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THE ROLE OF THE DIGITAL BUSINESS ECOSYSTEM IN INNOVATIVE AND INTELLECTUAL DEVELOPMENT OF REGIONS

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ABSTRACT

The article is devoted to the analysis of features of development of the digital entrepreneurial ecosystem in innovative and intellectual development of regions. The essence of the digital entrepreneurial ecosystem has been studied, and attention has been focused on three main elements, namely: digital citizenship of users, digital technology entrepreneurship and digital multilateral platform. Prerequisites contributing to formation of digital entrepreneurial ecosystems are outlined, as follows: progress of digital technologies; change in the competition nature; desire of customers to satisfy their needs online; urgent need to unite geographically separated economic subjects through globalization. Structured key factors affecting the innovative and intellectual development of the region in the context of the development of digital entrepreneurial ecosystems. The key performance indicators of development of digital entrepreneurial ecosystems are analyzed. Recommendations for further development of digital entrepreneurial ecosystems are provided.

Keywords: *Ecosystem, Entrepreneurship, Universities, Education System, Digital Entrepreneurial Ecosystem, Digital Transformation, Innovation, Innovative And Intellectual Development, Region, Public Authorities, State Policy*

1. INTRODUCTION

Today's development of society in general and the economy in particular is characterized by incredible speed of technological progress, which makes digitalization a key factor that affects all spheres of life, including development of business structures. The digital entrepreneurial ecosystem acts as a catalyst for innovative development, contributing to creation of new business models, improving productivity and competitiveness of enterprises. Introduction of digital technologies contributes to improved investment climate and the investments attraction in regions, providing for development of new sectors of the economy and jobs creation. In addition, the digital entrepreneurial ecosystem stimulates development of startups and innovative projects, which leads to revitalization of scientific research and introduction of new technologies, contributing to the increased level of education and qualifications of population. Thanks to digital technologies and platforms, access to information and resources is ensured, which contributes to social integration and community development. This is urgent for remote or sparsely populated areas where traditional options are limited.

As part of globalization, the digital business ecosystem opens up new opportunities for business and cooperation, which allows regions entering international markets, being more flexible and adaptable to new challenges, such as changes in demand, technological innovations or global crises. Using digital technologies in many business processes contributes to more efficient use of

resources, reduction of costs and negative impact on the environment.

Thus, studying the role of the digital entrepreneurial ecosystem in innovative and intellectual development of regions is extremely relevant, as it allows us to understand mechanisms that contribute to economic growth, social development and improvement of the life quality of the population.

2. LITERATURE REVIEW

Scientific studies devoted to digitization of the business ecosystem at both the global and national levels have been reflected in works of many leading scientists.

Within the scope of research [1], digital platforms and business ecosystems were analyzed and peculiarities of state policy regulation of public-private partnership development were analyzed. The authors [2-3] consider the impact of the digital business ecosystem on stakeholders' satisfaction and, using the example of Eastern European countries, analyze current trends in development of the e-commerce ecosystem. Articles [4] are devoted to study of blockchain within the framework of digital platforms and ecosystems in international business and regulatory policy of these processes.

Practical significance should be highlighted in scientific papers [5-6]; where authors analyze features of profiting from innovations in formation of digital business ecosystems, as well as investigate digital ecosystems and innovative business models of platforms in the service sector. Scientific works [7-8] proposed an ecosystem-oriented business model that promotes well-being using digital technologies, and modeled management of economic security of innovative entrepreneurship as a component of the modern ecosystem. Noting relevance of research [8]; [10], it is advisable to consider results of the analysis of features of managing the innovating potential development of the region and to the outlined potential for innovative and intelligent development of peripheral regions of Eastern Poland.

Articles [11-13] are devoted to various aspects of the use of artificial intelligence and the activities of business entities in the context of ensuring their innovative and safe development. Scientific papers [14-16] are devoted to the applied aspects of supporting the innovative development of business entities, within which the current trends in the digitalization of the financial services market are analyzed, risks, problems are investigated, and ways to solve them are presented. Studies [17-19] are of practical importance, within which the authors developed a business case for ecosystem management, analyzed the ecosystem of digital business, considered the business ecosystem using the example of water data ecosystems.

Authors [20-22] explore artificial intelligence technologies that ensure the efficiency of business models based on ecosystems, demonstrate the role of digital transformation and innovation in modern business ecosystems, and also conduct an analysis of the impact of the business ecosystem on the standard of living of the population. It is also appropriate to note the authors' research [23-26], where the authors analyzed the interrelationship of international political economy, business ecosystem, entrepreneurship and sustainable development in modern conditions of innovative and intellectual development; features of the application of tools of the business model of the future ecosystem are disclosed; the role of IoE and cognitive structures in the formation of a reliable smart city ecosystem is outlined; analyzed the factors of the entrepreneurial ecosystem in the context of supporting environmentally sustainable business.

