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INNOVATION AND INVESTMENT COMPONENT OF INTERNATIONAL COMPETITIVENESS IN CONDITIONS OF IMPLEMENTATION OF THE EUROPEAN INTEGRATION COURSE OF UKRAINE

Monograph

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The monograph provides a comprehensive study of the innovation and investment component of international competitiveness in terms of implementing the course of European integration of Ukraine. Theoretical bases of innovations and investment potential for ensuring international competitiveness are determined. The organisational and financial determinants of the innovative component of the country's competitiveness, the factors that shape the international competitiveness of Ukraine, the cluster analysis of systems of interaction in innovation processes in the context of Ukraine's European integration course are studied. Proposals for optimising the innovation and investment component of international competitiveness have been developed. The book is recommended for scientists, managers and specialists of management structures, graduate students, students of higher educational institutions.

CONTENT

Scientific research and everyday business practice in Ukraine provide important theoretical and empirical material for the conclusion that there are certain aggravating circumstances in the national economy, that there are various barriers that complicate, limit, and sometimes even prevent competition. In this regard, the issues of knowledge of patterns and trends in the formation of an international competitive environment become especially relevant. The assessment of the factors that determine the level of international competitiveness, in particular the investment and innovation potential, deserves special attention.

An integral component for the formation and development of a competitive environment is to understand the essence of effective competition as a component of economic competition, which creates the preconditions for accelerated innovation development; stimulating enterprises to increase their own competitive advantages; improving production conditions; improving the technological level, quality of products, works, services; development of new markets while ensuring a fair distribution of goods between producers and consumers.

Considering the general economic preconditions and theoretical principles of forming an effective competitive strategy of Ukraine in the process of globalization and European integration, it is necessary to highlight the need to establish a liberal economic system through purposeful policy of the state. The basis of such a system is free enterprise and an adequate system of state regulation of the economy, in particular from the standpoint of increasing the innovation and investment component of international competitiveness in terms of implementing the course of European integration of Ukraine. Only in such an environment is innovation possible in the search for new markets and ensuring the effective behaviour of economic entities in them in modern conditions. At the same time, the establishment of cooperation in the innovation processes of the region is the basis of the institutional policy of creating a developed competitive environment in the national economy. Only with a condition that it is carried out consistently, the national competitive advantages could be formed. Given the possibility of their further use in the development of European and new markets, attention should be focused on finding the most important ways for each country to identify and ensure the factors of high

competitiveness and maintain an environment conducive to free exercise of their advantages in foreign markets.

Today, the innovative development of the region and the intensification of innovation in particular depend on the level of interaction between the subjects of the innovation process, producing knowledge, developing innovative products or ensuring the production and sale of innovative products.

The main purpose of this scientific work is to study the principle problems and prospects for the use of innovation and investment component of international competitiveness in the implementation of the course of European integration of Ukraine.

The first section of the monograph reveals the evolution of the economic content of innovations and its specifics at the present stage of socio-economic transformations, defines the institutional principles of investment component of international competitiveness and develops methodological approaches to economic evaluation of interaction systems in innovation processes and elements such as evaluation principles, evaluation tasks and functions, subjects and objects, evaluation stages. A well-founded conceptual methodological approach to the evaluation of systems of interaction in innovation processes, in contrast to the existing provisions for the evaluation of innovation, involves monitoring the processes of establishment, and implementation of shared activities of participants in innovation processes. The developed methodological approach can be used to improve the procedure for evaluating the effectiveness of programs and projects of regional development and public-private partnership by both representatives of the business environment and local governments.

The second section is devoted to the diagnosis of innovations and investment component of Ukraine's international competitiveness in modern conditions. Thus, based on the results of the cluster analysis of innovation cooperation with foreign partners, it can be concluded that in all the regions of Ukraine enterprises with technological innovations do implement innovative projects with the participation of partners from EU countries. Interest in the formation of interaction systems should be initiated by the direct subjects of the innovation process and realised through the revival of communications at all levels of the innovation system.

The third section of the monograph reveals the economic and social tools of the mechanism of development of interaction systems, as well as

modelling the impact of innovation activities of economic entities on the macroeconomic indicators of Ukraine.

In particular, in the context of European integration aspirations, this study concludes that to enhance the interaction in innovation processes as prerequisites for development, may involve participants of different levels of government and ownership, activities that will improve the use of economic and social tools to intensify innovation.

In the conditions of globalization processes and rapid diffusion of innovations, the tendencies of development of national innovation systems largely determine the priorities and organizational and technological mechanisms for solving the problems of economic development of the state. Indicators of the efficiency of the innovation system form the level of development of the national economy as a whole, as investing in innovation processes on the one hand is possible with stable sustainable development of the economy, and on the other serves as a tool to increase innovation growth in the regions.

The results of the study suggest, that the research of models of the impact of innovation activity of economic entities on the development indicators of the region should be based on a combination of indicators of efficiency of innovation processes. This will ensure the complexity and systematisation of evaluation, and will allow to determine the input and output indicators of innovation policy.

It is substantiated that in the conditions of the conducted evaluation, among the performance indicators, the costs of innovations and the number of industrial enterprises that implemented innovations have the most significant impact. The results of econometric studies indicate a positive and significant impact of the level of knowledge intensity of GDP on the overall economic dynamics. Thus, innovation policy aimed at increasing the share of scientific and technical work in regional GDP is one of the most important factors to ensure economic growth.

The monograph does not claim to cover the problems related to the study of the innovation and investment component of international competitiveness in the context of the implementation of the course of European integration of Ukraine. We hope that the publication will be of interest to readers and will serve for the further development of economics.

THEORETICAL FUNDAMENTALS OF INNOVATION AND INVESTMENT POTENTIAL FOR ENSURING INTERNATIONAL COMPETITIVENESS

1.1. The evolution of the economic content of innovations and its specifics at the present stage of socio-economic transformations

The modern era of global socio-economic transformations has turned mobility into virtually the only sustainable characteristic of business development. Modern manifestations of mobility of the modern economic process include, for example, a rapid response of changing conditions of national and world markets, the development of formal and informal institutional environment, information asymmetry, development of the global economic system, etc. The dynamism of modern development necessitates the formation and improvement of innovation and investment model of development, as the most successful and most promising.

Innovation and investment activity in the modern conditions of global socio-economic transformations is an important factor influencing all spheres of development of both individual countries and entire regions of the world. Globalisation is in fact the root cause of the need to increase the efficiency of innovation and investment activities and provokes an even greater lag of the so-called third world countries from the industrialized countries. The highly developed countries of the world act as centres of investment attraction and, as a result, are producers of advanced innovations in all spheres of social production, and therefore receive better conditions for self-realisation.

In the conditions of internationalization of economic life, international innovation and investment activity plays a key role in all world's processes of recovery and is becoming more and more widespread. Awareness of the need to ensure quality economic growth (at the micro, macro, meso and mega levels), the impact of globalisation on all areas of human activity, modern transport routes, etc. form an appropriate environment for the intensification of innovation. In most cases, motivation in the field of innovation and investment includes a system of factors, which usually

includes not only positive but also negative (for example, the threat of crisis, armed conflict, negative aspects of labor migration, etc.).

The progressive phenomena of modern society and the urgent need for the formation of competitive business activities in the fields of production and services form a direct dependence on innovation.

A lot of economists argue that innovation activity is a fundamental factor in ensuring the proper level of efficiency of business entities and the market mechanism. For economies that are in the process of market formation or transformation, innovation is an impetus for qualitative change, and for highly developed countries - an element that allows to maintain a leading position in the world market and increase the welfare of citizens.

In the modern economic paradigm, innovation has a prominent place.

People have always been interested in innovations, because they are a necessary element to improve the level of well-being. The innovations exist from the moment of the first practical step of the person towards improvement of the life. The first mentions of innovation are found in the works of ancient Greek thinkers: in Xenophon's Domostroy, Plato's Politics, and Aristotle's Nicomachean Ethics, there are clear ideas about the expediency of activities that improve practical operations and generally increase productivity. In particular, Xenophon noted that the division of labor is an innovation in the process of organising production [1, p. 204; 2, p. 8–9].

However, the works of these ancient Greek researchers can not be considered a full-fledged origin of innovation theory, because their views in this area are fragmentary, and none of them attributed innovation to one of the main objects of their study.

The fundaments of full economic knowledge in determining the role of innovation processes can be traced in the theory of the classical school of political economy (XVIII-XIX centuries) due to the fact that one of the objects of study of this school was the field of production. Namely, in the works of A. Smith, J. Condorcet, D. Ricardo, J.B. Say and K. Marx there's quite clearly outlined the place of innovation in improving the efficiency of all spheres of social production.

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[1] Fedotov A. A. Osnovnыe koncepcy`y` y`nnovacy`onnogo razvy`ty`ya: y`story`chesky`j analy`z [Basic concepts of innovative development: historical analysis]. Visny`k Donecz`kogo nacional`nogo universy`tetu. Seriya V: Ekonomika i pravo. 2008. Vy`p.2. P. 203 – 208.

[2] Cherep A. V., Markova S. V. Ocinka efekty`vnosti innovacijno-investy`cijnoyi diyal`nosti pidpry`yemstv likero-gorilchanoyi promy`slovosti [Evaluation of the efficiency of innovation and investment activities of the enterprises of the alcoholic beverage industry]: monografiya. Derzh. vy`shh. navch. zakl. «Zaporiz. nacz. universy`tet Ministerstva osvity` i nauky`, molodi ta sportu Ukrayiny`. Zaporizhzhya: Zaporiz. nacz. un-t, 2012. 283 p.

In A. Smith's scientific work «An Inquiry into the Nature and Causes of the Wealth of Nations» there is a statement that the growth of labor productivity can be the invention of machines that simplify labor and increase its productivity. It is the division of labor and focus on the implementation of individual operations contributed to the invention of a better way to implement them (facilitation and acceleration) [3, p. 214–219]. The scientist also considered the causes and consequences of scientific and technological progress.

A contemporary of A. Smith, the French scientist J. Condorcet in his work «Sketch for the Historical Picture of the Progress of the Human Mind» (1795) explored the interaction between the development of industrial production and the state of scientific development. The scientist believed that scientific achievements ensure the progress of the industrial sector, which, in turn, has impact on the effectiveness of science and contributes to its entry into a new level of development. The result of this relationship is human and economic development [4, p. 250–258].

D. Ricardo and J.B. Say also adhered to the opinion of A. Smith that the first inventors were artisans and workers [5, p. 38–45]. To confirm these idea, we can bring specific historical facts: the workers-inventors created and introduced into the production process a spinning machine, a mechanical loom, a lathe, etc.

The English scientist D. Ricardo in his work «On the Principles of Political Economy and Taxation» (1817) more thoroughly than his predecessors considers the features of scientific and technological progress and its impact on general macroeconomic development:

- the growth of wages stimulates greater investment, resulting in the displacement of manual labor by machine and the emergence of technological unemployment;

- only those technological changes are useful that increase productivity. If this effect is not achieved, the innovations do not affect the cost of capital and labor in any way [6, p.482].

Continuing the views of the classics of economic theory on the role of innovation, it is worth mentioning the theory of cyclical crises of the

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3 Smy`t A. Y`ssledovany`e o pry`rode y` pry`chy`nax bogatstva narodov [A study of the nature and causes of the wealth of peoples] / A. Smy`t; vstup. stat. y` komment. V.S.Afanas`eva. M.: Soczegy`z, 1962. 684 p.

4 Kondorse Zh. Esky`z y`story`cheskoj karty`ны progressa chelovecheskogo razuma [Sketch of a historical picture of the progress of the human mind] / Zhan Kondorse; [per. s fr.]. M.: Yuty`ekn`j dom «LY`BROKOM», 2011. 280 p.

5 Sej Zh.-B. Traktat po poly`ty`cheskoj ekonomy`y` [A treatise on political economy]. Fredery`k Basty`a. Ekonomy`chesky`e sofy`zmy; Ekonomy`chesky`e garmony`y` [sost., vstup. st. y` komment. M.K. Bunky`noj y` A. M. Semenova]. M.: Delo: Akad. nar. xoz-va pry` Pravy`tel`stve Ros. Federacy`y`, 2000. 232 p.

