

PURDENKO Olena,

PhD (Economics), Associate Professor
of the Department of Economics and Business Finance
of Kyiv National University of Trade and Economics
19, Kyoto str., Kyiv, 02156, Ukraine

E-mail: o.purdenko@knute.edu.ua

ORCID: 000-0002-8661-5561

INNOVATIVE ECOSYSTEM IN THE CONDITIONS OF THE COVID-19 PANDEMIC

There is characterized the state of functioning of the innovation ecosystem in the conditions of a pandemic. There is presented the experience of reorganization of highly efficient innovation ecosystems during the crisis, which contributed to the achievement of optimal conditions for functioning and development. There are analyzed the main indicators of the Global Innovation Index 2020 and the main factors influencing the formation of the innovation ecosystem of Ukraine. There are proposed measures to strengthen it.

Keywords: innovation ecosystem, innovations, innovation activity, investments.

Background. Modern scientific research shows that the introductions of innovations is an important factor in improving the efficiency of Human Resources and capital investment and thus promote economic growth. The needs for innovation are growing more than ever, due to the needs to restore economic growth in the financial crisis caused by the COVID-19 pandemic. That is why the ecosystem approach to solving consequential problems and finding new mechanisms for cooperation of efforts of all participants in the innovation process in the chain of transformation of scientific knowledge into innovation and its further commercialization becomes especially important.

An indication of today is the functioning of the innovation ecosystem under the pressure of a number of negative factors that are generated by the spread of epidemic disorganization of the normal course of economic processes. An important issue is to build the capacity of the innovation ecosystem in the process of overcoming the recession caused by the COVID-19 pandemic and ensuring continuity of functioning.

Analysis of recent research and publications. In recent years, research has become significantly more relevant on the theoretical and methodological foundations and mechanisms for ensuring the existence and development of innovative ecosystems, for example, in the works of domestic and foreign scientists and practitioners: A. Marshall, A. Lippa, K. Ikeda, R. Singh [1], T. Gurney, J. Dibburn, T. Huber [2], O. Granstrand, M. Holgerson [3], G. Lanovska [4], S. Kravchenko [5], I. Pidorichev [6], I. Fedulova [7], L. Fedulova [8] and others.

The accumulated scientific array of developments and their obvious practical significance do not provide monosemantic approaches in strengthening the influence of external and internal factors on the functioning of innovation ecosystems in the economic crisis of non-cyclical nature caused by the pandemic as force majeure. This fact actualizes the needs to rethink the adopted management models, their modification according to other evaluation parameters.

The **aim** of the article is to identify the main threats to the balanced functioning of innovation ecosystems from the introduction of quarantine measures in relation to the COVID-19 pandemic, to find ways to improve the management of innovation ecosystem of Ukraine in crisis and post-crisis conditions.

Materials and methods. Theoretical and methodological basis of scientific research were scientific concepts and theoretical developments on the functioning of the innovation ecosystem; information and analytical materials of the State Program of Economic Stimulation to Overcome the Negative Consequences Caused by Restrictive Measures to Prevent the Occurrence and Spread of Coronavirus Disease (COVID-19) for 2020–2022. The research used methods of theoretical generalization, comparative analysis and synthesis, which allowed to identify the key determinants of innovation ecosystem development in the future.

Results. The formation of terminological support for the research of the innovative vector of economic development at the present stage has become controversial. Thus, according to G. Lanovska, the innovation ecosystem is seen as a synergy of the state, business and explorative environment with the use of organizational, regulatory, educational and methodological and financial resources and the introduction of a mechanism for knowledge transfer to transform into innovative products [4]; I. Fedulova argues that the innovation ecosystem is a set of organizational, structural and functional institutions and their relationships involved in the creation and application of scientific knowledge and technologies that determine the legal, economic, organizational and social conditions of the innovation process and ensure the development of innovation at the level of enterprises, and at the level of the region and the country in general according to the principles of self-organization [7].

According to managers, the innovation ecosystem plays an important role in the development of the innovation economy. After all, given the dynamic combination of economic and political programs on the innovation platform, in the context of creating a space for social product production, the innovation ecosystem is able to ensure cooperation of knowledge and technology between universities and business on progressive standards of innovation, creativity and quality; to promote the creation of a new innovative business through incubation mechanisms and accelerate the growth of its share in the formats of small and medium-sized companies, including in the global network, promoting the internationalization of business, etc.

