

Innovative development of regions in the era of digital economy: world experience and Ukrainian realities

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Summary

Within the article, forms of innovation structures are systematized, and those that exist in Ukraine are identified, their features, purpose and functions are clarified, activities and current state of their functioning are analyzed. It is proved that in the conditions of digital economy, domestic innovation structures are underdeveloped and do not fulfill their leading role at the present stage of innovative development of the country. To understand the importance of effective operation of innovation infrastructure, the main world models of innovation development are considered, and the directions of using the experience of their functioning for Ukraine are determined. The main indicators of innovation activity of Ukraine in the context of regions are analyzed. There is a significant differentiation of innovation indicators in the regional context. The cartographic analysis of innovative activity of regions is presented. The mechanism of definition and implementation of priority directions of innovative activity in the context of the digital economy development is offered.

Key words:

Innovative development, innovative activity, regional economic systems, region, digitalization, digital economy, information economy.

1. Introduction

The leading direction of modern economic relations in the world in the face of increasing competition is the transition to a new level of scientific and technological development, which is associated with the intensification of innovation in all sectors of the economy. Development of the innovation sphere is now becoming the basis for raising the economy level through the emergence of new activities, developments, technologies, products, etc. resulting in the increase in their productivity and competitiveness.

Modern transformation of the economic system takes place in the context of strengthening the role of information, which is a key element in all operational relations, research and development and is a major factor in innovative development. Thus, in the conditions of innovative progress, the skills and abilities to work with large flows and arrays of information, platforms and services, mastering the remote format of communication, digital literacy come to the fore. Of great importance is the

achievement of digital leadership in the innovation sphere, which is possible through the formation and implementation of digital strategies, the introduction of domestic enterprises of digital management, the translation of most operational processes into digital format. Thus, in terms of innovation activity, the development of the digital economy becomes relevant, which today should be considered, firstly, the basis for achieving positive economic results, and secondly, their engine.

2. Literature Review

Many scientists have devoted their research to the study of various issues of innovative development of regions and digitalization processes, including: Beilin I., Khomenko V., Tagirov M., Zinurova R., Saubanov K., Yakupova N. (2020); Butko M., Pishenin I. (2019); Ivanova N. (2020); Kholiavko N., Djakona A., Dubyna M., Zhavoronok A., Lavrov R. (2020); Ključnikov A., Civelek M., Krajčík V., Ondrejmišková I. (2020); Kychko I., Tulchynska S. (2021); Lazarenko I., Saloid S., Tulchynska S., Kyrychenko S., Tulchinskiy R. (2020); Malik K., Jasińska-Biliczak A. (2018); Oliver Falck, Johannes Koenen, Tobias Lohse (2019); Plechero M., Chaminade C. (2016); Popelo O., Revko A. (2021); Shkarlet S. (2019); Sudolska A., Łapińska J. (2020); Yunfu Xu, Aiya Li (2020); Zajkowska M. (2017).

German scientists Oliver Falck, Johannes Koenen and Tobias Lohse note that they evaluated one of the largest innovation policies in Germany, based on the field - the Innovation Regional Growth Program (IRGC). It subsidizes joint development and commercialization projects of firm state research institutes located in the regions of East Germany with the clear aim of creating local implications for regional economic development. The authors examined three potential types of effects on a wide range of outcomes at the company's and regional levels: the impact of policies on companies that are subsidized directly; consequences of the spread to non-subsidized innovative companies located in the same region; cumulative impact on economic performance at the regional level (Oliver Falck et al., 2019).

The scientific work of Ključnikov A., Civelek M. and Krajcik V. from the Czech Republic, Ondreimiskova I. from Slovakia is devoted to studying the potential of innovative regional development of a structurally disadvantaged industrial region focused on mining and metallurgical industries at the expense of local currency (Ključnikov A. et al., 2020).

Scientists Beilin I. L., Khomenko V. V., Tagirov M. Sh., Zinurova R. I., Saubanov K. R. and Yakupova N. M. investigate the role of the supply chain management of innovative biologically valuable food products in industrial development and economy of the region. They analyzed the process of updating the range of food products through the introduction of innovative developments and production principles that promote the production of new healthy dietary products (Beilin I. L. et al., 2020).

The authors Popelo O., Kychko I., Tulchynska S., Zhygalkevych Zh., Treitiak O. consider the influence of digitalization on the forms of change of employment and the labor market in modern conditions. Their research substantiates that the processes of digitalization directly affect the change of forms of employment and the range of occupations in the labor market, as well as the change of jobs (Popelo O. et al., 2021).

