startup events. The Government offers to support the development of the IT and startup ecosystem, offering tax incentives and other benefits to tech companies. Efforts have been made to enhance e-governance and transparency in Ukraine, which can streamline administrative processes for startups and reduce corruption.
5	Thriving Tech Hubs	Cities like Kyiv, Lviv, and Kharkiv have developed thriving tech hubs and co-working spaces, fostering collaboration and innovation within the startup community.
6	6. Investment activity	Ukraine has seen an increase in venture capital investments, both from local and international investors, providing funding for startups to grow and expand.
7	Startup success stories	Ukrainian startups have gained recognition on the global stage. Companies like Grammarly, Preply, and GitLab have achieved international success, inspiring the local startup community.
8	Favorable business environment	The government has worked to improve the legal and regulatory framework for startups. This includes simplifying the process for business registration, providing tax incentives for IT and tech companies, and reducing bureaucratic obstacles. Besides, Ukraine has established technology parks, business incubators, and accelerators to provide startups with resources, mentoring, and infrastructure. These organizations offer a supportive environment for early-stage companies.
9	Access to markets	Ukraine's strategic location provides access to both Eastern and Western markets, making it a promising base for startups with global ambitions.
10	Strong diaspora networks	The Ukrainian tech diaspora, which includes successful entrepreneurs and professionals based abroad, has played a role in connecting the local ecosystem with global networks and opportunities.

There is a growing interest in IT startups ecosystems as a means to understand the context of IT entrepreneurship at a macro level. It encompasses all the interconnected individuals and elements that facilitate and restrict entrepreneurship in a specific geographical area. Although growing in popularity, the concept of the IT startups ecosystem remains loosely defined and measured. In a broader sense, sturtup ecosystems represent a blend of social, political, economic and cultural components within a geographicak area that foster the development and expansion of startups. This, in turn, motivates aspiring entrepreneurs and various stakeholders to embrace the challenges of initiating and funding a business.

The evolved framework for the IT Startup Ecosystem designed by Kon et al. (2015) and adopted by to Ukrainian realities is presented in Figure 1 [11,12].

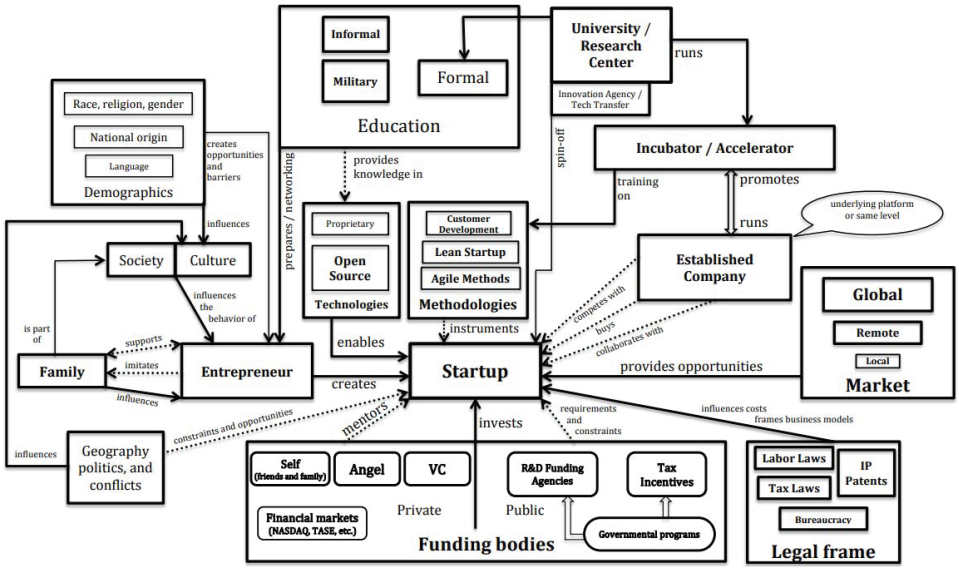

Fig. 1. Interconnection between IT startup ecosystem elements [11,12].

In Figure 1, the Startup, which is the major entity here, is created by one or more Entrepreneurs, who are highly affected by the Family, Society, and Culture shaped by Demographic characteristics. Startups develop products based on available Technologies and are strongly inclined to use Open Source software as a foundation. The most advanced companies rely on structured Methodologies. Most startups target either a Remote Market or the Global Market. Legal framework affects the choices related to market selection.