Despite significant achievements in this sphere, problems related to development of digital entrepreneurial ecosystems in innovative and intellectual development of regions in Ukraine in modern global challenges and upheavals remain insufficiently researched, which determined the purpose of the proposed article.

The purpose of the article is to study development of the digital entrepreneurial ecosystem as a key factor in innovative and intellectual development of regions.

Threats to the validity and selection of criticism criteria are limited access to statistical data on the subject of the study.

3. METHODOLOGY

The article is based on systematic approach that allows solving objectives and achieving the outlined goal. When structuring the article, the authors used the method of structural and logical analysis; to research approaches and determine main theoretical foundations – the monographic method; for analysis of statistical indicators of digitalization - the graphic method and the method of dynamic series; to determine prerequisites that contribute to formation of digital entrepreneurial ecosystems - methods of induction and deduction; for analysis of key factors affecting innovative and intellectual development of the region in development of digital entrepreneurial ecosystems and in development of recommendations for further development of digital entrepreneurial

ecosystems - methods of systematic analysis and generalization.

4. RESULTS

The new economic paradigm of modern times calls for transition to completely new level of "person-person" and "person-business" interactions in this economy. Development of technology is rapidly changing both on lives of people working in business, and determines the path and pace of business development in new business models of the global environment. In today's world, the concept of ecosystems is gaining popularity to describe organizational, competitive and collaborative relationships between business organizations.

The digital entrepreneurial ecosystem is a kind of driver that is constantly being strengthened, as acceleration of interactions enables each participant to acquire new knowledge and resources, create new and improve existing approaches to activity, and ensure the flow of innovations between participants. Therefore, the digital entrepreneurial ecosystem is becoming increasingly important in modern economy, where technology determines business success and its ability to innovate.

Based on results of the survey conducted among 2,514 experts of the European innovation ecosystems, activity of countries in creating these ecosystems that involve collaboration was analyzed by stakeholders, employed in various spheres and conducting activities of different nature, aimed at development of entrepreneurial and innovative activities in regions, by combining efforts of various groups of stakeholders (Fig. 1).

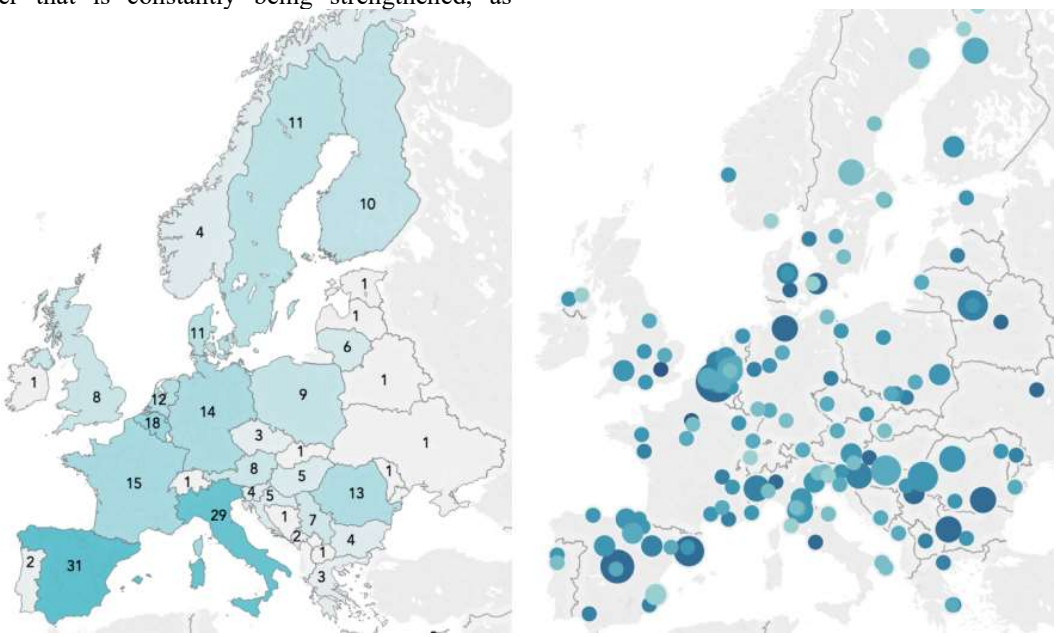


Figure 1: Development of innovative ecosystems in Europe

Source: [27]

According to research results, the most active participants in innovation ecosystems are universities, small and medium-sized enterprises and companies that actively implement innovative projects. A slightly smaller share of participation falls on large enterprises, cluster organizations, regional authorities and local self-government, regional development agencies, technology parks, etc. (Fig. 2).