The innovation ecosystem usually materializes in five key components that are quite sensitive to the state of the economy: science, engineering and technical communities, higher education institutions, which play the role of the main suppliers of innovative ideas for commercialization; the venture capital industry, which provides the attraction into the ecosystem of financial resources and business competence that is necessary for the formation of innovative companies and their transformation into full-fledged business structures; infrastructure that ensures the functioning of innovative companies, which can be formalized into technology parks, business incubators, development institutions, etc., as well as represent an intangible substance – a variety of services specifically tailored to the needs and specifics of innovative companies (intellectual property protection services, breeding and promotion innovative products for foreign markets); steady demand for high-tech products, technologies and start-ups – primarily from big business and other real sector companies, as well as for innovative companies along with all their developments and intellectual property (as promising objects for acquisition); legal field that provides comfortable conditions for participants in innovation processes [4].

In the context of the pandemic, some areas of innovation are virtually suspended, but at the same time, it is worth noting the surge in new inventions in the field of health care.

Thus, in Spain, the functioning of the innovation ecosystem is ranked as highly efficient. It includes the Universities of Castile and Leon, the Foundation for Universities and Higher Education (FUESCYL), the Ministry of Education of the Regional Government of Castile and Leon and the Red de Transferencia de Conocimiento Universidad-Empresa (TCUE) network, which is responsible for promoting knowledge transfer from universities to companies under the Regional Intelligence Specialization Strategy (RIS3). When the spread of the coronavirus epidemic led to a health crisis, the laboratories of four public universities in Castile and Leon were able to respond quickly by creating an effective network of cooperation, intensifying the production and delivery of protective equipment to hospitals and nursing homes. The University of Burgos joined the local network of protective masks supplied to the hospital in collaboration with the City Council, the Cluster of Innovative Solutions for Independent Living (SIVI) and local companies. As part of its innovative laboratories, the University of Valladolid joined the Renault to the rescue network to manufacture protective elements for medical staff in hospitals and nursing homes (using 3D printers). The solidarity project, launched by more than 120 employees of the Renault engine plant in Valladolid, was funded by Amazon crowdfunding in collaboration with CIDAUT Technology Center, Renault, the parent organization AENIUM and other organizations. On the basis of the laboratory of the University of Leon, the production of sanitary protection materials was introduced for the first time in coordination with the laboratory of the University of Valladolid and thanks to the efforts of local

companies. These achievements would be impossible without the coordination of the efforts of regional universities, local companies, other spontaneous networks of public associations, etc. Civic initiatives in a stable innovation ecosystem helped to support the health care system and did not break the value chain [9].

Combining the experience of the innovation ecosystem and its features in a pandemic, the National Smart Specialization Strategy for 2021-2027 for Castile and Leon, for example, will create and consolidate collaboration of environments for all stakeholders, deepening on its geographical expansion and linkages with other innovations. ecosystems of various scales. After all, general approaches do not cause exclusive trajectories of rational specialization by the criterion of achieving optimal conditions for the functioning of innovative ecosystems, their subjective content and technological originality [9].

In the United States, to support the innovation ecosystem and the effective collaboration of government, research, and business, the government has announced the launch of the high-performance computing consortium COVID-19, which will provide virus researchers around the world with access to the most powerful pandemic control [10].

World experience shows the needs to strengthen collaboration in the innovation ecosystem in a pandemic to maintain its current state and further development. In order to increase the innovation potential of the country and unite the efforts of participants in the innovation process in the innovation ecosystem, it is necessary to complement resources, opportunities and competencies in various combinations, and thus implement a system of expert monitoring of efficiency and potential of institutional and organizational innovation structures. This is possible under the condition of an effective service of management, audit and monitoring of the innovation environment. That is why it is necessary to conduct an audit of previously created innovation structures for the existing potential and feasibility of their existence. In a pandemic, based on foreign experience, it is advisable to reorganize the institutional and organizational innovation structures that are designed to develop innovation infrastructure for modern needs. Such a reorganization should be carried out in order to reduce unpromising institutions and organizations and create on their basis a small number of effective structures capable of establishing interaction between science, invention, innovation, on the one hand, and business – on the other. This will allow to obtain a positive economic effect in the crisis due to the intensification of the processes of formation of the national innovation ecosystem, ensuring investment and innovation development of small business, cooperation of government agencies, higher education institutions, small, medium and large enterprises in innovation, creation of scientific and technical clusters. This can lead to an increase in sectoral domestic product by 5–7% annually, which is crucial in a crisis.