6 Ricardo D. On The Principles of Political Economy and Taxation. John Murray, 1817.

German researcher K. Marx, according to which the basis of medium-term cyclical fluctuations in the economy are technological changes and upgrades. The material basis of cyclical fluctuations in the economy, according to Karl Marx, is the life cycle of the means of production. Therefore, it is quite natural to conclude about the need for constant technological discoveries that will positively affect the development of productive forces. However, in the first volume of his work «Capital» K. Marx considers scientific and technological progress as a superstructure, as the result of production, not a motive. In addition, the scientist proved the cyclical nature of innovations, which are activated in the phases of recession, crisis and depression and slow down somewhat during the recovery and upswing. K. Marx connects innovations with organizational and socio-economic changes in social production, and also identifies two types of economic growth and technical progress: extensive (production growth is achieved by intensifying the use of existing technology and equipment) and intensive (increasing production and positive changes in the economy are achieved through increased use of new equipment and technology) [7, p. 325–339].

The author mentions of the expediency of introducing innovations into the economic process are contained in the works of Ukrainian scientist M. Tuhan-Baranovsky. Namely in the work «Industrial Crises in Modern England, Their Causes and Influences on National Live» (1894) it is stated that the state is obliged to create favourable conditions and provide support for the creation of scientific developments, their testing and implementation in production. According to M. Tugan-Baranovsky, the root cause of industrial crises is the technical level of means of labor and the growth of their efficiency is an impetus for economic growth. M. Tugan-Baranovsky was the first to apply a reproductive approach to the study of uneven economic development under the influence of scientific and technological progress. The scientist, like Karl Marx, believed that innovation is closely linked to the cyclical nature of economic development. In addition, M. Tugan-Baranovsky was the first to point out that innovation is due to investment. And the scientist proved that fluctuations in investment are decisive in changing the phases of the economic medium-term cycle [8].

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[7] Marks K. Kapy`tal. Kry`ty`ka poly`ty`cheskoj ekonomy`y` [Critique of political economy]: v 4 t. M.: Poly`ty`zdat, 1983. T. 1: Process proy`zvodstva kapy`tala. 737 p.

[8] Tugan-Baranovsky`j M.Y`. Promyshlennye kry`zy`sy. Ocherk y`z socy`al`noj y`story`y` Angly`y` [Industrial crises. An essay on the social history of England]. K.: Naukova dumka, 2004. 368 p.

The scientific developments of the Ukrainian scientist Mykhailo Tuhan-Baranovsky became the basis of many author's works of Ukrainian and foreign researchers in the field of development of the innovation paradigm, which began to acquire a full-fledged form in the middle of the twentieth century [9, p.125–136; 10, p. 243–258; 11, p. 315–319].

Among the important developments in the development of the theory of innovation is the views and scientific developments of Nikolay Kondratiev, in particular his work «Great Cycles of Conjecture and Theory of Forecasting» (1928). The researcher analysed the actual static data of economic development at the time of the world's leading capitalist countries: the United States, England, Germany and France. After monitoring macroeconomic indicators in the long run, the scientist proved the existence of «long waves» lasting 54 years. The root cause of long-term economic fluctuations, the scientist calls the change of basic technologies used for social production of the country. The depth and novelty of the used innovations are decisive in stimulating the economic development of both the individual business entity and the national social production. In addition to innovative changes, among the defining causes of «long waves», the scientist calls the transformation of social life, which can take the form of long-term cyclical fluctuations in the economy [12, p. 219 –236]. Nikolay Kondratiev also proved and statistically substantiated that the phases of «long waves» (rising and falling) are determined not by the factors that accompany the cycle, but by the processes occurring two decades earlier and the accumulated effects of their interaction. For example, the researcher conducted a statistical analysis and proved that the ascending phase of the «long wave» is preceded by twenty years of recovery in the innovation sphere of the country, which includes the whole process of invention and active implementation of a new generation of research and technology. Nikolay Kondratiev the influence of innovative development not only on the country's economy, but also on the process of socio-political transformations is also proved [13, p. 358-362].

N. Kondratiev from the beginning of the industrial revolution of the eighteenth century singled out five «long waves» lasting 50-60 years.

Elaboration of N. Kondratiev's works allowed researchers of the innovation paradigm to identify six technological modes:

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9 Bell D. Tret`ya texnology`cheskaya revolyucy`ya y` ee vozmozhnye socy`al`noekonomy`chesky`e posledstvy`ya [The third technological revolution and its possible socio-economic consequences]. M., 1990. 408 p.

10 Bernal Dzh. Nauka v y`story`y` obshhestva [Science in the history of society]. M., 1956. 512 p.

11 Bell D. The Coming of Post-Industrial Society. N.Y., 1976. 507 p.

12 Kondrat`ev H.D. Bol`shy`e cy`kly konjuyunktury y` teory`ya predvy`deny`ya [Large business cycles and the theory of foresight]. M., 2002. 383 p.

13 Kondrat`ev H.D. Bol`shy`e cy`kly konjuyunktury y` teory`ya predvy`deny`ya [Large business cycles and the theory of foresight]. M., 2002. 383 p.

And: 1770-1830 invention of the water engine and textile machines;

II: 1830-1880 invention of the steam engine and distribution of railway and steamship transport;

III: 1880-1930 Invention of the electric motor, the beginning of steel production and inorganic chemistry;

IV: 1930-1970 Invention of the internal combustion engine, the emergence of the automotive industry, non-ferrous metallurgy, oil refining industry;

V: 1970-2010 microelectronic components, the emergence of computer technology, optical fiber, etc;

VI: 2010-2040 use of nanotechnologies, alternative energy, intellectualisation of all human activity, due to available productive forces [[14], p.180; [15], p. 68–70; [16], p. 256–264; [17]].

Based on these features, most highly developed countries in the period 10-20-ies of the XXI century entered the process of the sixth technological path.

An active researcher and developer of a complete theory of innovative development was the Austrian economist J. Schumpeter, who considered them, first, as the economic influence of organisational form on the transformation and diversification of products, which transforms these products from traditional to new ones. Secondly, he tried to reveal the essence of innovation in terms of system utility, as a new process and a new result. Third, he looked at innovation in terms of combining existing factors of production in a new way. J. Schumpeter, developing the ideas of Nikolay Kondratiev, is considered a representative of the classical theory of innovation and innovative development, the period of active formation of which falls on the 50s of the XIX century. - 50s of the twentieth century. J. Schumpeter and his followers argue that the replacement of machines and technologies will be effective only if it is not due to physical wear and tear, but through a decrease in the competitiveness of the manufacturer and the rate of profit from its activities. The desire to increase these indicators

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[14] Kolomiyecz` I. F., Goshovs`ka G. V. Evolyuciya teorij innovacijno-texnologichnogo rozvy`tku v retrospekty`vnij ocinci [Evolution of theories of innovation and technological development in retrospective evaluation]. *Regional`na ekonomika.* 2014. # 2. P. 178-186.

[15] Gury`eva L. Koncepcy`ya texnology`chesky`x ukladov [The concept of technological ways]. *Y`nnovacy`y`.* 2004. # 10 (77). P.70-71.

[16] Naukovi parky` innovacijnogo pidpry`yemny`cztva. Texnopark [Science parks of innovative entrepreneurship. Technopark]: monografiya / I.G. Grabar, M.I. Leshhenko, A.S. Maly`novs`ky`j, Ye.I. Xodakivs`ky`j. Zhy`tomy`r: Vy`d-vo ZhNAEU, 2009. 384 p.

[17] Peresun`ko Z. M. Teorety`chni aspekty` rozvy`tku innovacijnoyi teoriyi [Theoretical aspects of the development of innovation theory]. *Efekty`vna ekonomika.* # 7. 2013. URL: http://www.economy.nayka.com.ua/?op=1&z=2192.

should be the main stimulus for innovation. Entrepreneurs-innovators, who are most at risk to consolidate their leading positions in the market, are «locomotives» that will provoke the spread of innovation in all other areas of social production and which will prove their usefulness by their own examples through the return on investment [18, p. 5–6]. According to J. Schumpeter, it is from the business environment that the initiative of innovative activity should extend without outlining the regulatory influence of the state on this process. That is why the scientist proves that the emergence of innovations in the economic system is not a uniform process, but depends on basic innovations and the existing technological system. Highlighting the technological devices and stages of cyclical development, the scientist identified a specific factor that triggered the mechanism of innovation (for example, mechanisation of labor in the textile industry caused the cycle of 1790-1840, steam engine and railway - 1840-1890, electrification and ferrous metallurgy: 1890- 1940s, organic chemistry and the development of the oil industry: 1940-1990) [19, p. 156–159].

J. Schumpeter, introducing the term «innovation» in 1939 (since 1912 he used the category «new combination»), interprets its economic meaning not as an improvement of the process / product, but as the emergence of a new one, displacing the outdated production function. As a result, the creation and implementation of new activities necessitates organisational innovation [20, p. 214]. Thus, the scientist justifies the emergence of a cluster of innovations (innovation beams) - from technical and technological to organisational and social, from basic to secondary. Under innovation, he considers the so-called «new combinations»: a new product, a new method of production, a new market, a new source of raw materials, reorganisation [21]. Simultaneously with the substantiation of the time lag from the introduction of innovations and ensuring economic growth, J. Schumpeter

[18] Bazhal Yu. M. Innovacijna teoriya ekonomichnogo rozvy`tku: M. Tugan-Baranovs`ky`j, J. Shumpeter i problemy` perexidnoyi ekonomiky` Ukrayiny` [Innovative theory of economic development: M. Tugan-Baranovsky, J. Schumpeter and problems of transition economy of Ukraine]. *Naukovi zapy`sky`*. 2000. Tom 18. Ekonomichni nauky`. P. 3-7.

[19] Shumpeter J.A. Teory`ya ekonomy`cheskogo razvy`ty`ya. Kapy`taly`zm, socy`aly`zm y` demokraty`ya [Theory of economic development. Capitalism, socialism and democracy] / J.A. Shumpeter; [predy`slovy`e V.S. Avtonomova; per. s nem. V.S. Avtonomova, M.S. Lyubskogo, A.Yu. Chepurenko; per. s angl. V.S. Avtonomova y` dr.]. M.: Eksmo, 2007. 864 p.

[20] Shumpeter J.A. Teory`ya ekonomy`cheskogo razvy`ty`ya. Kapy`taly`zm, socy`aly`zm y` demokraty`ya [Theory of economic development. Capitalism, socialism and democracy] / J.A. Shumpeter; [predy`slovy`e V.S. Avtonomova; per. s nem. V.S. Avtonomova, M.S. Lyubskogo, A.Yu. Chepurenko; per. s angl. V.S. Avtonomova y` dr.]. M.: Eksmo, 2007. 864 p.

[21] Joseph A. Schumpeter Business cycles. A Theoretical, Historical and Statistical Analysis of the Capitalist Process. New York Toronto London : McGraw-Hill Book Company, 1939, 461 p. URL: https://discoversocialsciences.com/wp-content/uploads/2018/03/schumpeter_businesscycles_fels.pdf.

argues that the mass emergence of innovations indicates the beginning of the process of economic growth.

J. Schumpeter's undeniable achievements in the development of the innovation paradigm are the separation of simple reproduction through adaptation to changing economic conditions from specific dynamic changes due to specific needs, accompanied by the emergence of new technologies / goods / markets / raw materials / semi-finished products and reorganisation. Entrepreneurs-innovators, not the state, play the main role in initiating and implementing innovations.

J. Schumpeter's innovative concept deserves the status of a classical theory, as it comprehensively considers the features of innovative development. In summary, the classical conceptual positions of J. Schumpeter's theory are as follows:

- the interdependence and complementarity of social and economic determinants is investigated. The scientist clearly outlines their uniqueness and impact on economic development, as well as their interconnectedness. Considering the features of economic development, the scientist identifies a key element - entrepreneurship, which is crucial for ensuring economic growth and social welfare of the country at all stages of the economic cycle. [22, c.29];

- the basis of the country's innovative development is a competitive environment (competition for resources, for consumers, for the best conditions for the realisation of economic benefits, etc.), which pushes entrepreneurs to the risk of introducing innovations in science and technology in social production;

- social determinants not only regulate, but also actually determine the quality of the internal and external environment of entrepreneurship, which can both multiply the positive effects of entrepreneurial activity and slow down its action. The processes of socialisation are directly related to the processes of institutionalisation at all levels of government. The quality of institutionalisation is crucial for the effective dissemination and use of innovation.

J. Schumpeter's views are especially relevant in the context of socio-economic transformations under the influence of globalisation and internationalisation of economic development. It is under such conditions that the long-term reform of the economic system of not only Ukraine takes place, which actualises the views of the scientist in today's times.