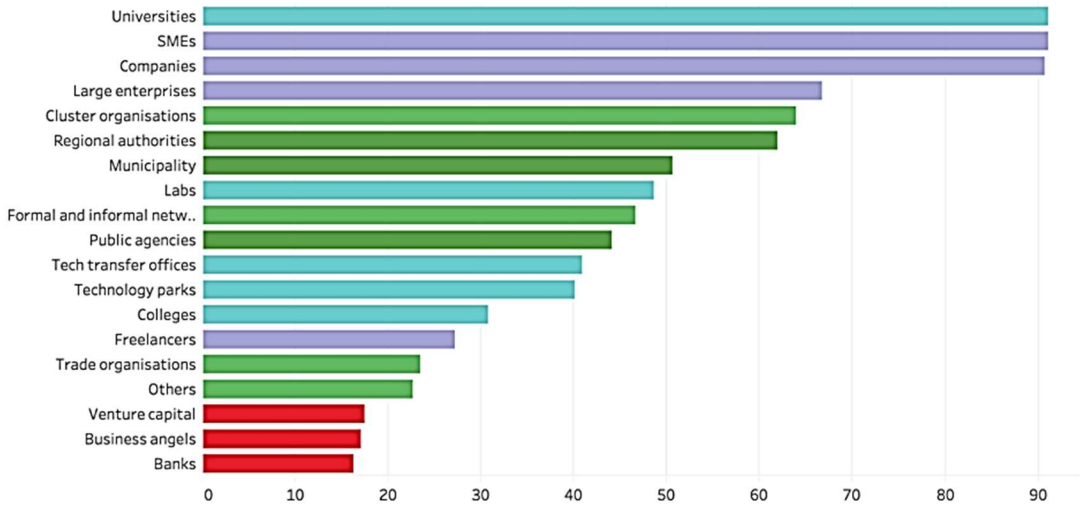


Figure 2: Involvement in EU innovative ecosystems (% of ecosystems that include such participants) Source: [27]

Some scientists define the digital entrepreneurial ecosystem as a dynamic network in which participants are connected and dependent on each other in certain geographic region, which in turn affects formation and ultimate trajectory of all participants, since these participants receive additional benefits that distinguish them from enterprises that operate outside this system.

There are three main elements of the digital entrepreneurial ecosystem:

1) digital citizenship of users - as an element of digital business infrastructure, which indicates that users use technologies safely, ethically and responsibly, protecting their personal data and information, and at the same time they can conduct business activities as producers or consumers;

2) digital technological entrepreneurship – entrepreneurs of various industries, developers of certain applications and other subjects of economic activity, which produce goods and services using innovations and digital platforms, providing for increase of their work efficiency and profit;

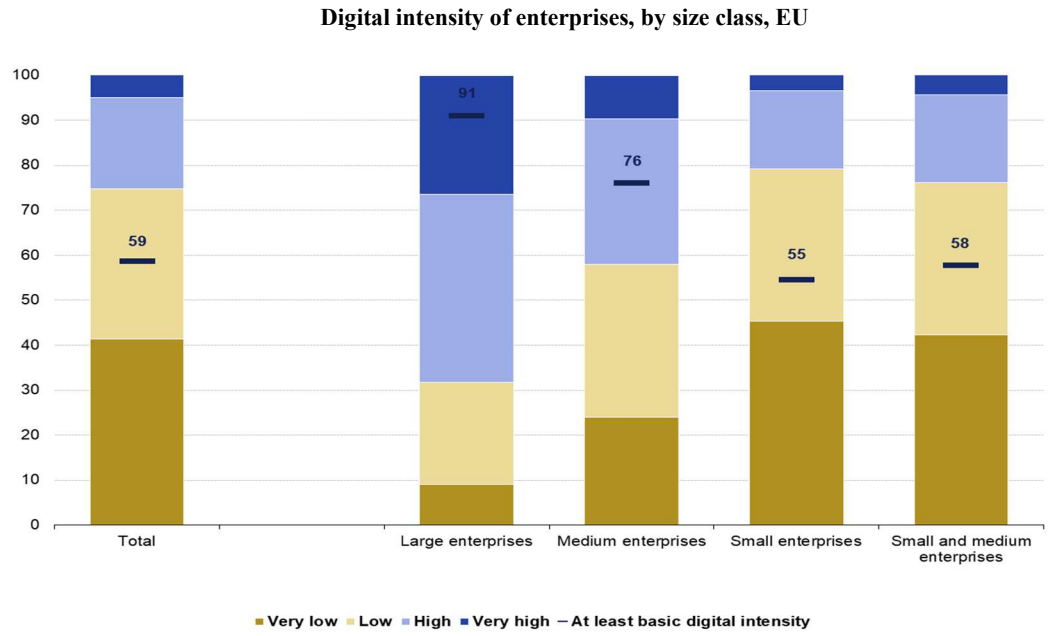
3) digital multilateral platform - special platforms that play the role of an intermediary by carrying out transactions with goods and services and are created for knowledge exchange, contributing to reduction and elimination of transaction costs due to timeliness, accuracy and impeccable quality.

It should be noted that each ecosystem is a unique phenomenon that is formed depending on geographical location and intellectual abilities of the population and can be represented in two types:

1) ecosystem of solutions – creates or offers goods or services, uniting different consumers in the market;

2) transaction ecosystem - connects various producers of goods and services with consumers on single platform.