Ukraine is open to the penetration of progressive experience, but it needs to create a strong system of state support for all actors in the innovation ecosystem. Global measurements of the current state of innovative development of Ukraine's economy are classified as crisis and inconsistent with the level of European countries (rating "Global Innovation Index 2020"). Despite the fact that in 2020 Ukraine improved its result by 2 steps, taking 45th place, it is almost twice lower than the value of the index of European leaders. In the same metrics for Ukraine, compared to 2018, there is a decrease of 2 positions. (figure 1).

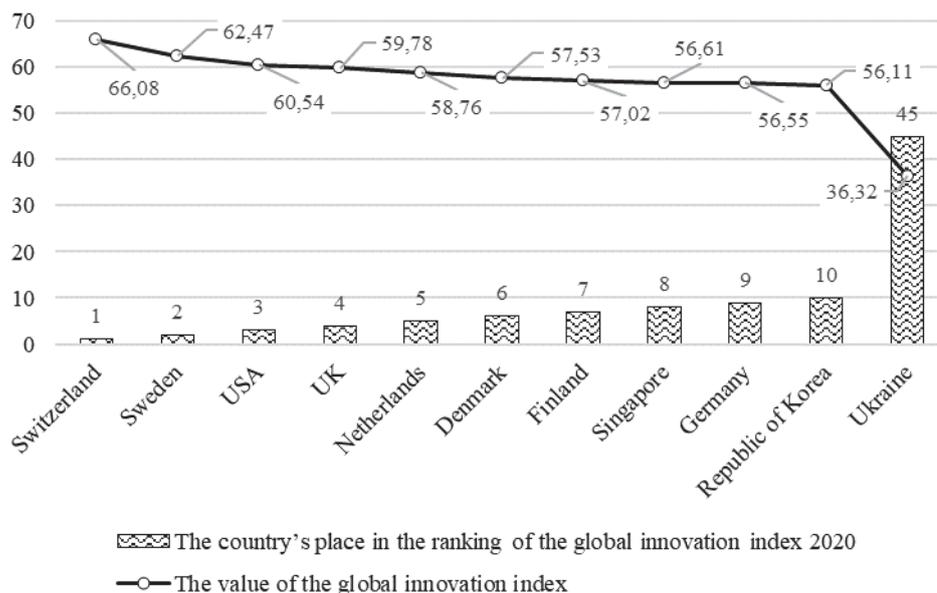


Figure 1. Global Innovative Development Rating 2020

Source: compiled by the author according to [11].

Ukraine ranks 93rd out of 129 countries in terms of institutional development (which is 3 positions higher than 2019) with signs of lagging behind due to intense turbulence and weak regulatory support and 94th place in terms of infrastructure development, which is identified as underdeveloped and inefficiently used even in its current state. Important in the context of determining the state of the innovation ecosystem of Ukraine is the indicator of the level of market development as a whole. Ukraine is ranked 99th in the ranking, which is 9 positions lower than the previous year. Analysts believe that this is due to difficult access to microfinance and investment of economic entities – the main economic agents.

Shown in figure 2 structural characteristics of the Global Innovation Index prove the fact that there are no changes in the innovation ecosystem of Ukraine and the processes of increasing the intensity of innovation renewal of the economic potential for the development of a competitive economy in the short term.