[22] Kravchenko M., Shergelashvy`ly` E. Y`nnovacy`onnaya parady`gma J. Shumpetera y` pry`ncy`py reorgany`zacy`y` ekonomy`chnoj sy`stemy [J. Schumpeter's innovative paradigm and principles of reorganization of the economic system]. Visny`k Ky`yivs`kogo nacional`nogo universy`tetu imeni Tarasa Shevchenka. Ekonomika. #145. 2013.P. 28-30.

In support of this thesis, we can give an example of modern innovative concepts:

- American scientists B. Johnson and B. Lundval and a number of others argue that an effective innovation system should consist of educational and research institutions (as an example, higher education institutions), government institutions and the business environment [23, p.9–13; 24, p. 114–120];

- the views of K. Freeman and his associates reveal the content of an effectively functioning innovation system: «it is a complex that includes not only radical innovations, but also their dissemination and use» [25, p.221; 26, p. 93; 27, p. 82–90]. The system that ensures the introduction and dissemination of innovations requires the presence of certain institutions (both economic and social), which use in their activities both formal and informal institutional factors [28, p. 122-143].

All of the above actualises the innovative theory of J. Schumpeter for modern economic conditions of countries with socially-oriented economic system and confirms its classicism.

During the Great Depression, the post-crisis period and the Second World War, scientists' attention to innovation issues decreased slightly.

Considering this period in economic theory can not ignore the Keynesian concept. John Keynes in the 30s and 50s of the twentieth century actively substantiated and defended the idea that a market economy is not able to be efficient and effective. He considered it necessary to intervene in all spheres of economic life and offers a range of tools and mechanisms. In addition, J. Keynes and his supporters studied the economic system in the short term at fixed prices by the state [29, p. 342–354]. That is why, at first glance, it may seem a misconception that a full-fledged study of the impact of innovation on economic development has been left out of Keynesian theory. J. Keynes does not really consider innovation as a basic condition for economic efficiency, but he proposed and justified the use under certain

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[23] Johnson B., Edquist C., Lundvall B. Economic Development and the National System of Innovation Approach. First Globelics Conference. Rio de Janeiro, November, 3–6, 2003. 24 p.

[24] Etzkowitz H. The Dynamics of Innovation: From National System and 'Mode 2' to Triple Helix of University-Industry-Government Relations. Introduction to the special 'Trip Helix' issue. Research policy. 2000. Vol. 29. No. 2. P. 109–123.

[25] Freeman C. Continental, National and Sub-national Innovation System-complementarily and Economic Grows. Research Policy. 2002. Vol. 31. Issue 2. P. 191–211.

[26] Johnson A. Functions in Innovation System Approaches. Mimeo: Department of Industrial Dynamics, Chalmers University of Technology, 1998. 148 p.

[27] Mowery D. C., Oxley J. E. Inward Technology Transfer and Competitiveness: the Role of National Innovation Systems. Cambridge Journal of Economics. 1995. Vol. 19. No 1. P. 67–93.

[28] Dement`ev V. V. Y`nsty`tuты, povedeny`e, vlast` [Institutions, behavior, power]: [monografy`ya]. Doneczk: GVUZ «Doneczky`j nacy`onal`nyj texny`chesky`j uny`versy`tet». 2012. 310 p.

[29] Kejns Dzh. M. Obshhaya teory`ya zanyatosty`, procenta y` deneg. Y`zbrannoe [General theory of employment, interest and money. Favorites]. M.: Eksmo, 2007. 960 p.

conditions of a set of organisational and structural innovations in government regulation [30]. Also the perception of J. Keynes of innovations explains the model of the investment multiplier formed by him: the necessity of active stimulating activity of the state concerning investment expenses is proved [31, p. 218; 32, p. 168]. Since investments, for the most part, usually have an innovative component, we can agree with the opinion of O.Alsufyeva that «increasing investment in innovation leads to an increase in gross national product and gross national income, taking into account the multiplier effect., ie the increase in investment in innovation leads to an increase in national output and total income of society by an amount greater than the initial increase in investment» [33]. Thus, J.Keynes studied the organisational and economic component of innovation, and he was an innovator of economic thought.

In the 50's of the twentieth century. American scientists M. Abramovich, E. Denison, D. Kendrick, studying economic change in the United States, found in the long run the pattern of faster GDP growth relative to the growth of capital and labor resources. Researchers have substantiated this fact by the active use of science and technology in social production [34; 35; 36, p. 180; 37, p. 112].

R. Solow's statements were similar: the scientist having studied macroeconomic indicators of efficiency of national economy of the USA for the forty-year period (1909-1949) calculated a causal relationship - increase in twice gross output has occurred on 87,5% in connection with qualitative technological changes and by 12.5% with the growth of labor capital [38]. Solow's work was awarded the Nobel Prize.

At this period of development of the concept of innovation is the emergence of socio-psychological theory of innovation, the developers of

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30 Alsuf'yeva O. O. Na shlyaxu do regulyuvannya zhy`ttyeradisnoyu intuyiciyeyu (Recepty` DZh. M. Kejnsa) [On the way to regulation by cheerful intuition (Recipes of J. M. Keynes)]. Problemy` ekonomiky` ta polity`chnoyi ekonomiyi. # 2. 2016. URL: http://politeco.nmetau.edu.ua/journals/2/4_a_ua.6.pdf.

31 Kejns Dzh. M. Obshhaya teory`ya zanyatosty`, procenta y` deneg. Y`zbrannoe [General theory of employment, interest and money. Favorites]. M.: Eksmo, 2007. 960 p.

32 Shapy`ro N.A. Y`nnovacy`y` y` «nalazhennoe obshhestvo», y`ly` Dzh.M.Kejns ob uchasty`y` gosudarstva v y`nnovacy`onnom vosproy`zvodstve [Innovation and the «established society», or JM Keynes on the participation of the state in innovative reproduction]. Fy`losofy`ya xozyajstva. #6(54). 2007. P.166-175.

33 Alsuf'yeva O. O. Na shlyaxu do regulyuvannya zhy`ttyeradisnoyu intuyiciyeyu (Recepty` DZh. M. Kejnsa) [On the way to regulation by cheerful intuition (Recipes of J. M. Keynes)]. Problemy` ekonomiky` ta polity`chnoyi ekonomiyi. # 2. 2016. URL: http://politeco.nmetau.edu.ua/journals/2/4_a_ua.6.pdf.

34 Abramovy`cz M. Sajmon Kuznecz (1905–1985) [Simon Kuznets (1905–1985)]. Al`manax «THESIS». Vyp. 2. Struktury y` y`nsty`tuty. URL: http://www.hse.ru/data/079/314/1234/2_4_2Abramov.pdf

35 Denison E.F. The Residual Factor and Economic Growth. Paris, 1962.

36 Blaug M. 100 vely`ky`x ekonomy`stov posle Kejnsa [100 great economists after Keynes]. SPb.: Ekonomy`kus, 2009. 384 p.

37 Kendry`k Dzh. Sovokupnyj kapy`tal SShA i ego funkcy`ony`rovany`e [Aggregate US capital and its functioning]. M.: Progress, 1976. 265 p.

38 Solou R. The Economic of Resources and the Resources of Economics, 1974. 321 p.

which are H. Barnett, E. Witte, O. Denison [39]. Scientists have argued that in the management of innovation processes the main role belongs to the personal characteristics of the subjects: education and awareness of innovation, socio-psychological, organizational and sociological factors of receptivity to innovation, etc. [40, p. 401].

The English historian and sociologist Arnold Joseph Toyby in his work «A Study of History» (12-volume edition, written from 1934 to 1961) discovered and studied the long centuries and millennia waves of epoch-making innovations [41].

It was from this period that the innovative concept began to be developed by researchers with renewed vigour. The views of the neoclassicists made a significant contribution to the development of innovation theory, because they studied the features of ensuring the overall balance of the market economic system through the most efficient use of resources, taking into account the cyclical development of the economy [42, c.55]. The contribution of representatives of the neoclassical trend in the development of the theory of innovation is that among all types of production resources, the directions of increasing the use of which they considered, a special place belongs to the technological component.

Thus, when considering the peculiarities of the innovation paradigm, it is worth mentioning the views of representatives of neoclassical theory of innovation, the concepts of which were reflected in the works of Americans Everett Mitchell Rogers («Diffusion of Innovations», 1962) [43], Brian Charles Twiss («Management of Science and Technology» 1974). [44], Edwin Mansfield («Industrial Research and Technological Innovation», 1968, «Research and Innovation in the Modern Corporation», 1971, «Innovation, Technology and Economy», 1995) [45], Simon Kuznets movements in production and prices, 1930, «Modern economic growth: findings and

[39] Barnett H.G. Innovation: The Basis of Cultural Change. New York: McGraw-Hill Book Company, 1953. 462 p.

[40] Sy`roty`ns`ka N. M. Zarodzhennya ta rozvy`tok teorety`chny`x osnov innovacij [Origin and development of theoretical foundations of innovation]. Visny`k Nacional`nogo universy`tetu «L`vivs`ka politexnika». 2011. # 714: Menedzhment ta pidpry`yemny`cztvo v Ukrayini: etapy` stanovlennya i problemy` rozvy`tku. P. 399–405..

[41] Tojnby` A. Posty`zheny`e y`story`y` [Comprehension of history]. Perevod s angly`jskogo E. D. Zharkova. M.: Ajry`s-Press, 2010. 640 p.

[42] Mulyar O.D. Evolyuciya teoriyi innovacij ta yiyi rozvy`tok v agrarnij sferi vy`robny`cztva [The evolution of innovation theory and its development in the agricultural sector]. Visny`k Zhy`tomy`rs`kogo nacional`nogo agroekologichnogo universy`tetu. 2011. # 2(2). S. 50-61. URL: http://nbuv.gov.ua/UJRN/Vzhnau_2011_2%282%29__9.

[43] Everett M. Rodzhers Dy`fuziya innovacij [Diffusion of innovations] /Pereklad V. Starko. K: Ky`yevo-Mogy`lyans`ka akademiya, 2009. 592 p.

[44] Tvy`ss B. Upravleny`e nauchno-texny`chesky`my` novovvedeny`yamy` [Management of scientific and technical innovations]. M.: Ekonomy`ka. 1989. 271 p.

[45] Mansfield E. Industrial Research and Technological Innovation: An Econometric Analysis. Norton, New York, 1968. 240 p.

reflections», 1971) [46; 47], German Gerhard Mensch («Technological Pat: Innovation Overcomes Depression», 1975) [48].

The second half of the twentieth century characterised by the presence of problems in the development of new technologies. The change of basic technologies has led to radical changes in all spheres of social production and human interaction. The advent of microelectronic technologies has provoked a significant gap between the introduction of new technology into production and the adaptation of society to it. The global nature of this problem at that time led to great attention to this issue, which was expressed in a large number of scientific publications and international symposia dedicated to solving this problem.

American sociologist Everett Mitchell Rogers in his work «Diffusion of Innovations» identified five stages of diffusion of innovation: knowledge, belief, decision (rejection or acceptance), implementation and confirmation [49, p.118]. In this process, E. Rogers identifies five categories of consumers of innovation, as they differ in age and perception of innovation:

- innovators: as a rule, financially secure and at-risk young people who are most active in innovation;

- early followers: slightly older than innovators, have a good education and can appreciate the benefits of innovation and compare them with their own interests;

- early majority: more prudent and cautious than early followers, but respond and perceive innovations faster than the average citizen; socially active with a strong civic position, are an example of the useful use of innovations;

- late majority: are characterised by low socio-economic status, show skepticism about innovations and perceive them only after the adoption of the majority due to economic necessity;

- lagging consumers of innovations: conservatives, not receptive to any changes, with low incomes, accept innovations only after they have become the norm in society [50, p. 149-165].

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[46] Kuznets S. Secular Movements in Production and Prices: Their Nature and Their Bearing upon Cyclical Fluctuations. Boston, 1930.

[47] Kuznets S. Modern Economic Growth: Findings and Reflections. Nobel Memorial Lecture, December 1971. In: Les Prix Nobel en 1971. Stockholm, 1972 (reprinted in: American Economic Review, 1973, v.63, p. 247–258).

[48] Mensh G. Stalemate Technology: Innovation Overcome the Depression. Cambridge, Masp., 1979. 279 p.

[49] Everett M. Rodzhers Dy`fuziya innovacij [Diffusion of innovations] /Pereklad V. Starko. K: Ky`yevo-Mogy`lyans`ka akademiya, 2009. 592 p.

[50] Everett M. Rodzhers Dy`fuziya innovacij [Diffusion of innovations] / Pereklad V. Starko. K: Ky`yevo-Mogy`lyans`ka akademiya, 2009. 592 p.