The author of the article Ober J. notes that the positive acceptance of innovation by staff is a very important and crucial issue for the proper functioning of business, industry and the socio-economic environment. The scientist considered the variables that affect the adoption of innovations and analyzed the selected factors of organizational culture from the standpoint of their impact on the implementation of innovations in Polish IT companies (Ober J., 2020).

The purpose of the article of the Polish scientists is to find out whether innovations can affect the competitiveness and sustainable development of small and medium enterprises. The focus was on identifying the processes and changes taking place at enterprises in terms of understanding the concept of sustainable development (Malik K. et al., 2018).

The main purpose of the article by Szopik-Depczynska K., Cheba K. and Wisniewska J. is to identify internal and external factors that motivate selected Polish research and development departments to participate in innovation, R&D and user-oriented innovation. The results of the study confirmed that it is important to invest in innovation, but it is especially important to have at least a research and development strategy in the enterprise. According to scientists, it is worth applying a more progressive research procedure in the process of analyzing further determinants of innovation in the research and development department in Poland (Szopik-Depczynska K. et al., 2020).

Chinese scientists Yunfu Xu and Aiya Li consider that today, thanks to the rapid development of the economy and the knowledge network, innovative human capital is an important factor in the region. Today, some features of China's innovative human capital can be identified, such as low human capital, lack of excellent talent, and unbalanced distribution. Because people are the bearers of innovation, innovative human capital is a combination of human and innovation, which is the core of the regional economy (Yunfu Xu et al., 2020).

The main purpose of the article of the Polish scientist Zojkowska M. is to analyze possibilities of applying open innovative models in the management of micro, small and medium enterprises (SMEs) in Poland. The article is based on the study of the essence of open innovations in terms of values, their origin and conditions of the implementation in the management process, which is characteristic of the SME sector. The study was based on in-depth semi-structured interviews conducted among business leaders / owners responsible for the innovative development of SMEs in Poland (Zajkowska M., 2017).

According to the scientific work of Butko M., Popelo O. and Pishenin I., the implementation of an innovative model of state economy requires significant modernization and integrated use not only of new technologies but also scientific approaches to management, especially to ensure sustainable development of priority segments of the national economy (Butko M. et al., 2019).

The aim of the article is to determine the factors that determine the innovative potential of Polish manufacturing enterprises. The theoretical presentation provides an overview of modern sources of literature on the company's innovative capabilities. The empirical contribution of the article is to recognize the relationship between certain practices used by Polish manufacturing companies and their innovative capacity, measured by innovative activity (Sudolska A. et al., 2020).

3. Methodology

This work used such research methods as the method of analysis and synthesis to identify modern forms of innovation structures and outline their main characteristics, the study of global models of innovation development; statistical - to form indicators that describe the state of innovation in the regions of Ukraine; grouping method - for the analysis of innovative development of regions; cartographic - for visual display of the received groups of regions on indicators of innovative activity; graphic - to visualize the mechanism for identifying and implementing priority areas of innovation in digital economy.

4. Results

Transformation of Ukraine's economy leads to structural changes in existing forms of management and the creation of new ones that can be adaptable to the

environment, as well as compete and make a profit in modern conditions. centers, etc. (Fig. 1).

Today, there are more than 3,000 innovative structures in the world, which are characterized by diversity.

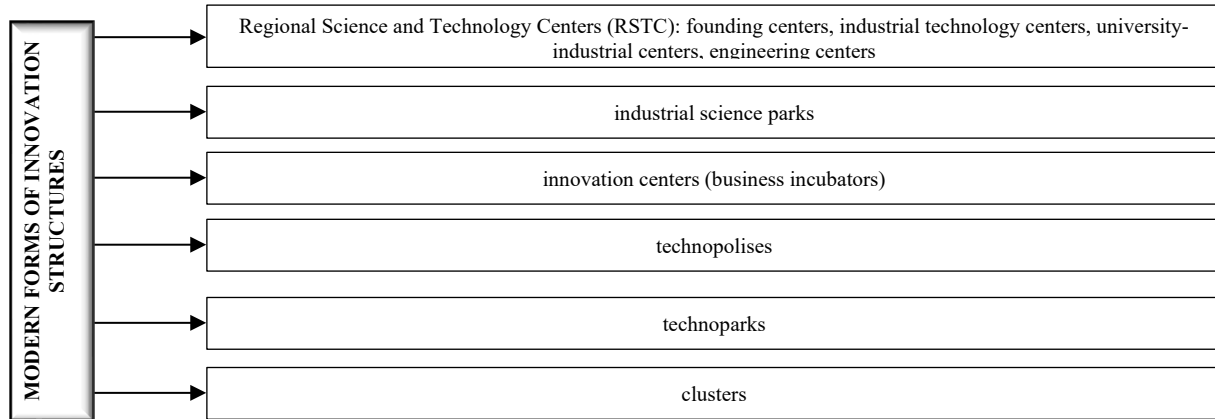


Fig. 1. Modern forms of innovation structures

Source: compiled by the authors

The variety of these innovative forms leads to the need for their detailed study, selection of leading and clarifying their role at the present stage of economic

development, for which the most common forms of innovative structures were studied (Fig. 2).