According to statistics, in 2023, 58% of small and medium-sized enterprises reached basic indicators of digital activity. The level of business digitalization in EU countries is demonstrated by the digital intensity index, which characterizes the level of use of digital technologies and activities of business entities. 91% of large enterprises, 76% of medium and 55% of small enterprises have reached the basic level of digital intensity. If we analyze the digital activity level of enterprises by sphere of activity, it is appropriate to note enterprises that have reached the basic level, namely information and communication activities (91%), professional, scientific and technical activities (76%), real estate transactions (70%), wholesale and retail trade; repair of cars and motorcycles (68%) and retail trade, except trade in cars and motorcycles (60%). Analyzing indicators of digital development of small and medium-sized enterprises, the top 3 countries should be noted in the overall rating: Finland (12%), Malta (11%) and the Netherlands (10%). (Fig. 3).



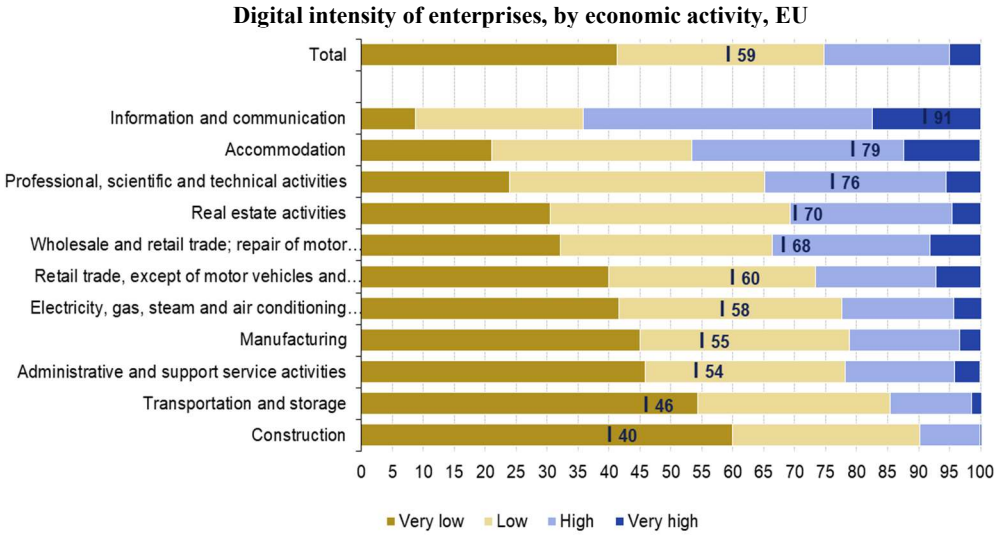


Figure 3: Digital intensity of enterprises in EU countries, 2023 (% enterprises)
Source: [28]

Thus, the digital business ecosystem is a complex of relationships between various participants of business environment, who use digital platforms in their activities to create, exchange and consume goods and services. This ecosystem consists not only of enterprises, but also of consumers, suppliers, partners, government bodies, investors and other stakeholders who interact in digital space. The key components of the digital business ecosystem are shown in Fig. 4.

In general, it is possible to highlight certain prerequisites that contribute to formation of digital entrepreneurial ecosystems:

– progress of digital technologies, which provides new opportunities for interacting with customers and researching their tastes;

– changing the nature of competition, focusing on effective cooperation;

– desire of customers to satisfy their needs without leaving home, with the least amount of time;

– urgent need to unify geographically separated economic entities through globalization;

– client's desire to receive personalized offers based on providing them with their personal data;

– desire of companies to cooperate with customers, and not with owners.