E. Rogers identifies the characteristics of innovation, which are first paid attention and evaluated by individuals when deciding whether to accept or reject innovation: the advantage over existing counterparts, the possibility of adjacent use of existing objects / processes and new, compliance with the values of potential consumers, ease of testing and use, the presence of obvious advantages due to the efficiency of use [51, p. 217].

The view of the American economist Brian Charles Twiss is different from the classics of the innovation concept, because he defines innovation not as certain changes, but as a process of reproduction of the economic element through a new idea, invention or process. The process of innovation, according to B. Twiss, necessarily involves economic content, which is expressed through market and consumer orientation, the ability to meet new needs and meet the goals of individuals and institutional actors, a mandatory system of selection and management of ideas, etc. B. Twiss also notes the importance of the ideas of M. Kondratiev to understand the uneven dynamics of innovation, as well as their importance for economic growth [52].

American researcher E. Mansfield complements the innovative views of his predecessors by adding another feature of innovation: «with the onset of application, the invention becomes a scientific and technological innovation» [53].

Simon Kuznets is another scientist who has studied the relationship between innovation and economic growth. In the Nobel lecture S. Kuznets formulated his own approaches to the concept of innovation, in which the scientist developed the ideas of J. Schumpeter and J. Bernal. Scientists have introduced the concept of «epoch-making innovations», under the influence of which there is an acceleration of economic growth during industrialisation / industrial revolution. The scientist proves that the source of economic growth in the industrial age is the acceleration of science [54]. S. Kuznets also notes that the social consequences of technological innovations can be not only positive but also negative, mitigation and, if possible, prevention of which should be dealt with by the state apparatus.

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51 Everett M. Rodzhers Dy`fuziya innovacij [Diffusion of innovations] / Pereklad V. Starko. K: Ky`yevo-Mogy`lyans`ka akademiya, 2009. 592 p.

52 Tvy`ss B. Upravleny`e nauchno-texny`chesky`my` novovvedeny`yamy` [Management of scientific and technical innovations]. M.: Ekonomy`ka. 1989. 271 p.

53 Mansfield E. Industrial Research and Technological Innovation: An Econometric Analysis. Norton, New York, 1968. 240 p.

54 Kuznets S. Modern Economic Growth: Findings and Reflections. Nobel Memorial Lecture, December 1971. In: Les Prix Nobel en 1971. Stockholm, 1972 (reprinted in: American Economic Review, 1973, v.63, p. 247–258).

However, the positive aspects, according to S. Kuznets, significantly predominate in technological innovations and their main role is in the locomotive effect: they launch innovative changes in all other areas of human interaction. «The constant emergence of technological innovations, which is characteristic of perfect economic growth, and the accompanying social innovations that facilitate the necessary adaptation, are the main factor influencing the structure of the economy and society, lead to innovations in law, institutional structures and ideology» [55, p. 257].

German scientists have made significant progress in developing the concept of innovation. In particular, Professor G. Mensch was a follower and follower of the views of J. Schumpeter. In particular, the researcher clarified the classification of innovations and hypothesised that basic innovations are not permanent, their emergence is wave-like in nature and associated with crises and peaks of economic growth [56, p. 38]. It is with these views that the theory of G. Mensha confirms the sequence with the theory of conjuncture by J. Schumpeter and the theory of cycles by M. Kondratiev. The researcher proved that the lack of innovation provokes economic crises. G. Mensh proposes to solve this problem by state intervention: state projects of innovative changes, cooperation of state institutions with the business environment to compensate for the risks associated with the lack of innovations at a certain stage of economic system development (stimulating the development, implementation and dissemination of innovations).

G. Mensh confirmed his statements by analysing the historical stages of development of machinery and technology for the period from 1740 to 1960. A significant merit of the scientist was the timely recognition of the state of the capital market and labor resources of the first harbingers of a new world stagnation in the 70s of the twentieth century. G. Mensch called this situation a «technological stalemate» (pause) (the same name is given to the scientist's scientific work). The scientist proved that such a pause is a natural process that accompanies the economic crisis caused by the state of existing machinery and technology.

Despite the fact that Mensch's theory is a natural continuation of the theories of J. Schumpeter and M. Kondratiev, still differences in these theories are significant. Namely:

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[55] Kuznets S. Modern Economic Growth: Findings and Reflections. Nobel Memorial Lecture, December 1971. In: Les Prix Nobel en 1971. Stockholm, 1972 (reprinted in: American Economic Review, 1973, v.63, p. 247–258).

[56] Mensh G. Stalemate Technology: Innovation Overcome the Depression. Cambridge, Masp., 1979. 279 p.

- in M. Kondratiev's theory the evolutionary development was represented by a smooth line, and the accompanying cyclic oscillations had the form of a wavy curve;

- in the theory of J. Schumpeter, evolutionary development was depicted by a stepped line;

- in the theory of G. Mensha long-term economic cycle has an S-shaped appearance, which reflects the life cycle of the technological mode of production at a certain stage of economic development. It is assumed that at the final stage of a certain life cycle, the emergence of a new one should begin. This period is called by the scientist and called a technological pause (path, structural crisis), because the curve S1 does not smoothly merge with the curve S2 and there is a technological gap.

G. Less refutes the hypothesis of continuity of scientific and technological progress. The instability of updating basic technologies, according to the scientist, determines the dynamics of economic change - from growth to stagnation. The scientist distinguishes between basic (technological and non-technological) and improving innovations: he believed that the latter follow the basic, allow to be more progressive and effective. However, these two types of innovations also compete with each other, which determines the S-shaped appearance of long economic cycles of M. Kondratiev. The scientist believed that basic technologies are the most effective anti-crisis measure, which determines the exit of the economy from the phase of depression in long-term economic cycles, as well as the economic crisis is a sign that existing basic innovations are not effective enough [57, p. 112–118]. G. Mensh substantiated the expediency of developing a set of measures of state innovation policy and gave a significant role to medium-sized businesses as a locomotive of innovative development.

The American scientist R. Foster not only supports the views of G. Mensch, but also in his work «Production renewal: attackers win», used S-curves as the main analytical tool, as well as summarising a large amount of statistical and factual material (reporting documentation of corporations for a 25-year period) came to the conclusion that there are technological limits and technological gaps, the possibility of forecasting innovations. That is why R. Foster considers it appropriate for corporations to carry out systematic work on the accumulation of scientific knowledge, conducting

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57 Mensh G. Stalemate Technology: Innovation Overcome the Depression. Cambridge, Masp., 1979. 279 p.

continuous research, attracting highly productive scientists, and the cause of economic crises is the underestimation of the need for continuous innovation [58, p. 86–109].

Researcher K. Freeman in his work «Economic Theory of Industrial Innovation» [59] is a follower of the innovation theory of J. Schumpeter. In particular, K. Freeman expanded the list of successive industrial revolutions, described the innovations of M. Kondratiev's long economic waves, and considered the introduction of radical innovations and the spread of technological change to all sectors of the economy to be the root causes of crises. K. Freeman argues that the spread of innovation must be accompanied by socio-institutional transformations.

The founder of the theory of competitive advantage M. Porter in his research reflected the relationship between innovative development and ensuring the competitiveness of enterprises. The latter, according to the scientist, is impossible without innovations: technologies, processes, methods at all stages of social production [60, p. 215]. M. Porter argues that to achieve a high degree of competitiveness only those companies that timely and fully update all production and management processes, responsibly respond to the emergence of innovations. According to him, innovations, as technologies and methods, do not necessarily have to be a technological breakthrough, but can be a new design, a change in the organisation of production, etc. [61, p. 469].

Polish scientist K. Poznansky understands innovation as changes of any nature in methods and technologies of production, changes in goods, etc., which are new to this technological method of production [62, p.21]. The conclusion is obvious that the opinions of M. Porter and K. Poznansky on the essence of innovation are unanimous.

In general, neoclassical views on the role of innovation in economic growth and effective transformations of the economic system are quite numerous, multifaceted and capacious to various ideas, but they all resemble

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[58] Foster R. Obnovleny`ya proy`zvodstva: atakuyushhy`e vyy`gryvayut [Production upgrades: Attackers win]. M., 1987. 272 p.

[59] Freeman C. The Economics of Industrial Innovation / Freeman C., Soete L. [3-d edition]. L.: Pinter, 1997. 256 p.

[60] Porter M. E. Konkurency`ya [Competition] / Porter M. E. ; per. s angl. M.: Y`zdatel`sky`j dom «Vy`l`yams», 2005. 608 p.

[61] Porter M. E. Konkurency`ya [Competition] / Porter M. E. ; per. s angl. M.: Y`zdatel`sky`j dom «Vy`l`yams», 2005. 608.

[62] Poznanski K. Innowacje w gospodarce kapitalistycznej. Warszawa: PWN, 1979. 32 p.

that the growth of innovation is a determining endogenous factor in ensuring long-term economic growth.

N. Rylach in his work «Formation of the innovation paradigm: retrospective and modernity» [63] systematized the study of neoclassical theory of innovation on the modelling factor of economic growth:

- modelling of development with the help of STP (research by N. Kaldor, P. Romer, K. Jones, R. Lucas, T. Schultz);

- simulation modelling of economic and scientific and technical development with the development of individual models for individual countries (research by J. Forrester, D. Meadows);

- substantiation of technocratic economic development (research by J. Furastier, R. Clark, F. Sterberg);

- the concept of personal and creative nature of innovation: the carrier of innovation are creative individuals (research by H. Barnett, E. Witt, E. Denison);

- the concept of personal and entrepreneurial nature of innovation: the carrier of innovation are entrepreneurs, as individuals who are most at risk for commercial success (study by P. Drucker);

- theories of diffusion of innovations (research by T. Hagerstrand, P. Hagget, E. Rogers, E. Mansfield, R. Foster);

- the concept of the educational nature of innovation: the source of innovation and economic growth are highly educated professionals with special education (research by A. Jaffe, J. Lerner, S. Stern, A. Aror, A. Gambardell);

- the concept of defining the role of innovation as the «main impetus» of economic development, based on the new properties of economic goods, new ways of organising the production and sale of goods, etc. (B. Twiss research);

- the concept of regionalisation of innovations: the separation of centers of origin and dissemination of innovations (research: F. Perrault, J. Baudville, P. Potier, J. Friedman);

- the concept of restructuring society: the formation / transformation of economic laws occurs under the influence of scientific and technological development, and economic development reflects the state of STP (research

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63 Ry`lach N. M. Formuvannya innovacijnoyi parady`gmy`: retrospekty`va i suchasnist` [Formation of the innovation paradigm: retrospective and modernity]. Aktual`ni problemy` mizhnarodny`x vidnosy`n. Vy`pusk 127 (chasty`na I). 2016. P. 138-148.

by D. Bell, E. Toffler, E. Masuda, A. Touraine) [64, p.142]. In particular, E. Toffler believed that the result of extensive innovation is long waves. The first such wave occurred 8-9 thousand years ago and was characterised by the emergence of agriculture, livestock, handicrafts; the second - coincides with the emergence of industrial civilisation and the industrial revolution [65, p. 117].

As you can see, all the above innovative concepts under the source of economic growth understand only internal factors, among which the leading role belongs to innovation processes and STP.

Since the 90s of the twentieth century. the innovation concept was newly developed, system analysis was used and all levels of the innovation system were considered: from national to global.

The study of the national level of the innovation system began in the 80s of the twentieth century. K. Freeman [66], B. Lundvall [67] and R. Nelson [68]. The research of these scientists was aimed at various aspects of building and developing a national innovation system. Thus, K. Freeman considered the institutional aspects of innovation, B. Lundvall - the characteristics and features, and R. Nelson - the scientific and technological component [69, p. 143].

The period since the 90s of the twentieth century. is quite fruitful for the study of the nature, features and role of innovation in the processes of ensuring sustainable economic development and increasing the welfare of all institutional units.

A. Anchishkin, studying the evolution of STP and the development of basic innovations, identified three epoch-making scientific and technological upheavals, and also showed signs of a new wave of scientific and technological revolution - the latest restructuring of technology based on electronics,

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[64] Ry`lach N. M. Formuvannya innovacijnoyi parady`gmy`: retrospekty`va i suchasnist` [Formation of the innovation paradigm: retrospective and modernity]. Aktual`ni problemy` mizhnarodny`x vidnosy`n. Vy`pusk 127 (chasty`na I). 2016. P. 138-148.

[65] Toffler E. Tret`ya volna [The third wave]. M.: OOO «Fy`rma «Y`zdatet`stvo AST», 1999. 261 p.