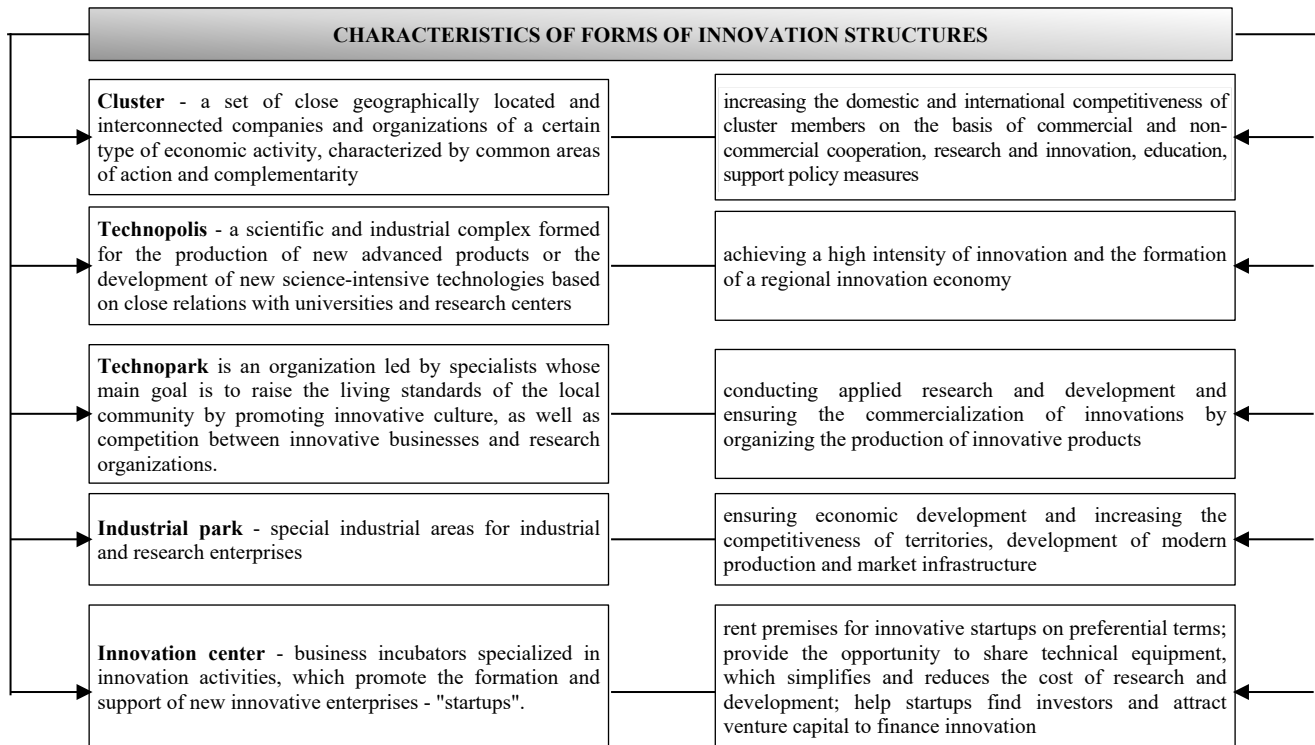


Fig. 2. Characteristics of the most common forms of innovation structures

Source: compiled by the authors

In addition, the authors identified the functions shown in Fig. 2 of the innovation infrastructure types. Thus, for the cluster the main functions are to obtain positive results through the association of organizations in order to improve interaction, exchange information, defend their rights, use the latest technologies and improve the skills of employees; production and sale of better products compared to competitors. The main functions of the technopolis should include: promoting innovation clustering; consolidation of the strength of individual entities to ensure high intensity of research and innovation; ensuring the functioning and renewal of innovation infrastructure; formation of the framework of regional and national innovation systems. Functions of technology parks are the implementation of the full cycle of the innovation process; promoting the exchange of experience, information and technology between innovative enterprises - residents; intensification of cooperation between residents and acceleration of the formation of partner networks, including between small innovative enterprises and divisions of TNCs; providing various consulting and service services to residents. Among the main functions of industrial parks should be noted: the formation of new industrial and industrial complexes with developed engineering and transport infrastructure, comfortable conditions for attracting strategic investors in industry and science. At the same time, the innovation center implements the following functions: lease premises for innovative startups on preferential terms; provide the opportunity to share technical equipment that simplifies and reduces the cost of research and development; help startups find investors and attract venture capital to finance innovation.