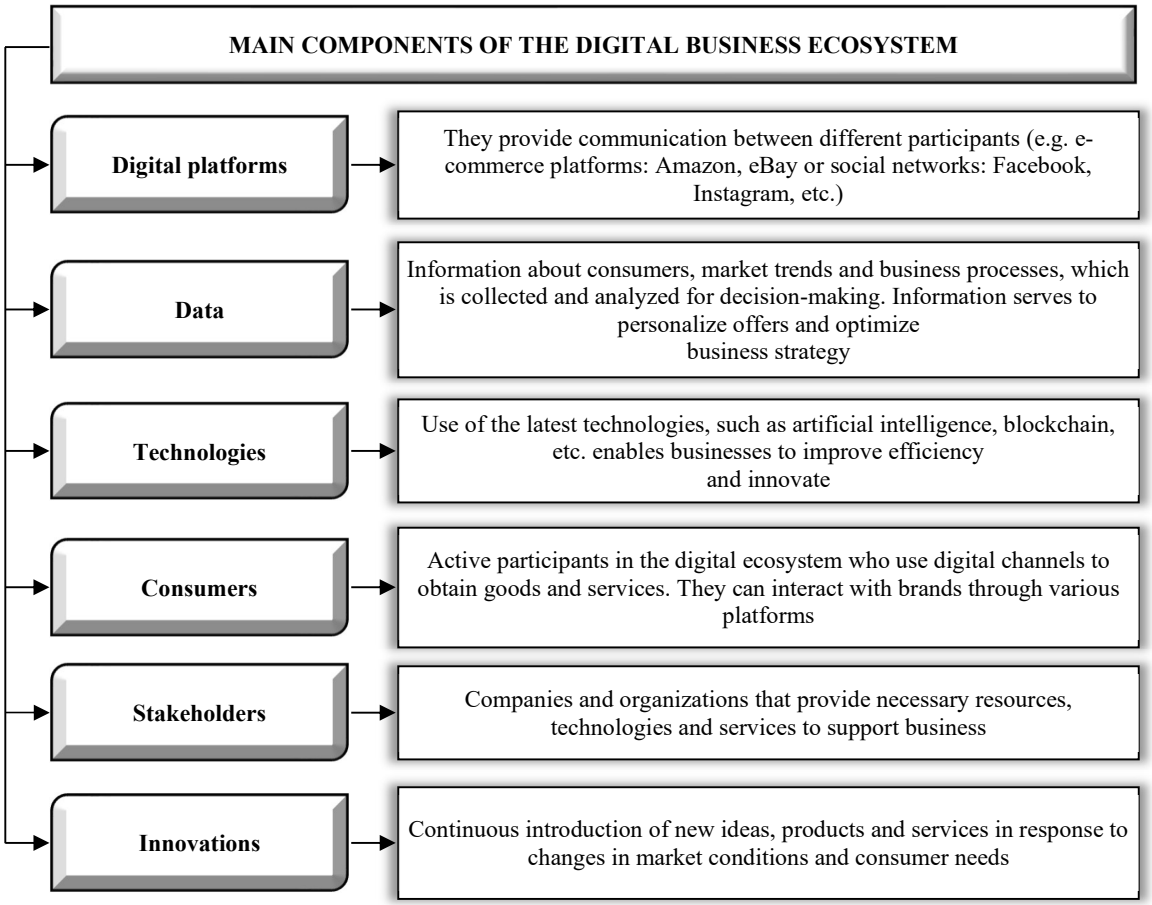


Figure 4: Main components of the digital entrepreneurial ecosystem
Source: systematized by the authors

Thus, the advantage of functioning of the digital entrepreneurial ecosystem is:

– flexibility – ability to quickly adapt to changes in the market environment;

– efficiency – optimization of business processes using digital technologies and analytics;

– market expansion – accessibility to the largest possible range of consumers through digital platforms;

– innovativeness - creation of new products and services thanks to cooperation with various participants of the ecosystem.

Therefore, in our opinion, the digital business ecosystem is a system set of actions and processes defined by commercial enterprises, interconnected by digital technologies and solutions or digital products and services, designed to help simplify the construction of new business processes and adjust existing ones, for effective functioning in the world of digital technologies and cloud data storage.

In Fig. 5, key factors that will influence innovative and intellectual development of the region in the context of development of digital entrepreneurial ecosystems are presented.

Innovative and intellectual development of the region involves using of intellectual potential, innovations and new technologies to increase competitiveness, economic efficiency and social well-being. This process includes:

– creation and implementation of innovations, which represents development of new products, services and technology that can satisfy modern requirements of the market and consumers;

– development of human capital, namely improvement of personnel qualifications, development of the education system and scientific personnel;

– cooperation with scientific institutions, business and public authorities to form partnerships and exchange resources and knowledge;

– stimulation of entrepreneurial activity aimed at supporting startups, small and medium-sized enterprises through financing and consulting services;

– creation of favorable investment climate, namely creation of conditions for attracting investments to the region.

It can be argued that development of digital entrepreneurial ecosystems has a positive effect on both innovative and intellectual development of these systems and regions as a whole, due to combined efforts of various economic entities and agents.

One of the main roles in formation of the digital entrepreneurial ecosystem is played by development of innovative and intellectual potential of the regions, which contributes to:

1. Training of the personnel reserve - the development of digital skills for working with data and information is a key and critically important position for successful integration of new technologies into business.

2. Attracting talent - is an important component of development of the digital entrepreneurial ecosystem, as it becomes attractive for talented specialists and implementation of their ideas, which will contribute to innovative development of the region, which will be represented by this cluster.