[66] Freeman C. The Economics of Industrial Innovation / Freeman C., Soete L. [3-d edition]. L.: Pinter, 1997. 256 p.

[67] National Systems of Innovation: Towards a theory of Innovation and Interactive Learning / Lundvall B-A. (ed.). L. : Pinter Publishers, 1992. 348 p.

[68] National Innovation Systems. A Comparative Analysis / Nelson R. (ed.). Oxford: Oxford University Press, 1993. 560 p.

[69] Ry`lach N. M. Formuvannya innovacijnoyi parady`gmy`: retrospekty`va i suchasnist` [Formation of the innovation paradigm: retrospective and modernity]. Aktual`ni problemy` mizhnarodny`x vidnosy`n. Vy`pusk 127 (chasty`na I). 2016. P. 138-148.

biotechnology, and the materialization of scientific knowledge. economic reproduction [70, p. 21–30].

L. Baryutin in his work «Management of technical innovations in industry» innovation considers «the managed process is complex and involves the introduction of various changes in existing systems and structures in order to create, disseminate and use a fundamentally new or modified practical tool that satisfies specific social needs and creates an economic, technical or social effect» [71, p.12].

V. Kushlin identified and researched the problems of updating the production apparatus and saw the content of innovations in its improvement [72, p. 113].

Scientist Yu. Yakovets was a researcher of the formation and development of the theory of innovation. Investigating its evolution, the scientist identified three stages:

- the period of formation of basic technologies, which falls at the beginning of the twentieth century, is the period of formation of the basis of the theory of innovation;

- the period of development of basic innovations falls on the 30-60s of the XX century;

- the period of formation of post-industrial society began in the 70's of the twentieth century. and, according to the forecast of Yu Yakovets, will continue during the first decades of the XXI century [73, p. 18].

S. Menshikov and L. Klimenko, studied long-term trends in the capitalist economy, which were based on innovations, especially in the technological and technical spheres [74, p. 119].

L. Vodachek, O. Vodachkova interpret innovations as targeted changes in the functioning of the enterprise [75, p. 44].

Scientist B. Santo interprets innovation as a process of social, technical and economic nature, involves the implementation of ideas and inventions in

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70 Anchy`shky`n A.Y`. Nauka-texny`ka-ekonomy`ka [Science-technology-economics]. 2-e y`zd., M.: Ekonomy`ka, 1989. 384 p.

71 Baryuty`n L.S. Upravleny`e texny`chesky`my` novovvedeny`yamy` v promyshlennosty` [Management of technical innovations in industry]. L., 1986. 171 p.

72 Kushly`n V.Y`. Y`ntensy`fy`kacy`ya obnovleny`ya proy`zvodstvennogo apparata [Intensification of renewal of the production apparatus]. M.: Mysl`, 1986. 264 p.

73 Yakovecz` Yu. V. Uskoreny`e nauchno-texny`cheskogo progressa: teory`ya y` ekonomy`chesky`j mexany`zm [Acceleration of scientific and technological progress: theory and economic mechanism]. M. : Ekonomy`ka, 1988. 342 p..

74 Men`shy`kov S.M., Kly`menko L.A. Dly`nnye volny v ekonomy`ke. Kogda obshhestvo menyaet kozhu [Long waves in the economy. When society changes its skin]. M.: Mezhdunarodnye otnosheny`ya, 1989. 272 p.

75 Vodachek L., Vodachkova O. Strategy`ya upravleny`ya y`nnovacy`yamy` na predpry`yaty`y` [Enterprise innovation management strategy]. [Sokr.per.so slovacz. / Avt.predy`sl. V.S. Rapoport]. M. : Ekonomy`ka, 1989. 167 p.

practice in order to create products and technologies with better properties [76, p. 76-81].

A. Kruglikov believes that innovations should contribute to the manufacture of a certain tool for the first time or the implementation of a certain method of action for the first time [77, p. 88].

F. Brodel substantiated the existence not only of long waves of Kodratiev M., but also developed the theory of innovations in the rhythm of cyclical patterns of development of society [78, p. 118].

M. Khuchek identifies three characteristics of innovation:

- functional feature: innovations are changes in equipment, technology, organization of production;

- attributive feature: innovation is the result of growing needs of society;

- subject feature: innovations are new means and objects of labor [79, p. 87-92].

Yu. Bazhal considers innovations as a change of production technology, which has the form of a jump from one production function to another [80, p. 86].

Scientists E. Utkin, G. Morozova, N. Morozova understand innovations as innovations, as an object realized in social production differs from analogues by new consumer features that were obtained as a result of scientific research [81].

A. Schlesinger Jr., studying American history, identified political cycles lasting 30 years as cycles of active life of one generation. According to the scientist, the law of generational change is valid throughout the period and determines the rhythm of fluctuations in innovation activity [82, p. 416].

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76 Santo B. Y`nnovacy`y` kak sredstvo ekonomy`cheskogo razvy`ty`ya [Innovation as a means of economic development]. M. : Progress, 1990. 296 p.

77 Krugly`kov A.G. Sy`stemnyj analy`z nauchno-texny`chesky`h novovvedeny`j [System analysis of scientific and technical innovations]. M.: Nauka, 1991. 120 p.

78 Brodel` F. Matery`al`naya cy`vy`ly`zacy`ya, ekonomy`ka i kapy`taly`zm, XV-XVIII vv. [Material civilization, economics and capitalism, XV-XVIII centuries.]. T.3. Vremya my`ra. Y`.: Progress, 1992. 679 p.

79 Huchek M. Y`nnovacy`y` na predpriyatiyax i y`x vnedreny`e [Innovations in enterprises and their implementation]. M.: Luch, 1992. 162 p.

80 Bazhal Yu. M. Ekonomichna teoriya texnologichnyh zmin [Economic theory of technological change] : navch. posib. K. : Zapovit, 1996. 238 p.

81 Utkin E.A., Morozova G.Y`., Morozova N.Y`. Y`nnovacy`onnyj menedzhment [Innovation management]. M.: AKALY`S, 1997. 208 p.

82 Shlezy`nger-mladshy`j A.M. Cy`kly amery`kanskoj y`story`y` [Cycles of American history]. M.: Progress, Progress-Akademy`ya, 1992. 688 p.

Scientist O. Lapko considers innovation as a set of actions (design, creation, commercial use and distribution) to create a new technical and / or other product [83, p. 117].

Scientist I. Balabanov believes that innovations have a material expression, involves obtaining the effect of investing in production [84, p.114–1126].

Scientist M. Avsyannikov considers innovations as a result of practical or technical use of innovations [85, p. 26–28].

Scientists S. Ilyashenko and O. Prokopenko believe that innovation is the result of certain activities, reflected in new / improved goods, services, production technologies, management methods that help increase the efficiency of the enterprise [86, p. 184–196].

Economists L. Antonyuk, A. Poruchnyk, V. Savchuk interpreting the content of innovations focus on new events, innovations or any changes in the company's activities to increase competitiveness in domestic and foreign markets [87].

Ukrainian scientist P. Khariv defines the content of innovations as the result of any stage of the innovation process, which has the form of innovations of scientific, technical, organizational or socio-economic direction [88].

O. Datsy's views on the content of innovations are reduced to effective changes in the economy, ecology, social sphere, engineering, technology, labor organization [89, p. 129-142].

Scientists M. Zubets and S. Tyvonchuk under innovations consider innovations that have acquired the material expression of a new product

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83 Lapko O. Innovacijna diyal`nist` v sy`stemi derzhavnogo regulyuvannya [Innovative activity in the system of state regulation]. In-t ekon. prognozuv. NAN Ukrayiny`; Ivano-Frankivs`ky`j derzh. texn. un-t nafty` i gazu. K., 1999. 253 p.

84 Balabanov Y`.T. Y`nnovacy`onnyj menedzhment [Innovation management]: ucheb. posoby`e dlya vuzov. SPb.: Py`ter, 2001. 303 p.

85 Avsyanny`kov N.M. Y`nnovacy`onnyj menedzhment [Innovation management]. M. : Y`NFRA-M, 2002. 295 p.

86 Illyashenko S. M., Prokopenko O. V. Formuvannya ry`nku ekonomichny`x innovacij: ekonomichni osnovy` upravlinnya [Formation of the market of economic innovations: economic bases of management]: monogr. Sumy`: VTD «Universy`tets`ka kny`ga», 2002. 278 p.

87 Antonyuk L.L., Poruchny`k A.M., Savchuk V.S. Innovaciyi: teoriya, mexanizm rozrobky` ta komercializaciyi [Innovations: theory, mechanism of development and commercialization]: monogr. K.: KNEU, 2003. 394 p.

88 Hariv P.S. Innovacijna diyal`nist` pidpry`yemstva ta ekonomichna ocinka innovacijny`x procesiv [Innovative activity of the enterprise and economic estimation of innovative processes]: monogr. Ternopil`: Ekonomichna dumka, 2003. 326 p.

89 Dacij O.I. Rozvy`tok innovacijnoyi diyal`nosti v agropromy`slovomu vy`robny`cztvi Ukrayiny` [Development of innovative activity in agro-industrial production of Ukraine]. K.: NNCz IAE, 2004. 428 p.

after passing all stages of the scientific, technical and innovation cycle [90, c.45-49].

Examining modern views on the content of innovation, it is worth mentioning scientists A. Jaffy, J. Lerner and S. Stern, who are considered developers of the concept of the educational nature of innovation, because studying the factors of economic prosperity and innovative development of developing economies, they called one of the main factors education, which contributes to scientific and technological progress [91, p. 53–55].

Among the supporters of these views are A. Aror and A. Gambardel, who also believed that highly educated professionals are the basis of innovative development. For the development of the high-tech sector of the economy requires a significant number of highly specialized specialists in all diversified areas of the industrial base [92, p. 156–176].

Researchers N. Chukhrai, R. Patora interpret the content of the economic category "innovation" as new ideas of the enterprise, implemented in products, services, processes, management methods [93, p. 87].

The research team led by V. Dubichynsky [94] sees in innovations a set of measures for the introduction of new equipment, technology, etc.

I. Dyakonov, considering the history of mankind for forty thousand years, singled out eight historical phases of development, the change of which took place, according to the scientist, under the influence of significant innovations in armaments, means of destroying humanity [95, p. 72-84].

B. Zablotsky interprets innovation as a process that forms new thinking, creates, develops, implements in industrial use and disseminates new technical, product, system, social, environmental and other solutions

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90 Zubecz` M., Ty`vonchuk S. Rozvy`tok innovacijny`h procesiv v agropromy`slovomu vy`robny`cztvi [Development of innovative processes in agro-industrial production]. K.: Agrarna nauka, 2004. 192 p.

91 Jaffe A. B., Lerner J., and Stern S. Innovation Policy and the Economy / National Bureau of Economic Research: The MIT Press. – Cambridge, Massachusetts, 2005. Vol. 5. P. 39–86.

92 Arora A. and Gambardella A. Bridging the Gap. In A. Aurora and A. Gambardella, eds., From Underdogs to Tigers: The Rise and Growth of the Software Industry in Some Emerging Economies. Oxford, UK: Oxford University Press, 2005. 328 p.

93 Chuhraj N., Patora R. Tovarna innovacijna polity`ka: upravlinnya innovaciyamy` na pidpry`yemstvi [Commodity innovation policy: innovation management in the enterprise]: pidruchn.. K.: Kondor, 2006. 398 p.

94 Suchasny`j tlumachny`j slovny`k ukrayins`koyi movy`: 5000 sliv [Modern explanatory dictionary of the Ukrainian language: 5000 words] / Za zag. red. d-ra filol. nauk, prof. V.V. Dubichy`ns`kogo. H. : Shkola, 2006. 832 p.

95 D`yakonov Y`.M. Puty` y`story`y`: Ot drevnejshego cheloveka do nashy`x dnej [Ways of history: From ancient man to the present day]. Y`zd. 2-e, y`spr. M.: KomKny`ga, 2007. 384 p.

(innovations), which aims to meet a certain production, social need or national interest [96, p. 118].

Scientists V. Konoplitsky, G. Filin revealing the content of innovations emphasize the technical and technological innovations that have become possible as a result of scientific discoveries in a particular industry or subsector [97, p. 269].

G. Osovska, O. Yushkevych, J. Zavadsky revealing the essence of innovations, believe that these are «newly established methods of organization of production and management, which are implemented not only in the enterprise but also in the industry» [98, p. 196].

Economist V. Medinsky believes that innovation is necessarily the object of scientific research, involves implementation, is characterized by distinctive features from its predecessors [99].