Thus, the analysis of innovation structures shows that they are the accumulators of innovation, which operate by combining necessary elements into a single whole and establishing links between them to achieve competitiveness, profitability and intensification of innovation and investment processes. In Ukraine, the innovation infrastructure is not sufficiently developed, does not cover all parts of the innovation process and does not have a systematic approach to providing appropriate services in the field of innovation. Today, the country has virtually no venture funds and technology transfer centers, there is no proper support for scientists and inventors who have completed scientific and technical developments. Only some components of the innovation structure have been formed. Thus, Ukraine has experience in the formation and functioning of cluster structures. The analysis of the functioning of domestic cluster structures showed attempts to cluster the economy of all regions of the country: promising areas are explored, potential opportunities are assessed, strategies, projects, etc. are developed and approved, but real steps are less frequent,

and the number of real clusters in Ukraine is small. Today there is no consensus on the number of clusters in Ukraine.

In addition, in Ukraine there is experience in the creation and operation of technology parks and industrial parks. There are 16 technology parks in the country, but their performance has not been updated since 2010, indicating their very low or no physical activity. The analysis of the domestic technology parks' functioning makes it possible to identify their differences and features. Technoparks in Ukraine were formed on the basis of the Soviet heritage, so they are relatively small closed, poorly integrated into the socio-economic sphere of scientific and technological complexes, which have a number of features: the activity is based on lack of significant financial support from the state and other organizations, there is a state budget, which leads to almost complete dependence of the productivity of scientific and innovative activities on the amount of state funding; low level of attraction of national and international investments; weak impact on the development of the territory and local infrastructure; mostly act as subordinate structural units of academic institutions; there are no TNC divisions with high-tech specialization among the subjects; do not incubate innovative startups; the spin-off process is not pronounced or absent.

In Ukraine, there are also industrial parks (IP), which as of 17.05.2021 created 60, the Register of industrial (industrial) parks (as of 14.05.2021) includes 49, which are located in 20 of the 24 regions of the country. Domestic individual entrepreneurs have been established for an average period of 30-50 years, their total area is over 2,000 hectares, but 25 individual entrepreneurs do not have a management company, and 42 individual entrepreneurs have no participants. Such data indicate an unsatisfactory state of the FE's activity, the reason is the insignificant advantages of its participants (targeted financing on a non-repayable basis and interest-free loans for industrial parks, as well as exemption of park participants from equity participation in infrastructure development) that this mechanism could become a catalyst for the domestic economy development.

In addition, in Ukraine there are 28 registered science parks (NP), in 2018 there were 12 active NPs, which implemented more than 90 projects, mainly with funds raised from other sources.

These data indicate that the domestic infrastructure of innovative development is at the stage of formation, which is due not only to the limitation of the number of innovation structures, but also their structural and functional incompleteness.

This state of affairs is a negative factor in the context of forming an innovative model of the country's development, because the activity of innovation infrastructure should be ensured primarily by the formation of clusters and creation of innovative enterprises

(innovation centers, technology parks, etc.), which in turn will create the basis for the country's rapid transition to an innovative model of development. The analysis of foreign experience shows the leading role of innovation structures in the models of innovation development of different countries.

Today there are four leading models of innovative development: traditional, Western European, Asian and alternative (Fig. 3). The traditional model, which is typical for the countries of the Atlantic region, is based on the

implementation of a full innovation cycle - from the formation of an innovative idea to the release of mass production, with motivation for high innovation activity is a competitive business environment. Based on the study of the main characteristics and features of this model, we can conclude that it will be useful for Ukraine to study the experience of the traditional model and the introduction of new tools for the development of inventions - venture capital and small innovative business.