To track digital transformations in Ukraine and to find out whether domestic institutional conditions correspond to external challenges and the European agenda, current status and legislative trends in the field should be considered.

Current status and legislative trends in the field.

It should be noted that in the Ukraine-EU Association Agreement, scientific and technical cooperation and exchange of information for the development and improvement of technologies is defined as one of the main tools, and the integration of research and innovation systems and programs of the Eastern Partnership and the EU remains a key

task of the SHP. However, we have to note the continued decline in Ukraine's scientific and technological potential in the period after the signing of the Agreement.

At the same time, the issue of innovative development of Ukraine over the past few years has been the focus of attention of the government, a number of donor structures and the expert and scientific environment of Ukraine. In December 2018, the Ukrainian Startup Fund was created. Ukrainian Startup Fund is a national investment program that provides financing for the implementation of business ideas of Ukrainian entrepreneurs.

Besides, the Government of Ukraine has launched a number of initiatives aimed at creating opportunities for the development of the domestic ecosystem of innovation, information and communication technologies and startups. In 2020, Parliament registered a bill aimed at implementing the "E-residency" project of the Ministry of Digital Transformation. The project is designed to create conditions for non-residents to conduct business in Ukraine without a physical presence on its territory. An e-resident is actually a "limited" individual entrepreneur. E-residents can only be tax payers under the simplified system (group 3, only 5% of income). The election of this taxation system occurs at the time of registration as an e-resident and does not require the submission of a separate application. Despite the fact that the possibility of obtaining electronic resident status in Ukraine was initiated in 2020, the implementation of the technical part never took place. An analysis of the procedure and steps that must be taken to obtain e-resident status allows us to conclude that even on paper this is a complex process involving the interaction of many entities. In particular, these are the NBU, the Ministry of Foreign Affairs, the Ministry of Justice, the Ministry of Internal Affairs, the Security Service of Ukraine and the State Tax Service. And this is subject to martial law, technical limitations of the work of many registries, etc. [13].

Another ambitious project for the development of the IT industry in Ukraine is "Diia.City", initiated by the Ministry of Digital Transformation of Ukraine. Diia.City is a unique legal and tax space for IT business in Ukraine. Diia.City aims to give companies and startups effective tools for intensive development, scaling and capitalization.

One of the steps to create a map of the ecosystem of innovation, information and communication technologies and startups in Ukraine was the announcement in 2020 of the development of an online platform reflecting the current status of the Ukrainian IT ecosystem, providing an opportunity to search for business information about IT companies, professionals, investors and of the entire technological ecosystem of Ukraine [14]. It is expected that one single portal will collect and structure information about the entire IT ecosystem, which concerns universities, startup accelerators, technohubs and all technology industries. The project will be implemented within the framework of a memorandum between the Ministry of Digital Development and the company Sannacode, specializing in web development and mobile application development (previously, Ukrainian Bridge and DOU joined the creation of the portal). The initial information basis for the development of the portal will be the results of the study of the IT sector of Ukraine, carried out within the framework of the memorandum between the Ministry of Digital and the TechUkraine platform with the support of the USAID Program "Competitive Economy of Ukraine" [12].

From a technical point of view of the development of the innovation and ICT ecosystem in Ukraine, the emergence of initiatives aimed at creating data storage

and processing centers is positive. Thus, back in 2020, the Ministry of Digital Transformation of Ukraine and the international technology holding TECHIIA signed a memorandum of cooperation on the development of the information technology industry, the construction of data centers, the development of e-sports and STEM education. Cooperation, among other things, provides for the implementation of the Ecotechnopark project in the Kherson region. It is based on a data center with a capacity of up to 500 MW, which performs the functions of storage, data processing and 3D rendering. To implement the first stage of the project, it is planned to attract at least $200 million in investments in infrastructure [15].

An important strategic initiative in the field of ICT is the development of the Concept for the development of artificial intelligence in Ukraine. In December 2020, the Cabinet of Ministers approved the concept for the development of artificial intelligence until 2030. For Ukraine, the concept of AI development is a big step that will help integrate innovative technologies into economically important sectors of the state. The concept covers 9 areas of application of artificial intelligence: education and science, economics, cybersecurity, information security, defense, public administration, legal regulation and justice.