Scientist V. Zyanko interprets innovation as the result of the introduction or materialization of an innovative idea with new consumer properties (goods, technology, services, means of labor), which make it possible to achieve economic, environmental, social or other effects [100, p. 49-53].

The research team led by S. Mocherny [101] explaining the economic category of «innovation» focuses on the process of introducing new equipment, technology, organization of production and marketing, etc., which gives the opportunity to gain an advantage over competitors.

Scientist W. Thompson considers innovation as a complex process involving the development, testing, adjustment, implementation of methods, goods, services [102].

According to N. Syrotynska, it is expedient to distinguish between the concepts of «innovation» and «innovation process». The scientist proposes to interpret innovations in the enterprise as «the end result of the innovation

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96 Zablocz`ky`j B. F. Ekonomika j organizaciya innovacijnoyi diyal`nosti [Economics and organization of innovation]: navch. posibny`k. L`viv: Novy`j Svit — 2000, 2007. 456 p.

97 Konoplicz`ky`j V.A., Filina G. I. Ekonomichny`j slovny`k. Tlumachno-terminologichny`j [Economic dictionary. Explanatory and terminological]. K.: KNT, 2007. 580 p.

98 Osovs`ka G.V., Yushkevy`ch O.O., Zavads`ky`j J.S. Ekonomichny`j slovny`k [Economic dictionary]. K.: Kondor, 2007. 358 p.

99 Medynsky`j V. G. Y`nnovacy`onnyj menedzhment [Innovation management]. M.: Y`NFRA – M, 2008. 294 p.

100 Zyan`ko V.V. Innovacijne pidpry`yemny`cztvo: sutnist`, mexanizmy` i formy` rozvy`tku [Innovative entrepreneurship: essence, mechanisms and forms of development]: monogr. Vinny`cya: UNIVERSUM-Vinny`cya, 2008. 397 p.

101 Ekonomichny`j ency`klopedy`chny`j slovny`k [Economic encyclopedic dictionary] /[Mocherny`j S.V., Larina Ya.S., Ustenko O.A., Yurij S.I.]: u dvox tomax / Za red. S.V. Mochernogo. L`viv: Svit, 2008. T. 1. 616 p.

102 Tompson V. Spravochny`k po vdoxnoveny`yu [Inspiration Guide]. My`nsk: Sy`mvol, 2009. 256 p.

process for the implementation of innovations, which through investment are embodied in new or improved goods (services), technologies, methods of production and marketing» [103, p. 402].

Scientists S. Glukhov and M. Chorna believe that the category of «innovation» is a fairly comprehensive concept and suggest that the idea may be an innovation [104, p. 83–84; 105, p. 10].

Scientist O. Dovgal believes that in the XXI century the basis of economic development is not only innovation, but also basic research at all levels and the commercialization of scientific developments [106].

Scientist Z. Peresunko singles out innovations and innovative activity. In particular, in innovation the researcher sees a set of innovation processes, which in turn is the modernization of existing methods, approaches, products, principles or the creation of new methods, approaches, products, principles in all areas based on new knowledge. Z. Peresunko interprets the concept of "innovation" as a result of the innovation process, and also emphasizes that innovative development must be intensive [107].

The scientist O. Bogashko considers it expedient to consider as innovations «newly created (applied) and (or) improved, different from the existing practice, competitive technologies, products or services, as well as organizational and technical solutions of production, administrative, commercial or other nature that significantly improve structure and quality of production and (or) social sphere, are the result of scientific and technological progress and ensure its further development» [108, p. 28].

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[103] Sy`roty`ns`ka N. M. Zarodzhennya ta rozvy`tok teorety`chny`x osnov innovacij [Origin and development of theoretical foundations of innovation]. Visny`k Nacional`nogo universy`tetu «L`vivs`ka politexnika». 2011. # 714: Menedzhment ta pidpry`yemny`cztvo v Ukrayini: etapy` stanovlennya i problemy` rozvy`tku. P. 399–405.

[104] Gluxova S.V. Suchasni pidxody` do vy`znachennya sutnosti innovacij [Modern approaches to defining the essence of innovation]. Ekonomichny`j analiz. Zbirny`k naukovy`x pracz`. 2008. Vy`pusk 3 (19). P. 82 – 84.

[105] Chorna M.V., Gluxova S. V. Ocinka efekty`vnosti innovacijnoyi diyal`nosti pidpry`yemstv [Evaluation of the effectiveness of innovative activities of enterprises]: monografiya. Hark. derzh. un-t harchuvannya ta torgivli. H. : HDUHT, 2012. 210 p.

[106] Dovgal` O.A. Innovacijny`j rozvy`tok ekonomiky`: metodologiya analizu [Innovative economic development: methodology of analysis]. Visny`k Universy`tetu bankivs`koyi spravy` Nacional`nogo banku Ukrayiny`. 2013. # 1 (16). URL: https://www.researchgate.net/publication/337562375_Innovacijnij_rozvitok_ ekonomiki_metodologia_analizu.

[107] Peresun`ko Z. M. Teorety`chni aspekty` rozvy`tku innovacijnoyi teoriyi [Theoretical aspects of the development of innovation theory]. Efekty`vna ekonomika. # 7. 2013. URL: http://www.economy.nayka.com.ua/?op=1&z=2192.

[108] Bogashko O. L. Evolyuciya teorety`chny`x pidxodiv do innovacijnogo rozvy`tku v ekonomichnij nauci [Evolution of theoretical approaches to innovative development in economics]. Visny`k Berdyans`kogo universy`tetu menedzhmentu i biznesu. 2013. # 2 [22]. P. 23-29.

Scientist Riggs H. considers innovation as a commercial development of a new idea [109, p. 7], Tidd J. - as a process of transformation of opportunities into new ideas used in practice [110, p. 38].

J. Soros treats innovation as the main advantage of the free market, but notes that in financial markets they inevitably lead to instability. «Innovations provide an opportunity to get intellectual pleasure, as well as profit for those who use them. However, the purpose of innovation should be somewhat different - to maintain stability» [111, p. 263].

An unconventional definition of innovation is given by R. Nelson and S. Winter in the work «Evolutionary Theory of Economic Change»: «innovation is a change in routine. Its capabilities depend on consumer assessment» [112, p.46].

Researchers G. Hamel and K. Prahalad believe that innovations can provide maximum profits only if they are ahead of the global scale [113, p. 216].

Considering the content of the category «innovation» it is advisable to refer to the current legal framework, namely the Law of Ukraine «On Innovation», according to which innovations are newly created (applied) and (or) improved competitive technologies, products or services, as well as organizational and technical solutions of production, administrative, commercial or other nature, which significantly improve the structure and quality of production and (or) social sphere [114].

Also in the domestic legal framework, namely in DSTU GOST 31279: 2005 (Innovation. Terms and definitions) (GOST 31279-2004, IDT), it is stated that innovations are new or improved technologies, types of products or services, as well as organizational and technical solutions of production, administrative, commercial or other nature that promote the promotion of technologies, products and services on the market (innovation is the end

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109 Rigs X. Managing high technology companies Blmont. N.Y., 1983. 76 p.

110 Tidd J., Bessant J., Pavitt K. Managing snnovation. John wiley & Sons, LTD, Chichester, 2001. 114 p.

111 Soros Dzh. Otkrytoe obshhestvo. Reformy`ruya global`nыj kapy`taly`zm [Open society. Reforming global capitalism]. M., 2001. 401 p.

112 Nel`son R., Uy`nter S. Evolyucy`onnaya teory`ya ekonomy`chesky`h y`zmeneny`j [Evolutionary theory of economic change]. M.: Fy`nstaty`nform, 2000. 195 p.

113 Hamel G., Prahalad K. Konkury`ruya za budushhee [Competing for the future]. M.: Oly`mp-by`znes, 2002. 314 p.

114 Zakon Ukrayiny` «Pro innovacijnu diyal`nist`» [About innovative activity] vid 04.07.2002 r. # 40-IV. VVRU. 2002. # 36. S. 266. URL: https://zakon.rada.gov.ua/laws/show/40-15#Text.

result of activities to implement new or improve the product, process and organizational and technical measures that used in practice) [115].

When considering the content of the economic category «innovation», it is advisable to refer to international standards. Thus, for the first time at the international level, the classification of innovation was developed in the Italian city of Frascati by the Organization for Economic Co-operation and Development in 1963 and reflected in Frascati: A Standard Practice for Surveys, Research and Experimental Development.

In general, as a result, methodological guides of the "Frascati family" were prepared and published [116]:

- Frascati Manual - a set of standards for experts from member countries of the Organization for Economic Cooperation and Development, which collect and publish information on R & D projects [117];

- Oslo Manual - a set of standards for measuring the innovation process and scientific and technological activity [118]. This document defines innovation as «the commissioning of any new or significantly improved product (good or service) or process, a new method of marketing or a new organizational method in business practice, job organization or external relations» [119, p. 31];

- Canberra Manual - a set of standards for measuring the quality and activity of human resources involved in the development of innovative projects [120];

- National Innovation Systems - a set of standards for the regulation of the exchange of innovative developments between the institutions of

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115 Pro nadannya chy`nnosti v Ukrayini mizhderzhavny`m standartam, zminam do mizhderzhavny`x standartiv ta skasuvannya normaty`vny`x dokumentiv [On entry into force of interstate standards in Ukraine, changes to interstate standards and abolition of normative documents]: Nakaz Derzhavnogo komitetu Ukrayiny` z py`tan` texnichnogo regulyuvannya ta spozhy`vchoyi polity`ky` #285 vid 05.10.2005 r. URL: http://ua-info.biz/legal/baseft/ua-smwzcr.htm.

116 Skvorczov D.I. Innovaciya, innovacijnist` ta innovacijny`j rozvy`tok z pozy`cij ekonomichnoyi teoriyi [Innovation, innovation and innovative development from the standpoint of economic theory]. URL: http://ena.lp.edu.ua/bitstream/ntb/24636/1/46-309-314.pdf.

117 Proposed Standard Practice for Surveys of Research and Experimental Development – the Frascati Manual. OECD, 2002. 193 c.

118 Rukovodstvo Oslo. Rekomendacy`y` po sboru y` analy`zu dannyx po y`nnovacy`yam [Oslo Guide. Recommendations for collecting and analyzing data on innovations]. 3-e y`zd., sovmestnaya publy`kacy`ya OESR y` Evrostata / per. na rus. yaz. M.: GU «Centr y`ssledovany`j y` staty`sty`ky` nauky`», 2010. 107 p.

119 Rukovodstvo Oslo. Rekomendacy`y` po sboru y` analy`zu dannyx po y`nnovacy`yam [Oslo Guide. Recommendations for collecting and analyzing data on innovations]. 3-e y`zd., sovmestnaya publy`kacy`ya OESR y` Evrostata / per. na rus. yaz. M.: GU «Centr y`ssledovany`j y` staty`sty`ky` nauky`», 2010. 107 p.

120 Rukovodstvo Oslo. Rekomendacy`y` po sboru y` analy`zu dannyx po y`nnovacy`yam [Oslo Guide. Recommendations for collecting and analyzing data on innovations]. 3-e y`zd., sovmestnaya publy`kacy`ya OESR y` Evrostata / per. na rus. yaz. M.: GU «Centr y`ssledovany`j y` staty`sty`ky` nauky`», 2010. 107 p.

national innovation systems (enterprises, free economic zones, research centers, research institutes, etc.) [121];

- The Knowledge-based Economy - a guide to outline the role of research in economic development [122];

- Interpreting Technology Balance Manual - a set of standards that outlines the methods used to study the international exchange of technologies [123].

In order to better understand the historical genesis of innovation theory and highlight aspects that need to be clarified and supplemented in the current global socio-economic transformations, the development of institutionalism and industrial society, it is advisable to systematize researchers' views on innovation and the role of technological change to ensure economic growth. all levels.

In particular, it is obvious to outline five approaches to the evolution of the views of researchers, domestic and international legal framework on the content and role of innovation in the economic system (Table 1.1).

From the above views of scientists on the development of the innovation concept it is clear that it is in the process of formation and especially intensified research on the nature and nature of innovative changes during the crisis in the economy and socio-economic transformations.

The conclusion is obvious that at this stage of development of productive forces the categories of «innovation» and «innovation process» are almost synonymous. And using the concept of «innovation», almost all scientists of the modern stage of development of economic theory mean a process that includes three interrelated procedures:

- creation of innovation: new ideas, new knowledge, innovation proposals, new and improved products, new management and production processes, etc;

- introduction of innovations into practice in order to meet certain needs of an innovative nature and turn them into innovation;

- diffusion of innovations: dissemination of mastered innovation.