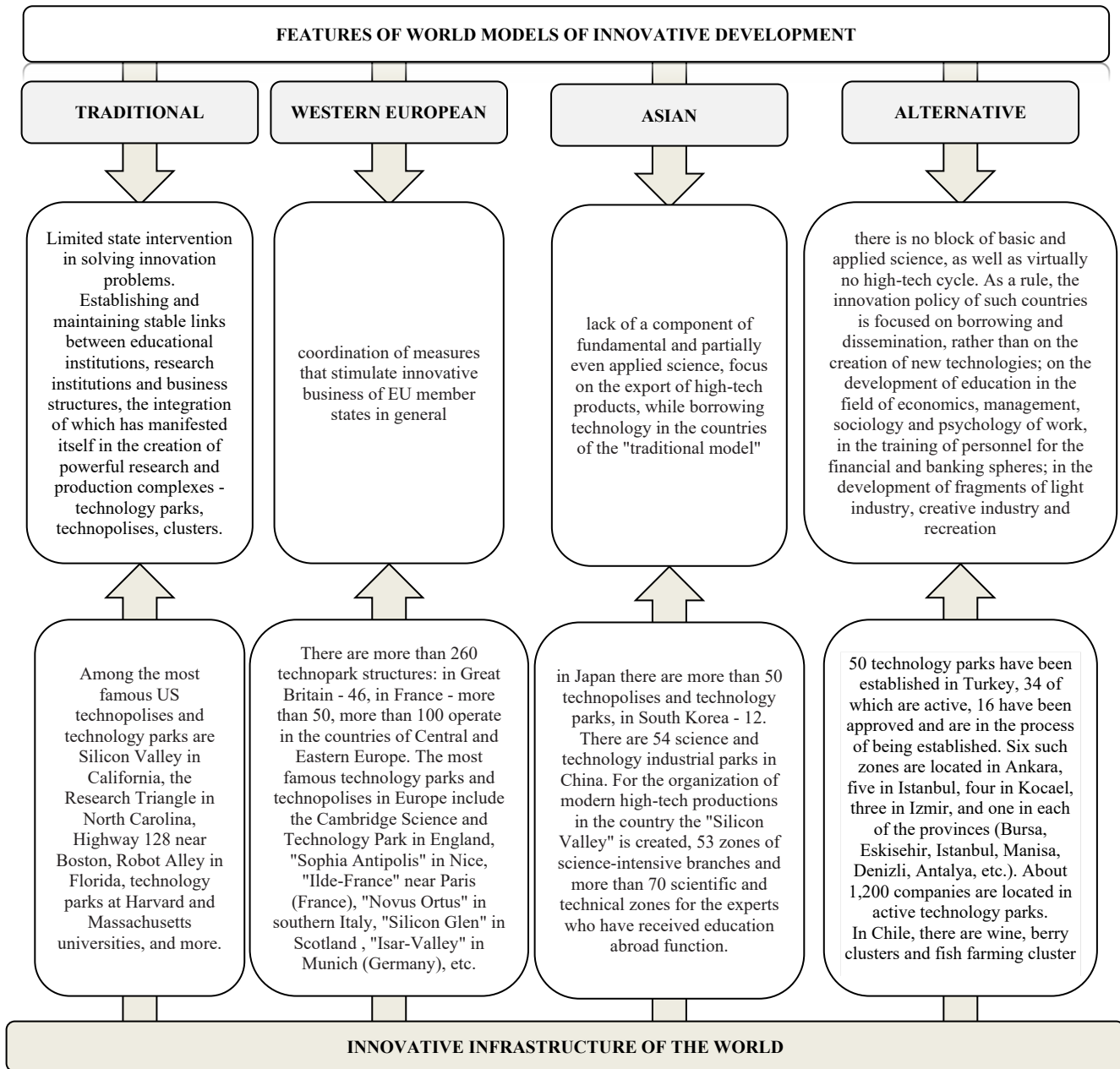


Fig. 3. Characteristics of the most common forms of innovation structures

Source: compiled by the authors

The United Kingdom, as well as EU member states, in particular Germany, France, Italy, Sweden, the Netherlands, Denmark, etc., is characterized by a Western European model based on a high level of development of the basic science funded by the state; cooperation with business in the field of applied research and development; concentrating the integration of science and technology at the regional level; changes in the structure of the regional economy, the formation of a high-tech industrial complex and a developed innovation infrastructure. In view of this, Ukraine needs to use the European experience in terms of the regionalization of innovative development of EU economies and the formation of technology parks and technopolises.

The Asian model is typical for such countries as Japan, South Korea, Hong Kong, Singapore, China. The model is based on the significant role of the state, established interactions between government agencies and corporations, the establishment of effective information communications. At the same time, Japan is characterized by the leadership of large corporations, which have significant resources and intensify the innovation process, as well as the development of applied research, which focuses on creating unique samples and providing high quality export products in high technology. In South Korea, the main agents of economic growth are large industrial groups, whose desire to diversify their activities on the basis of knowledge-intensive technologies to increase the share of exports in total products, is actively supported by the state. A similar model of innovative development is possible for use in Ukraine, in regions where powerful scientific and technical complexes have been created (Dnipro, Kyiv, Kharkiv, Lviv). In China, there is a simulation model of innovative development, which is based on the active import of foreign technologies and their industrial mastery in order to produce knowledge-intensive products. The state pays great attention to the scientific and educational sector, the development of science, innovative technologies and the creation of science-intensive products. The model focuses on the use of the resource base of a country or a specific region. It

should be noted that this model can be used in Ukraine in regions with specific natural resources, such as recreational, climatic or mining.