In January 2022, the EU Electronic Communications Law adopted by the Ukrainian government came into force. This confirms that further integration into the EU Digital Single Market is an important priority for Ukraine. Going forward, bilateral digital assistance will continue to focus on supporting digital infrastructure recovery, digitalization of government, and cybersecurity.

Conclusions

In an era of rapid technological progress, the development of digital technologies has transformed the way of doing business, making it more dynamic and global. Ecosystems of innovations, information and communication technologies and startups include complex interaction between the state, enterprises, startups, and society in a legal environment. The role of the state in the management of these ecosystems is of great importance, as it can influence the creation of a favorable environment for their development and provide an effective regulatory framework. The state acts as a facilitator to create an enabling environment where businesses can interact, collaborate and share data and innovation. In particular, it can develop support programs for startups and innovative projects, provide financial incentives for the development of digital technologies, and promote the creation of incubators and technology parks. Management of digital ecosystems also requires the state to develop adequate legal and regulatory frameworks. This includes protecting intellectual property, regulating cybersecurity and data privacy, and ensuring fair competition in the marketplace.

During the largest European war, Ukraine, as a digital state, reveals the necessary basis of stability for economic recovery and victory. Our country is actively expanding opportunities for technological progress and economic recovery, as evidenced by systematic work on mobilizing additional financial resources and deepening international cooperation in the field of digital transformation, attracting grants and loans to support reforms and investments aimed at increasing the growth potential of the Ukrainian economy and strengthening digital integration. Such intensive cooperation and financial support, even under martial law, will allow Ukraine to actively develop infrastructure, promote digital transformation, strengthen technological potential, sustainable economic recovery and deepen integration into the European digital market.

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DIGITAL TRANSFORMATION POLICIES TO DEVELOP AN EFFECTIVE ECOSYSTEM: THE CASE OF UKRAINE

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The article analyzes the evolutionary development and implementation of the digital transformation policy on the way to building the digital economy of Ukraine. The need to carry out reforms, improve the investment climate, and economic recovery prompted the state to develop a legal basis for future digital transformations in the development of the national ecosystem. Along with this, the above-mentioned steps contribute to the further integration of Ukraine into the EU. Using advanced technologies, such as artificial intelligence, blockchain, analysis of large data sets, and others, digitalization becomes a key driver in the creation of innovative products and services, which in turn increases the competitiveness and efficiency of

the socio-economic model of the state as a whole. But with the beginning of a full-scale military invasion of the russian federation into Ukraine, the state is forced to look for non-standard solutions for the continuation of the digital transformation policy. Currently, the question arises of the need to conduct an in-depth analysis of the key elements of the ecosystem of IT startups and determine the role of the state in the use of relevant tools and reforms on the path of further effective digital transformation in all sectors of the economic complex.

In the course of the research, it has been found that the scientific and technological potential in Ukraine continues to decline in the period after the signing of the Ukraine-EU Association Agreement. At the same time, the issue of innovative development of Ukraine has been in the center of attention of the government, a number of donor structures, and the expert-scientific environment of Ukraine for the past several years. The Government of Ukraine has launched a number of initiatives aimed at creating opportunities for the development of the domestic ecosystem of innovations, information and communication technologies (ICT) and startups, among which such promising and ambitious projects as: "E-residency" (creating conditions for non-residents to conduct business in Ukraine without a physical presence on its territory), "Diia.City" (a unique legal and tax space for IT business in Ukraine, which aims to give companies and startups effective tools for intensive development, scaling and capitalization), an online platform of the current status of the Ukrainian IT ecosystem (will provide an opportunity to search for business information about IT companies, professionals, investors and, in general, the entire technological ecosystem of Ukraine), development of the Concept of the Development of Artificial Intelligence in Ukraine (covers 9 fields: education and science, economy, cyber security, information security, defense, public administration, legal regulation, justice) and others.

According to the results of the study, it becomes clear that in the era of rapid technological progress, the development of digital technologies has transformed the way of doing business, making it more dynamic and global. Management of digital ecosystems requires the state to develop adequate legal and regulatory frameworks. Intensive cooperation and financial support, even under martial law, will allow Ukraine to actively develop infrastructure, promote digital transformation, strengthen technological potential, sustainable economic recovery and deepen integration into the European digital market. Currently, there is no doubt about the need to strengthen efforts to implement current and prospective programs of digital reform of the ecosystem of Ukraine.

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