This conclusion is due to those economic processes that are a consequence of the formation of post-industrial society.

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[121] National Innovation Systems. OECD, 1997. 49 p.
[122] National Innovation Systems. OECD, 1997. 49 p.
[123] National Innovation Systems. OECD, 1997. 49 p.

Table 1.1. Approaches to the interpretation of the concept of «innovation» and the development of innovation theory

INNOVATION		
as a result of scientific and technological progress, innovation and practical / technical use of innovations	XVIII: A. Smith, J. Condorcet, D. Ricardo, J.B. Say XX: E. Mansfield, S. Kuznets, V. Kushlin XXI: I. Balabanov, M. Avsyannikov, P. Khariv, S. Ilyashenko, O. Prokopenko, M. Zubovets, S. Tyvonchuk, V. Zanko, N. Sirotynska, Z. Peresunko and others.	XIX: K. Marx, J. Schumpeter XX: M. Huchek
as targeted changes in the functioning of the enterprise and qualitative changes in all elements of social production	XIX: M. Tugan-Baranovsky XX: M. Kodratiev, M. Abramovich, E. Denison, J. Kendrick, R. Solow, R. Mueller, E. Rogers, G. Mensch, R. Foster, M. Porter, K. Poznansky, A. Anchishkin, L. Vodachek, O. Vodachkova, Y. Bazhal, Y. Yakovets and others. XXI: O. Datsiy, V. Medinsky, O. Bogashko, R. Nelson, S. Winter and others.	
as a system or a set of measures for the introduction of new equipment, technology, etc.	XX: O. Lapko and others. XXI: V. Dubichenko and others.	
as a process of the creation and practical use of innovations and reproduction of the economic element through a new idea, invention or process	XX: B. Twiss, L. Baryutin, B. Santo XXI: A. Kruglikov, B. Zablocki, S. Mocherny, V. Thompson, L. Antonyuk, A. Poruchnyk, V. Savchuk, Tidd J., Oslo Manual and others.	
commercial solution or product: the end result of innovation	XX: V. Geets, A. Kazantsev, K. McConnell, P. Hariv, N. Chukhrai, H. Riggs XXI: Law of Ukraine «On Innovation», DSTU GOST 31279: 2005 (Innovation. Terms and definitions) (GOST 31279-2004, IDT)	

Source: created by authors.

A bibliographic review of international and domestic legislation, scientific, monographic and periodical literature, the study of the views of scientists for several centuries allows us to conclude that innovation is a fairly comprehensive concept and comprehensive definition, as well as one of the most relevant phenomena to ensure high level of competitiveness of the enterprise or the country, especially in the conditions of global social and economic transformations.

The World Economic Forum in 1994 defined competitiveness as «the ability of a country or company to create more wealth than their competitors in the world market» [124, p. 18].

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[124] The World Competitiveness Report, 1994, World Economic Forum, Lausanne.

Of course, to ensure the appropriate level of competitiveness, it is necessary to constantly monitor the actions of competitors and forecast them in the light of changes in the internal and external environment. However, such actions are insufficient to ensure sustainable development and they belong to passive competition. To ensure a sufficient level of efficiency of their own activities, first of all, it is advisable to outline their own competitive position, the reflection of which is a competitive advantage, which:

- first, it is determined by the uniqueness of the position relative to competitors, which is expressed by the level of profitability, which should be above the average level in the sector [125, c. 114];

- secondly, the ability to adapt in a timely manner to market needs [126, p. 58] and the presence of «competencies» that distinguish from competitors and create advantages.

Competitive advantages are determined not only by the quality of the internal environment (structural-organizational, resource, innovation-technological, managerial and market competencies), but also by external factors (legal and political environment, general level of equipment and technologies, state policy on science and innovation, innovation development). and transport and logistics infrastructure, the state of scientific traditions, experience of interaction with high-tech countries and industries, welfare, participation in international value chains, world market conditions, availability of resources, etc.).

Thus, competitiveness is an economic category that consists of interconnected elements of different weights, which together provide the creation of competitive advantages both nationally and internationally. All the above views of scientists prove that it is the innovation component that has gradually evolved into a decisive factor in the competitiveness of all socio-economic systems:

- innovations provide an opportunity to reduce costs and increase productivity, efficient employment, income, welfare, but require significant and constant investment, which comes as a result of a balanced innovation policy of the state;

- innovations are a necessity, and the process of their creation should be continuous, which should begin with high-quality innovative marketing to identify innovative demand. That is why innovations, in the vast majority of cases, are not accidental, but can be accidental, because the R&D process is unpredictable - trying to solve a certain problem, you can make a discovery or invention;

125 Upravlinnya konkurentospromozhnistyu pidpry`yemstva [Enterprise competitiveness management]: navch. posibny`k / L. Balabanova, G. Kry`venko, I. Balabanova. K.: Profesional, 2009. 256 p.
126 Dolzhans`ky`j I.Z., Zagorna T.O. Konkurentospromozhnist` pidpry`yemstva [Competitiveness of the enterprise]: navchal`ny`j posibny`k. K.: Centr navchal`noyi literatury`, 2006. 384 p.

- innovations must be provided with quality infrastructure.

We offer in table 1.2 a comprehensive interpretation of the economic category of «innovation» taking into account the modern features of economic activity.

Table 1.2. Comprehensive description of the category «innovation»

	Feature	Characteristic
INNOVATION	goal	preventing problems solving an existing problem meeting the needs of consumers (explicit, implicit)
	tipe	accidental (discovery), non-accidental (result of purposeful research)
	result	implementation of a new idea; obtaining economic, social, environmental and other types of effect
	objects	qualitatively new, qualitatively improved: - economic goods (goods, works, services) - production, marketing, organizational, management methods, approaches, principles
	subjects	individuals and institutional participants in the innovation process of micro-, macro-, meso- and mega-levels
	stages of the innovation process	**Stage 1 «Pre-production»:** research of unmet needs in existing or new market niches in order to identify and meet innovative demand; synthesis of new ideas, knowledge, innovation proposals, etc.; R&D implementation **Stage 2 «Production»:** implementation of the results of stage 1 in practice in order to meet certain needs of an innovative nature and turn them into innovation **Stage 3 «Market»:** the spread of mastered innovation and commercialization
	the formula for the success of innovation	
		* Optimization of the management system involves: - the presence of desire and incentives for innovation at the micro, macro, meso and mega levels; - creation of appropriate innovation infrastructure; - creating conditions for the preservation, development and use of scientific, technical and innovative potential at the micro, macro, meso and mega levels; *** Improving competitive positions* involves improving the efficiency of market positioning, improving production and marketing activities, improving the efficiency of jobs, improving the safety of life and health, as well as reducing the negative impact on the environment

Source: created by authors.

Thus, in our opinion, comprehensively interpreting innovations, it is advisable to consider them as a result of synthesis of new ideas in the process of R & D, which are usually non-random and targeted (to meet unmet needs in existing or new market niches) , need investments and optimal innovation and management infrastructure, which are carried out in order to improve competitive positions and obtain commercial success, social and environmental effect at the micro, macro, meso and mega levels.

1.2. Institutional principles of formation of the investment component of international competitiveness

In domestic economics, there are different approaches to defining and interpreting the essence of investment policy. According to the level, extent and scale of influence, investment policy can be classified into state (national), regional, sectoral and individual business entities [127, p.22]. All these levels are interconnected, but the main one is the state investment policy, which is formed at the national level. The state investment policy determines the institutional environment, forms the principles and creates conditions in the sphere of investments and aims to intensify investment activities at all levels of the national economy.

In connection with the above, it is necessary to consider the concepts of «investment policy» and «state regulation of investment processes». Some researchers understand them as the activity of any economic entity (state, region, enterprise, entrepreneur), aimed at the formation and effective use (investment) of financial results [128, p.87; 129, p.94]. For example, in this definition, the category «politics» is considered to be identical to the concept of «activity». In our opinion, this definition of investment policy is somewhat narrowed. Investment policy should take into account and reflect not only the implementation of the investment process at the previous level of development, but also indicate the possibility of achieving a new quality state and social status.

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[127] Serzhanov V.V. Investy`ciyi ta globalizaciya: dialekty`ka vzayemodiyi [Investment and globalization: the dialectic of interaction]. Materialy` I Mizhnarodnoyi naukovoyi Internet-konferenciyi «Nacional`na bezpeka u fokusi vy`kly`kiv globalizacijny`x proczesiv v ekonomici» (m. Ky`yiv-Baku, 28-29 chervnya 2018 r.). K.: NAU. 2018. P. 22–24.

[128] Vasy`l`eva N. V. Y`nnovacy`onno-y`nvesty`cy`onnaya poly`ty`ka – perspekty`va dal`nejshego razvy`ty`ya Ukray`ny [Innovation and investment policy - prospects for further development of Ukraine]. Problemy upravleny`ya. 2010. # 3(36). P. 87–90.

[129] Ganushhak-Yefimenko L. M. Konczeptual`ni zasady` upravlinnya innovacijno investy`cijnoyu diyal`nistyu promy`slovy`h pidpry`yemstv [Conceptual principles of management of innovation and investment activity of industrial enterprises]. Aktual`ni problemy` ekonomiky`. 2013. # 10. P. 93–99.

P. Sokurenko believes that investment policy is a form of behavior of government agencies, subordinated to the achievement of the main goal and designed for a certain period of time [130, c. 209]. The advantage of this definition in comparison with the previous one is the reflection of the whole in it. However, it is also insufficiently practical as it considers investment policy exclusively from the point of view of management, while the important task of the state is to create favorable conditions that determine the need for investment.

From this point of view, A. Muzychenko's interpretation is considered quite successful. He claims that «Investment policy is the main tool for regulating the reproduction process, creating a material basis for economic development. Investment policy takes into account the state of the economy at this particular stage and in the future, includes an assessment of possible sources of investment resources, determines the priorities and development of investment» [131, p. 21]. This interpretation is characterized by high universality, as it indicates the sources, priorities and methods of implementation.

A. Adrisov advocates a significant expansion of the formed idea of the content of investment policy, bearing in mind the consideration in its composition of a set of problems that ensure the ability of enterprises to industry [132, p.134]. Here the approach to the decision of a problem on the basis of intensification of business activity and increase of competitiveness of national economy is shown.

In our opinion, the lack of demarcation of the investment policy of the state, regions, firms and individual investors is a problematic aspect of the above points of view on the content and essence of investment policy. In addition, most scientific research lacks a targeted approach to defining public investment policy. In the scientific literature it is rightly noted that in the formation of the concept of state investment policy it is necessary to determine the most effective areas of use of investment resources and selectivity in the implementation and realization [133, p.12].

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[130] Sokurenko P. I. Investy`cijna polity`ka yak efekty`vna forma upravlinnya uhvalennyam investy`cijny`h rishen` [Investment policy as an effective form of investment decision management]. Yevropejs`ky`j vektor ekonomichnogo rozvy`tku. 2010. # 1 (8). P. 208–214.

[131] Muzy`chenko A. S. Investy`ciyi i ekonomichny`j rozvy`tok. Ekonomika Ukrayiny`: investy`cijno-innovacijna skladova [Investments and economic development. Economy of Ukraine: investment and innovation component]: [kolekty`v. monografiya] / [za red. V. F. Besedina, A. S. Muzy`chenka]. K.: NDEI. 2012. 288 p.

[132] Adry`sov A.B. Strategy`cheskoe manevry`rovany`e y` analy`z effekty`vnosty` y`nvesty`cy`y` [Strategic maneuvering and analysis of investment efficiency]. M.: Fy`ly`n`, 1998. 265 p.

[133] Gurova I.P. «World Economy» translator Sh.Veshapidze; Tbilisi, 2014. 312 p.

We should also agree with the opinion of D. Faizullayev that the state investment policy should be based on a solid scientific basis, with a clear distinction between strategy and tactics of investment activities. It is inadmissible to replace strategic goals with tactical tasks [134, p.24].

Investment policy is often understood as a set of economic decisions that determine the main directions of capital investment, the measures of their concentration. Achieving the planned pace of development of social production, balance and efficiency of the economy, obtaining the highest growth of production and national income will depend on this [135].

In modern scientific research, different interpretations of the concept of «investment policy» are given. Their systematization and generalization make it possible to assert that investment policy is a set of actions of economic agents to ensure the conditions of simple and widespread reproduction of capital development.