Countries with an alternative model of innovative development include Thailand, Chile, Turkey, Portugal, and Jordan. These countries do not have significant potential in the field of basic and applied science; Agriculture still plays a significant role in economy that is not characterized by large stocks of raw materials, processing technology or the sale of which could be the basis of national competitiveness. Such a model of innovative development (in particular, the Chilean one) is attractive for agricultural regions of Ukraine, where "value chains" are created on the initiative of the agro-processing enterprises themselves. The motive for such an association should be the ability of its members to attract modern agricultural technologies, which would ensure the competitiveness of the final product, and that is very important for Ukraine. The spread of such chains of "increase in value" to other areas of activity will lead to the creation of a base for technological impetus, involving knowledge-intensive technologies.

Under such conditions, the study of innovative development of the regions of Ukraine by such indicators as the volume of sold innovative industrial products (goods, services) per capita, the number of innovatively active industrial enterprises in % of the total number of industrial enterprises and the amount of funding for innovation (per 1 population) is presented (Table 1, Fig. 4). The data analysis in Table 1 shows the presence of a large differentiation of indicators of regional innovative development, so you can divide all regions into 3 groups: the first group includes regions, in which the analyzed indicators are higher than all-Ukrainian (Zaporizhia, Mykolaiv, Sumy regions and Kyiv); to the second – regions, in which these indicators are lower than the average in Ukraine (Volyn, Zhytomyr, Transcarpathian, Kiev, Luhansk, Lviv, Rivne, Kherson, Khmelnytsky and Chernivtsi regions); to the third – regions, in which different indicators differ significantly from each other and vary from high to low relative to the average Ukrainian.

Table 1: Indicators of innovative development of the regions of Ukraine in 2019

Region	Volume of sold innovative industrial products (goods, services) per 1 person of the population	Number of innovatively active industrial enterprises in% to the total number of industrial enterprises	Volume of financing of innovative activity (per 1 person of the population)
Ukraine	21,21	15,8	12,20
Crimea	–	–	–
Vinnitsia	15,31	15,4	19,29
Volyn	7,67	10,4	3,25
Dnipropetrovsk	12,16	12,5	25,01
Donetsk	127,53	13,0	12,15
Zhytomyr	8,13	14,0	5,68
Transcarpathian	3,99	7,0	1,28
Zaporizhzhia	59,40	19,3	14,45
Ivano-Frankivsk	3,74	16,9	6,07
Kiev	20,26	11,9	7,25
Kirovohrad	37,39	19,4	5,29

Luhansk	7,75	14,9	0,45
Lviv	12,50	12,8	4,91
Mykolaiv	30,61	23,2	29,79
Odesa	10,97	16,5	3,00
Poltava	8,12	16,6	19,35
Rivne	0,23	13,9	0,91
Sumy	24,49	18,9	29,32
Ternopil	5,30	29,9	9,27
Kharkiv	48,44	27,1	9,09
Kherson	15,81	13,3	2,92
Khmelnysky	6,29	6,6	0,45
Cherkasy	30,46	18,6	2,53
Chernivtsi	1,08	10,9	0,62
Chernihiv	24,56	8,7	2,19
Kyiv city	25,61	16,3	45,15
Sevastopol city	-	-	-