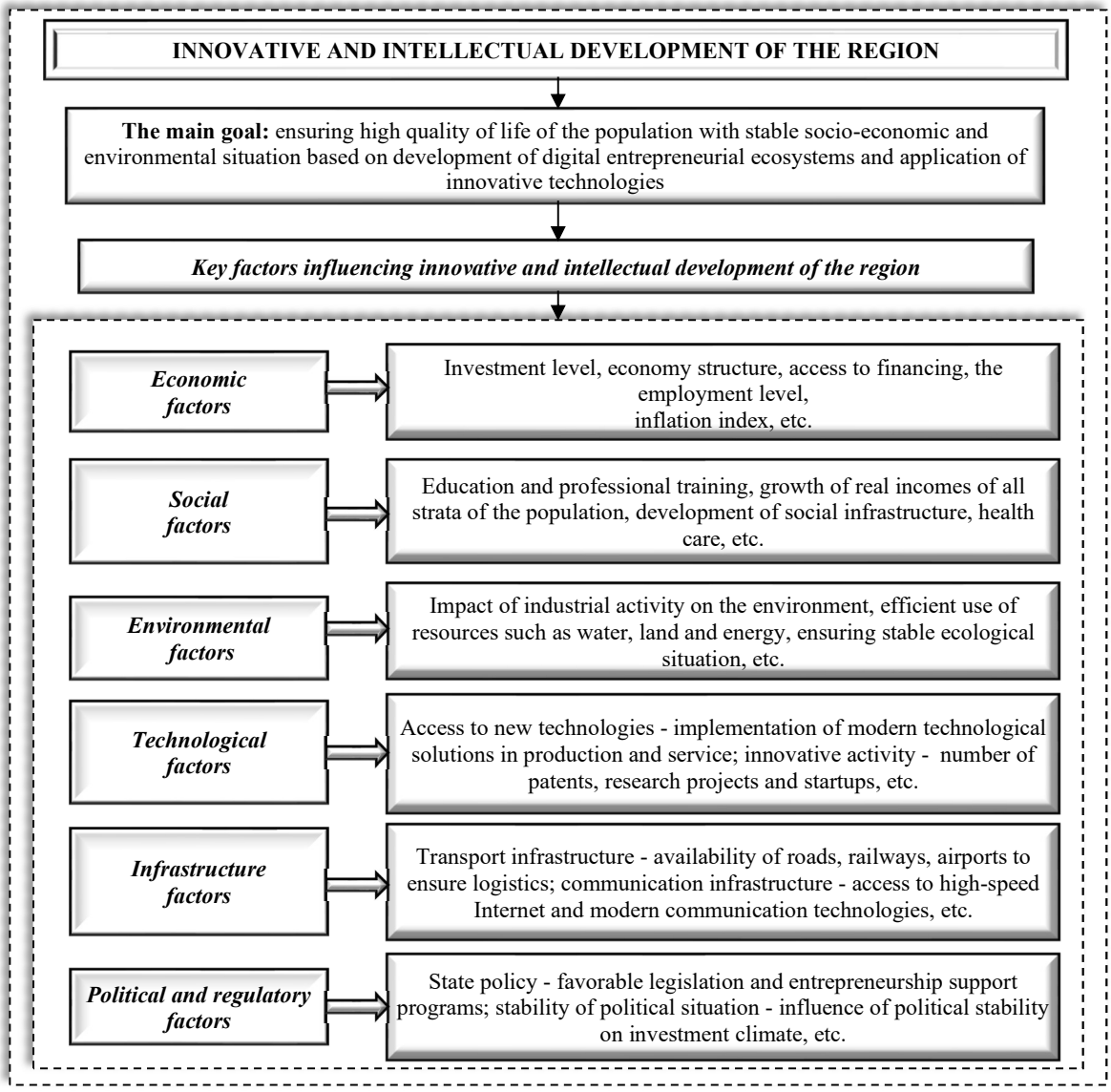


Figure 5: Key Factors Influencing Innovative And Intellectual Development Of The Region
Source: Systematized By The Authors

3. Support of local regional initiatives will stimulate digital development of the region, by involving public-private partnerships and international investment institutions, through

creation of network of high-speed fiber-optic Internet of the next generation, a 5 G network, IT incubators, which will contribute to development of the digital business ecosystem in the region.

4. Investments in regional infrastructure through their support by successful digital enterprises located in the territory of relevant regional communities and actively cooperating with universities and research centers for development of new technologies and innovations and receiving tax benefits in exchange for co-financing of social projects from the state.

Starting from 2022, the Ministry of Digital Transformation of Ukraine began to analyze key performance indicators of development of digital entrepreneurial ecosystems. Such analytical data formed compilations that began to record statistical data in economy digitalization, digital mobile innovations and network cloud data storage, informatization of implementation of electronic document flow, development of the infrastructure of broadband access to the Internet and e-commerce and e-business. As of 2024, Ukraine ranks fifth in the world ranking for digitalization of providing services to the population and business. We will analyze the Digital Transformation Index for 2022-2023 and present the graphical results in Fig. 6.