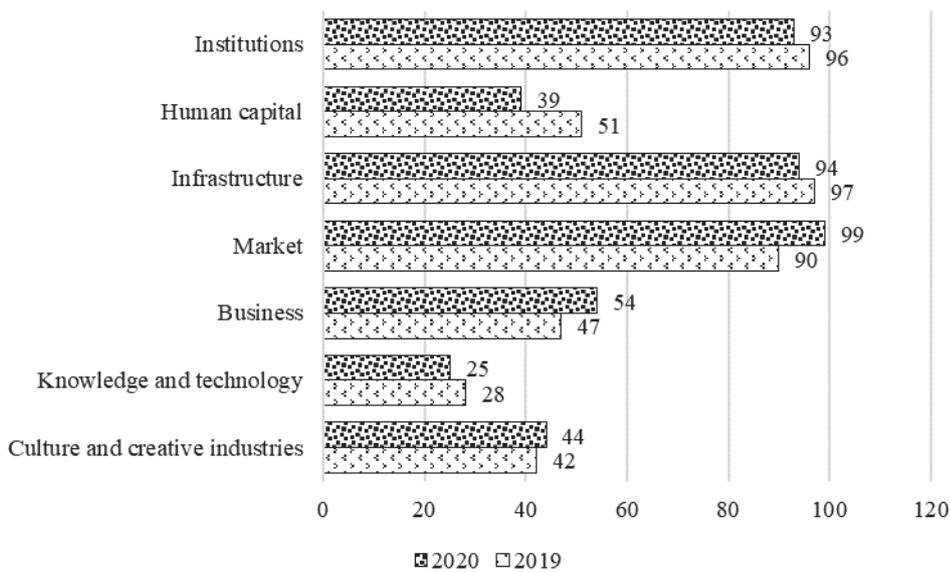


Figure 2. The value of the multipliers of the Global Innovation Index of Ukraine 2019–2020

Source: compiled by the author according to [11].

The introduction of high-tech robotics can reduce labor costs per year in the field of production on the globe by 6.3 trillion dollars. US (19% of global labor costs), automation of information and knowledge – to reduce labor costs over the same period by \$ 9 trillion. USA (27% of world labor costs) [12].

It is proved that the growth of labor productivity and improving the quality of life of the population directly depends on the level of innovation, which in the long-term perspective becomes a determining factor in the ability to create and use new technologies.

According to the June 2020 forecast of the International Monetary Fund (IMF), world GDP will shrink by 4.9% by the end of the year, and is projected to slow down ten years, with high unemployment and long-term damage to globalized trade and value chains [11].

The sphere of functioning of the innovation ecosystem is a multi-factorial environment (*figure 3*), where the greatest threat is posed by factors of negative impact, especially in a pandemic.

During the pandemic, investment in innovation has "depressive" signs, with a significant decline in economic growth, spending on innovation is rather solely due to falling business profitability due to declining consumer market activity, solvency, growth of investment and credit markets. As a result, innovation ecosystems face the problem of funding, and in a pandemic, this problem is exacerbated by the reduction of sources of investment capital.



Figure 3. The main factors of negative impact on the functioning of the innovation ecosystem of Ukraine in a pandemic

Source: compiled by the author according to [1–6].

However, the financial crisis of 2008-2009 did not cause a sharp drop in R&D for the economies of a number of countries (Argentina, China, Costa Rica, Egypt, France, India, the Republic of Korea, Mexico, Poland and Turkey). The crises of previous years had different effects on different countries: in some of them there has even been an increase in innovation, in others – a decrease [9]. The current economic scenario of the country’s development raises a number of questions regarding the effectiveness of investment policy in terms of innovation vector, including on a short- or long-term basis. That is, the policy of stimulating investment in innovation is a leading tool for strategic management of business, national economy, and world economic trajectories.

It is strategically important for Ukraine to create favorable conditions for the existence and development of innovation clusters as a platform for the successful functioning of the entire innovation ecosystem. After all, Ukraine is still not represented in the world’s TOP-100 scientific and technological clusters, and this is due to the existence of public administration tools. Investment and innovation policy in Ukraine is declared as the organization of cooperation between small, medium and large enterprises in the field of innovation in the near future. However, so far no agglomeration of small and medium enterprises has been created around large enterprises – technological leaders in certain sectors of the economy. In the experience of leading countries, leaders create powerful innovative production and service networks that are filled with small businesses. That is why in order to create highly efficient innovation clusters it is necessary to introduce a system of digital transformation in the field of innovation in order to eliminate artificial procedural obstacles to the creation of innovation structures (clusters). Also in the context of digital transformation, it is necessary

to provide for simplification of the procedure for obtaining copyright documents and optimize all processes of interaction in the innovation ecosystem in general, which will significantly affect the strengthening of the innovation ecosystem in a pandemic.