Source: compiled by the authors

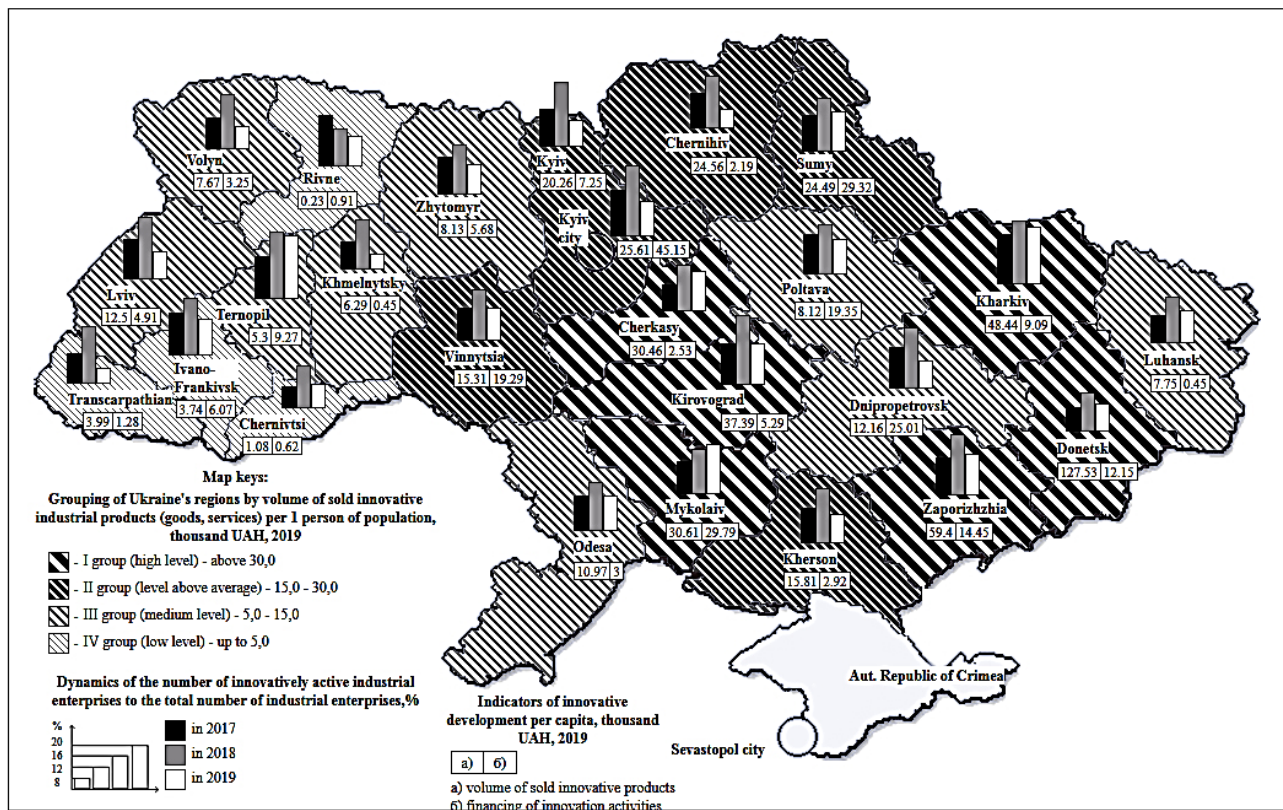


Fig. 4. Grouping of Ukraine's regions according to the indicators of innovative development

Source: compiled by the authors

In general, the analysis of regional innovation development showed an insufficient level of innovation, which requires prompt action to correct the situation. In order to accelerate the transition of economy to an innovative path of development, we propose the use of a

mechanism for identifying and implementing priority areas of innovation (Fig. 5).