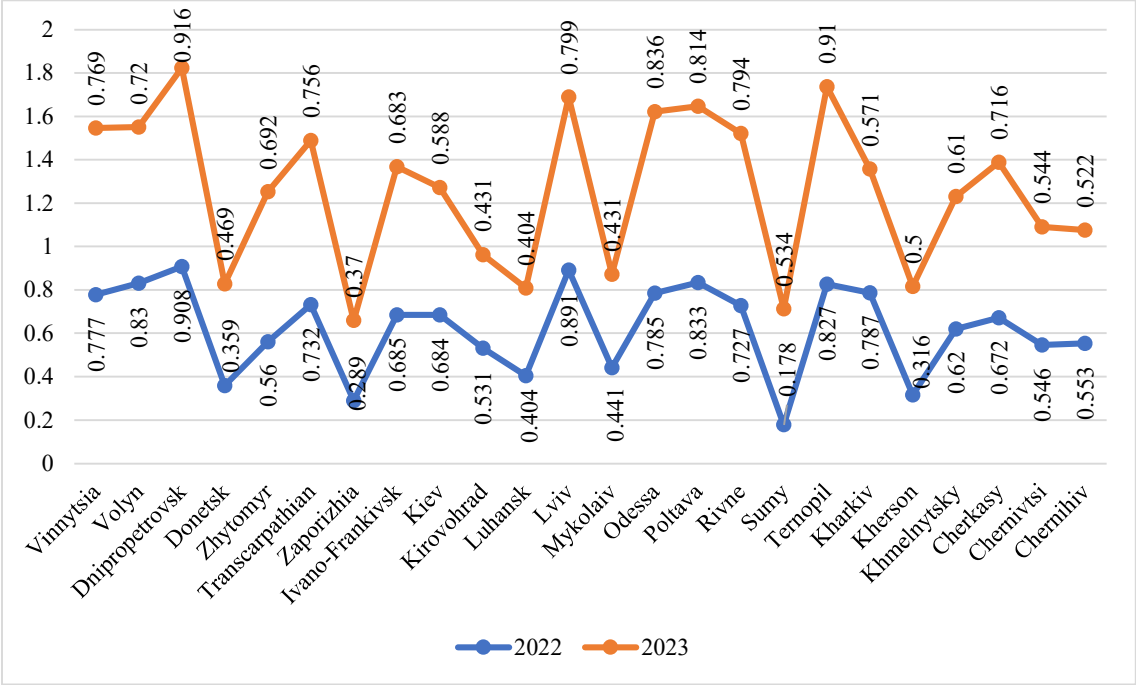


Figure 6: Index Of Digital Transformation For 2022-2023
Source: Systematized By The Authors Based On Ministry Of Digital Transformation Of Ukraine [29-30]

Modern digital technologies both transform enterprises, and encourage active regional development by creating innovative ecosystems and clusters. Digital entrepreneurial ecosystems should be in close relationship with educational institutions and the state to ensure sustainable intellectual development and economic growth and, receiving certain benefits, help develop social infrastructure of the region where they are territorially located.

The basis of the digital entrepreneurial ecosystem in regional context is the indicator of institutional capacity, which demonstrates available effective and developed or approved informatization program, which provides for financing of activities in digital transformation supported by national grant programs on digitalization at the regional (region) and local (community) levels. Let's consider the value of this indicator in more detail in Fig. 7.

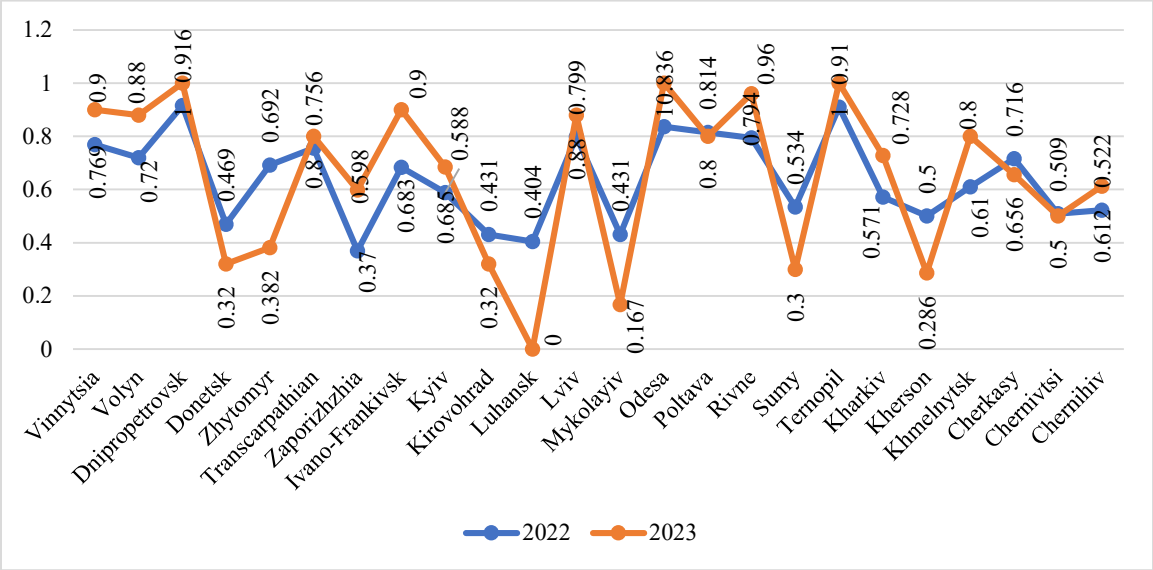


Figure 7: Index of institutional capacity for digital transformation, 2022-2023
Source: systematized by the authors based on Ministry of Digital Transformation of Ukraine [29-30]