Thus, the implementation of proposals to strengthen the innovation ecosystem in a pandemic will maintain the current position and will accelerate the pace of economic development in a lockdown.

Conclusion. Successful innovation ecosystems should be based on a collaborative format, i.e. relationships between subjects that continuously share knowledge, form common rules and structures, agree on common decisions and coordinate actions to achieve common goals, including in the fight against a pandemic. After all, the ecosystem approach involves evolution over time, taking into account the influence of environmental factors, i.e. innovative ecosystems are characterized by an open dynamic nature.

In the conditions of crisis the state regulation of activity of innovative ecosystems through the mechanism of direct influence on subjects of the organization and definition of conditions and rules of their activity acquires special value. The analysis of highly efficient innovation ecosystems indicates the existence of a mechanism of self-development. That is, under the right conditions of regulation and support, the innovation process can be continuous even in a pandemic. Effective collaboration on the platform of the innovation ecosystem will promote the development of an innovative economy, as evidenced by the foreign experience of Spain and the United States. Coordination of efforts of state, regional, local authorities and companies can facilitate the search for cooperation of knowledge and technology between research institutions and business and, as a consequence, the creation of a new innovative product.

In Ukraine, the innovation ecosystem is underdeveloped, and during the pandemic there is a threat of growing lag behind the leading countries. The main reason for slowing down the development of the ecosystem is the lack of proper government regulation, control and evaluation of the innovation environment. In the conditions of the crisis there are practically absent: the state support of the subjects of the innovation ecosystem and effective investment and innovation policy to ensure collaboration between large, medium and small enterprises; effective tools for organizing such cooperation (pilot projects for the creation of innovation and production agglomerations in the form of scientific and technical clusters of large, medium and small innovative enterprises based on large enterprises – technological leaders to eliminate the crisis in health care); government orders in science-intensive and high-tech sectors of the economy in accordance with the requests of health care institutions; public investment in the development of new organizational forms of such cooperation. The introduction of an effective mechanism of state regulation will lead to overcoming the destructive impact of the pandemic on the innovation ecosystem, as the benefits of uniting the participants of the innovation ecosystem are obvious. Combining

different unique competencies to overcome the pandemic will help create innovative products. Competitive advantages in overcoming the pandemic will be on the side of those innovative ecosystems that combine their unique resources and knowledge to develop new products that will further define the market.

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Пурденко О. Інноваційна екосистема в умовах пандемії COVID-19.

Постановка проблеми. Інноваційна екосистема України сьогодні перебуває в процесі подолання рецесії, спричиненої пандемією COVID-19. Саме тому особливого значення набуває екосистемний підхід до вирішення проблем та пошуку нових механізмів кооперації зусиль усіх учасників інноваційного процесу.

Аналіз останніх досліджень і публікацій. Визначено, що попри наявність окремих наукових досліджень з питань інноваційних екосистем існує необхідність встановлення механізму подолання кризи в умовах пандемії COVID-19.

Метою статті є ідентифікація основних загроз від запровадження карантинних заходів у зв'язку з пандемією COVID-19, визначення ініціатив для ефективного функціонування інноваційної екосистем України.

Матеріали та методи. Теоретико-методологічною основою наукового дослідження стали наукові концепції та теоретичні розробки з питань стану інноваційної екосистеми, а також інформаційно-аналітичні матеріали державних органів влади.

Результати дослідження. Наведено досвід існування високоефективної інноваційної екосистеми під час вибуху кризи та їх успішної реорганізації, що сприяло досягненню оптимальних умов для функціонування й розвитку інноваційних екосистем. Проаналізовано основні показники Глобального Індексу Інновацій 2020 та основні виклики інноваційної екосистеми України.

Висновки. Встановлено, що в Україні інноваційна екосистема є недостатньо розвиненою, а в період пандемії існує загроза посилення відставання від провідних країн. Головною причиною гальмування розвитку екосистеми є відсутність належного державного регулювання, контролю та оцінки інноваційного середовища. Запропоновано заходи щодо зміцнення інноваційної екосистеми.

Ключові слова: інноваційна екосистема, інновації, інноваційна діяльність, інвестиції.