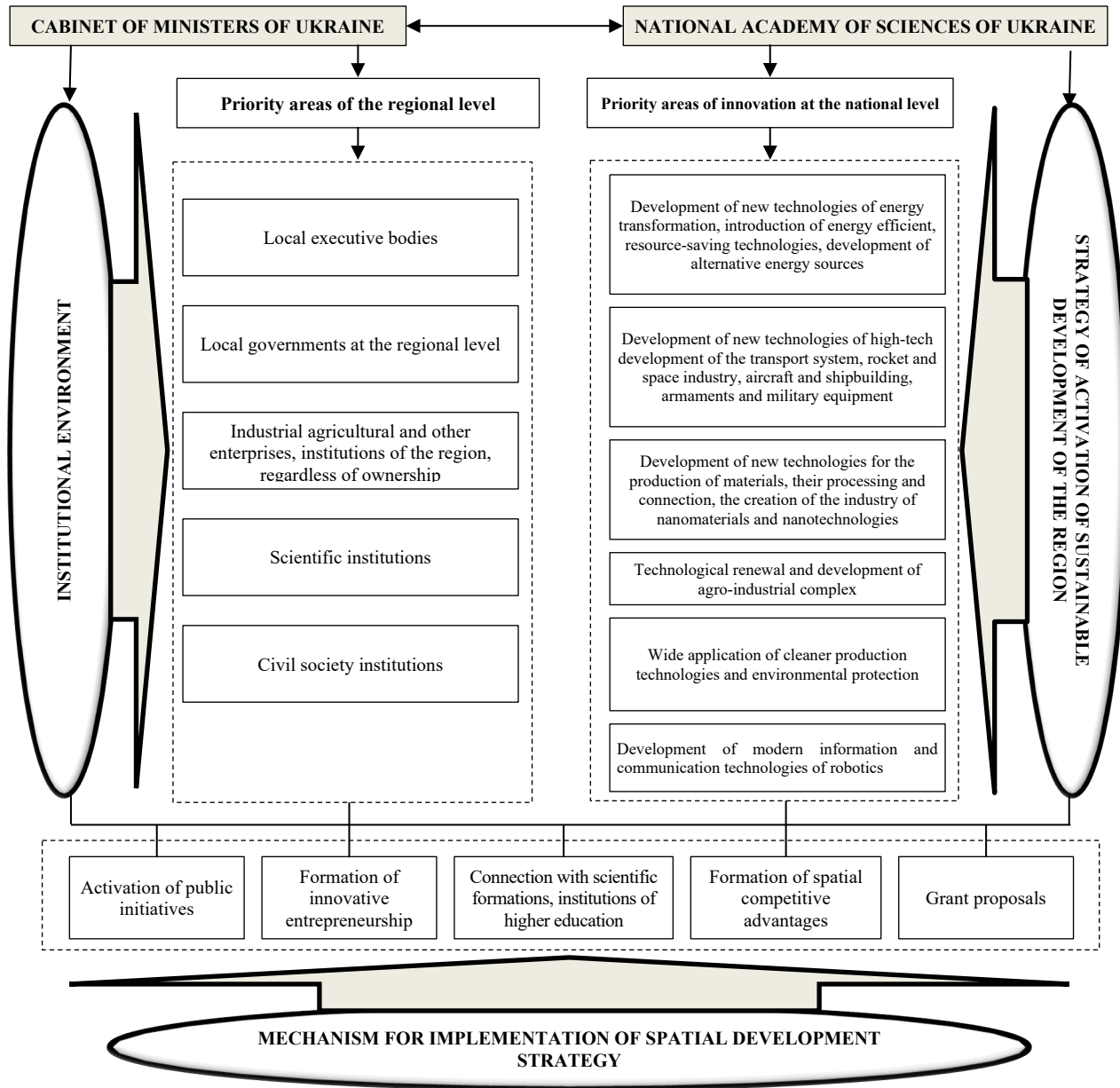


Fig. 5. The mechanism of identifying and implementing the priority directions of innovative activity in the context of the digital economy development
 Source: developed by the authors

This requires:

1) to resume forecasting and analytical research. To do this, it is necessary to form a new State program for forecasting scientific, technological and innovative development to find directions for innovative breakthrough and to ensure the competitiveness of the domestic economy. To implement such a program, Ukraine has sufficient expertise, proven methodology and experience in organizing foresight research;

2) to improve the structure of priority areas of science and technology development, making it hierarchical

(similar to the structure of priority areas of innovation), defining: strategic national priorities (for a period of 20 years); medium-term priorities at the national level; medium-term priorities of the industry level.

The meaning of such an algorithm is that for each of them should be provided in its own specific implementation mechanism. However, this is not presented in the Law of Ukraine "On Priority Areas of Innovation Activity in Ukraine";

3) each level requires the appropriate justification, its inherent formulation and adequate implementation mechanism.

For the first level, very broad generalizations are quite acceptable. In today's world, we can hear from many political leaders that any such science in general is a top priority for them and their governments, and we do not see anything wrong with such statements or, moreover, with concrete actions and their confirmation. Reliance on science as a characteristic feature of state policy is a sign of foresight of its respective political leaders. It is negative if the proclamation of this priority remains nothing more than a political declaration. In most countries of the world, priority areas are recognized, for example, environmental protection, energy and energy conservation, biotechnology, creation of new materials, development of new drugs - that is, fairly broad sectors of the front of scientific research, design and technological work;

4) to implement both scientific and technological and innovative medium-term priorities of national importance should fully use the relevant capabilities of the program-targeted approach - a method whose uniqueness and effectiveness is confirmed by world experience, i.e., state scientific and scientific-technical programs should be developed. However, such programs should not be created automatically for each of the priorities, but through a program competition. After determining medium-term priorities for the development of science and technology (or innovation), the initiators of the programs submit their justifications, concepts and projects of the programs to the competition, and only those who prove their respective potential effectiveness and compliance with the established criteria can apply for their budget financing. Innovative programs should be financed on a parity basis: the state provides no more than half of the required funds, the rest - the interested manufacturing enterprise;

5) to provide an effective and flexible mechanism for managing programs (so far the heads of scientific and technical programs could not effectively influence the course of their implementation), the possibility of maneuvering funds and involving organizations of any form of ownership and individual highly qualified specialists.

5. Conclusions

The article, based on a thorough analysis and systematization of data, identifies the leading forms of innovation structures that exist in digital economy. To understand their role at the present stage of digitalization, parameters of their functioning have been thoroughly studied. The state of domestic new forms of management, such as cluster structures, technology parks, industrial and science park, the immaturity and structural incompleteness

of innovation infrastructure are analyzed, which inhibits innovation development in Ukraine. In order to offer practical steps to increase the innovation activity level of the country, the main world models of innovative development are identified and formed: their characteristics are considered, features and highlights of the foreign experience use are identified. The state of regional innovation development of Ukraine, based on the results of which a cartographic analysis is presented, are analyzed. It has been found that the vast majority of regions have a low level of innovation. In order to improve the situation created by the authors, a mechanism for identification and practical implementation of priority areas of innovation in the context of the digital economy development has been developed.

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