The value of this indicator shows how much the region is developing digital business ecosystem, the greater the increase, the better the situation, development of digitalization of commercial services. So, looking at the situation, we can state that the best indicators of growth are shown by Zaporizhzhia region +22.8%, Ivano-Frankivsk region +21.7%, Khmelnytskyi region +19%, Rivne region +16.6%, Odesa region +16, 4%, Volyn region +16%, Kharkiv region +15.7%, Kiev region +9.7%, Chernihiv region +9%, at the same time, the worst values of the indicator were shown by such regions as: Sumy region -23.4%, Kherson region -21.4%, Nikolaiev region - 26.4%, Zhytomyr region -31%.

In Table 1, dynamics of digital economy share in Ukraine's GDP together with the main indicators of the economy digitalization in Ukraine for 2022-2024 with forecast values for 2025 are presented.

Table 1: Indicator of the digital economy share in GDP of Ukraine and main indicators of the economy digitalization in Ukraine, 2022-2024.

Indicators	2022	2023	2024	2025 (forecast)
Share of the digital economy in to total GDP, %	5.0	8.0	11.0	15.0
Internal market (use of information and communication technologies), billion dollars	2.5	3.0	4.5	6.0
Impact on GDP, % growth	+1	+2	+3.5	+4.5

Source: systematized by the authors based on Ministry of Digital Transformation of Ukraine [29-30]

Digitalization impact of business processes and public services is determined by the added-value indicator, which is created for each branch of the economy separately at the macro level. The added-value indicator is a corresponding share of the total GDP, and it is this cumulative share that is the indicator of the digital economy development as a part of the traditional analog economy. The higher the score, the better, as it will mean that digital business ecosystems are displacing traditional ways of doing business, providing consumers with better quality products and services anytime, anywhere.

Development of digital entrepreneurial ecosystems in Ukraine is a relatively new direction of the economy digitalization. However, in a few years, this direction developed quite quickly, due to circumstances of a full-scale invasion and spread of hostilities. We present recommendations for further development of digital entrepreneurial ecosystems, which, in our opinion, are the most important and will be relevant in the coming years:

- concentration of efforts on the development of open online platforms that will be able to provide access to technical resources and source software code, allowing new participants of the ecosystem to develop their own options for using the platform and develop it;

- improvement of collective intelligence in digital applications, namely exchange of digital data and information through cooperation and competition to find collective and agreed solution to the tasks. The main advantage of collective intelligence is that it shows how programs interact with the user and how they can influence management decisions;

- expanding the impact of the "digital network effect", which refers to reaching a larger number of users. Developing more digital products and services on cross-platform code attracts more users to engage with it. At the same time, users involved in the digital network effect attract even more participants by their example of using relevant digital products and services;

- building a coherent system of digital values, which is a set of actions for creation and joint use of a corresponding position, which will be considered as digital value within the framework of the entire digital ecosystem. This is a difficult task, since digital value can dynamically change or be completely recoded, depending on the user's needs;

- correct interpretation and forecasting of "digital market expectations" criteria related to how potential users may perceive the proposed newly created digital business ecosystem, or rather their final digital product or service, from the point of view of the potential development of the corresponding product or service in the long term;

- creation and implementation of a clearly defined model of intellectual property, respecting all intellectual rights for developers, according to which they can fairly monetize their digital developments, programs, products or digital services;

- determination of correct model of revenue generation and their redistribution among all participants of the digital entrepreneurial ecosystem, which will stimulate new participants to join this particular ecosystem at an early stage of development and implementation of digital services or products.

5. CONCLUSIONS

As part of rapid growth in demand for using new digital technologies, the biggest advantage is given to companies that could unite under their name a strong digital entrepreneurial ecosystem – the online platform that has no physical limitations in use, since its members can be located in different parts of the world and get in touch via online conferences and online chats. In this case, the digital entrepreneurial ecosystem is a set of elements, including: defined digital online platform, existing or hidden network effects, expectations from the sale of a digital product in the market. Digital entrepreneurial ecosystems are gradually turning into strong competitive business projects that can compete in the digital services market with global IT companies and IT clusters, having, as a rule, a much cheaper digital product with similar, unique or better characteristics.

The strengths of this research are a thorough analysis of the features of the digital entrepreneurial ecosystem functioning in the innovative and intellectual development of the regions, including: the outline of the prerequisites that contribute to the formation of digital entrepreneurial ecosystems, the structuring of key factors affecting the innovative and intellectual development of the region in the context of the development of digital entrepreneurial ecosystems, analysis of the main indicators of the effectiveness of the digital entrepreneurial ecosystems development, as well as recommendations for the further development of ecosystems digital entrepreneurship.

Prospects for further research are the analysis of foreign experience and best global practices in the formation and development of digital business ecosystems.

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