Accordingly, the essence and content of the investment policy consists in the reproduction of fixed assets, their expansion, renewal and modernization. Let's consider some definitions of the state investment policy provided by domestic scientists.

O. Koyuda considers the «state investment policy - the definition of structural and quantitative needs in investment resources, increasing the sources of financing, the choice of priority areas of financing and the formation of an effective proposition» [136, p. 21].

Such scholars as S. Chistov, A. Nikiforov and T. Kutsenko interpret the state investment policy as «a set of legal, administrative and economic measures of the state aimed at expanding and activating of investment procceces» [13711, p. 93].

A. Yatsenko offers the following definition: «state investment policy is a system of measures that determine the volume, structure and main directions of all investments of investment resources of various forms (physical, financial, material)». The purpose of the state investment policy is to ensure high rates of economic development by concentrating on those projects on which the achievement of high rates of production development, balance and efficiency depend on the achievement of high rates. This will

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134 Fajzullaev D. Y`nostrannыe y`nvesty`cy`y` pomogayut ozdorovy`t` ekonomy`ku [Foreign investment helps to revitalize the economy]. Azy`ya y` Afry`ka segodnya. 2004. # 12. P. 24.

135 Kury`lo S. V. Investy`cijna polity`ka, yiyi sutnist` i rol` u suchasny`h umovah [Investment policy, its essence and role in modern conditions]. URL: http://www.nbuv.qov.ua/portal/soc qum/Dtr er/2009 2/files/Econ 02 2009 Kurilo.pdf.

136 Koyuda O. P. Investuvannya [Investing] / O. P. Koyuda, O. P. Lepejko, V. O. Koyuda, V. M. Gry`n`ova. K.: Znannya, 2008. 452 p.

137 Derzhavne regulyuvannya ekonomiky` [State regulation of the economy]: navch. posibny`k / S. M. Chy`stov, A.Ye. Ny`ky`forov, T. F. Kuczenko ta in. K.: KNEU, 2000. 316 p

contribute to the creation of a social environment in the country that meets the requirements of society for the necessary quality of life, the appropriate level of meeting social standards, taking into account the needs of future generations. In our opinion, from the point of view of mapping the main components, this definition is quite successful. In our opinion, from the standpoint of mapping the main components, this definition is quite successful [138, p.15].

Given the basic understanding, the fact that investment policy is a component of the economic policy of the state and taking into account the peculiarities of the development of the investment process, we consider it to be considered an investment. The state investment policy of the national economy is a system of measures implemented at the national level by public administration bodies. They determine the volume, structure and main directions of investment of funds, resources, labor, capital, intellectual property, etc. This is based on the coordination of economic interests of all participants in the investment process and aims to select the most effective areas for achieving sustainable development goals. All this will contribute to ensuring economic growth and social well-being based on macroeconomic changes and trends. This approach makes it possible to avoid limited understanding from the standpoint of organizational and economic relations.

In the scientific world, there is an opinion that it is more expedient to divide the subjects of state investment policy into three levels according to the influence on the investment process (Fig. 1.1).
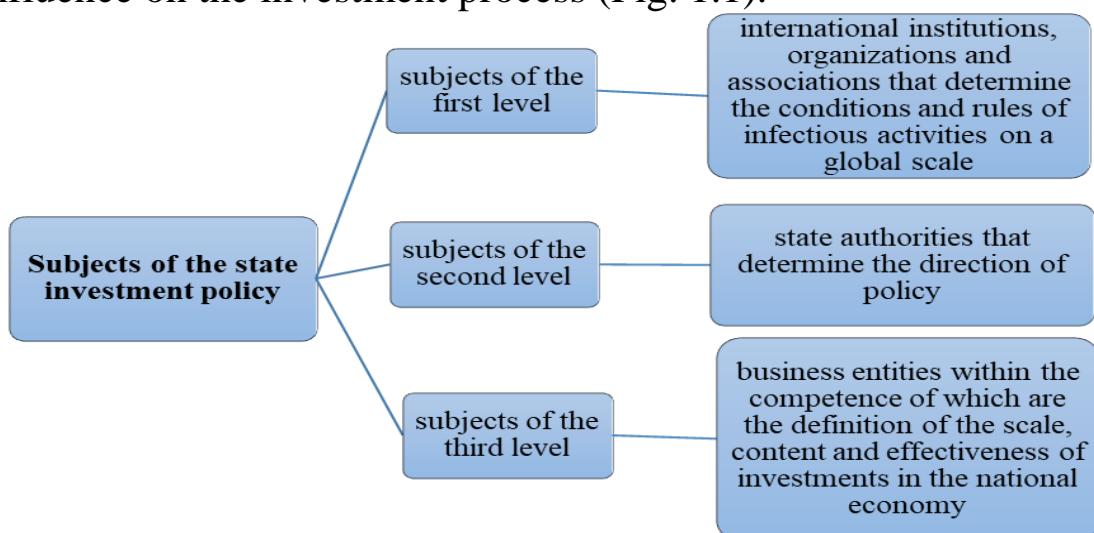
Fig. 1.1. Subjects of the state investment policy
Source: created based [139, c. 184-185].

138 Yaczenko A. V. Formuvannya investy`cijnoyi polity`ky` zi strategichny`x pozy`cij rozvy`tku Ukrayiny` [Formation of investment policy from strategic positions of development of Ukraine]. Investy`ciyi: prakty`ka ta dosvid. 2010. # 8. P. 12–17.

139 Ekonomika pidpry`yemstva [Economy of the enterprise]: [pidruch.] / G. O. Shvy`danenko, V. G. Vasy`l`kov, N. P. Goncharova, I. A. Pavlenko [ta in.] ; za zag. ta nauk. red. G. O. Shvy`danenko; [M-vo osvity` i nauky` Ukrayiny`, DVNZ «Ky`yivs`ky`j nacz. ekon. un-t im.  V. Get`mana»]. K: KNEU, 2009. 598 p.

The object of intervention and regulation of state investment policy are all investment processes that take place in the national economy.

To implement its own policy in the national economy, the state has a whole arsenal of methods and tools. Regulatory instruments of state investment policy are similar to instruments of state economic policy. The arsenal of the latter distinguishes between administrative and economic methods, which, depending on the type and purpose, can be used in different combinations, with different intensity and different periodicity. The most common classification of investment policy instruments is the distribution depending on the level of the economy to which its impact is directed:

- macroeconomic - instruments that determine the general economic investment climate;

- microeconomic - instruments that affect certain components of investment or certain sectors or industries;

- institutional - tools that allow to achieve coordination of public investment programs and programs of private investors [140, p. 98].

The concept of the state investment policy of the national economy in the conditions of world internationalization of spheres of manufacture and services aims at comprehensive and sustainable development on the basis of. At present, the main recipients of foreign direct investment are those countries that are actively developing and countries with transformational economies and their importance as recipients of foreign direct investment continues to grow.

Also, these countries have not only become the main recipients of foreign direct investment, they are increasingly becoming large investors, and their share in world trade is now more than a third. There are also other types of investors in the world market. State-owned enterprises are important participants in FDI. Although they make up only 1% of the total number of transnational enterprises, their investments abroad account for about 10% of world FDI flows. International institutions, organizations and foundations are also important as FDI participants. Their total FDI will amount to about $ 160 billion in 2018, and their investments abroad account for less than 2% of global foreign direct investment flows [141].

It is clear that the patterns and types of investments of these new players (from the point of view of the countries that accept investments and from the point of view of investors) differ, and these are their political

[140] Serzhanov V.V. Ocinyuvannya rezul`taty`vnosti investy`cijnoyi polity`ky` derzhavy` [Evaluation of the effectiveness of the state investment policy]. Intelekt - XXI. 2017. # 5. P. 96-100.

[141] By`rka M.I. Teorety`ko-metodologichni pidxody` do analizuvannya pryamy`h inozemny`h investy`cij v konteksti yih zaluchennya [Theoretical and methodological approaches to the analysis of foreign direct investment in the context of their involvement]. URL: http://jrnl.nau.edu.ua/index.php/SR/article/view/4701/0.

priorities. In addition, it is worth monitoring the investment climate in developed market economies in the face of competition from increasingly active investors in developing countries.

Industrial policy and strategies of industrial development are spreading in developed countries. These strategies often contain elements of targeted or restricted investment incentives, which increases the importance of an integrated and consistent development and investment policy. Governments are also stepping up their efforts to promote the participation of domestic companies in global value chains. They promote such participation through the use of local potential, technological modernization and investment promotion activities, such as cooperation or the creation of special economic ones. Expectations of incentive actions by governments have become higher as they increasingly focus on the quality (rather than just quantity) of investment. Concerns about the emergence and growth of unemployment (or low employment) in many regions are also increasing pressure on governments, forcing them to look for the «right types» of investment and to take measures to maximize them. In developed countries, such fears have sometimes provoked a debate as to whether and how to deny domestic companies investment abroad, or to promote the repatriation of foreign investment at home [142, c. 41].

The strengthening of the role of the state is also manifested in relation to other issues of sustainable development. Whether new social and environmental standards are being introduced or existing ones are being strengthened, all this has implications for investment. In addition to regulatory activities, governments are making increasing efforts to actively promote sustainable development, for example, by encouraging foreign direct investment in environmental protection. They also pay more attention to corporate responsibility by promoting the adoption of private codes of corporate conduct.

The tendency of the developers of the state policy assumes partial intervention in economy and management of investment activity. This is confirmed by the share of regulatory and restrictive policies in general investment policy measures. It has grown over the last ten years, although investment liberalization and encouragement remain dominant.

In this regard, V. Serzhanov substantiates the need to define «investment protectionism». In general, in his view, protectionist measures related to investments include, first of all, measures aimed at foreign investors, which directly or de facto discriminate against them and are

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[142] Serzhanov V.V. Formuvannya derzhavnoyi investy`cijnoyi polity`ky` rozvy`tku nacional`nogo gospodarstva [Formation of the state investment policy of development of the national economy]: [monogr.] K.: Nacional`na akademiya upravlinnya, 2018. 281 p.

intended to prevent them; second, measures aimed at domestic companies that require them to repatriate assets or operations to their country. Such definitions contain a number of shortcomings. Namely, in such a context, «measures» refer to national regulatory measures, but also include the use of administrative procedures or even less tangible political pressure [143].

For many economists, the concept of «protectionism» has a negative connotation, as the protectionism of one country may be the industrial policy of another.

V. Serzhanov defines «investment protectionism» as the policy of the state, which is expressed as a set of ties and relations (organizational, economic, legal), aimed at stimulating the development of national investment, investment investment market. protection of the national economy, minimization of potentially negative impacts on investment processes. There is a great need for global coordination of investment policy. The need to solve common problems of sustainable development and effective response to global economic and financial shocks in order to avoid future crises initiated calls for new models of global governance [144, p. 108].

In the field of investment, there are compelling reasons to improve international coordination. This can help maintain protectionist tendencies and eliminate discriminatory attitudes of foreign investors to inspections. In addition, in a world where governments are increasingly struggling for the types of investment they want, this can help avoid «races» in regulatory standards or «strive for the top» in incentives.

The number of specific investment issues underscores the need for better global harmonization of investment policy, as by their nature they can only be effectively addressed through cooperation.

First, better international coordination will help to overcome inconsistencies. These problems have arisen due to the extensive system of international agreements, which consists of about 3,300 basic agreements (bilateral investment agreements and other agreements with investment provisions). Another example is international cooperation in the field of taxation. The existence of government deficits and debts has made governments more prone to tax evasion, manipulative transfer pricing, tax breaks, and similar options available to transnational firms for non-tax liability.

Investment policy is characterized by the recognition of the role of investment as the main driver of economic growth and development, as well as the realization that it is a central part of the strategy. In addition, it is

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143 Serzhanov V.V. Arxitektonika derzhavnoyi investy`cijnoyi polity`ky` [Architectonics of state investment policy]. Infrastruktura ry`nku. 2018. Vy`pusk 17. URL: http://market-infr.od.ua/uk/17-2018.

144 Serzhanov V.V. Etapy` formuvannya modeli derzhavnoyi investy`cijnoyi polity`ky` – instrumentu pidvy`shhennya konkurentospromozhnosti nacional`noyi ekonomiky` [Stages of formation of the model of the state investment policy - the tool of increase of competitiveness of national economy]. Naukovy`j visny`k Hersons`kogo derzhavnogo universy`tetu. Seriya: Ekonomichni nauky`. 2017. Vy`pusk 26. Chasty`na 1. P. 107–110.

important to jointly recognize the need to increase the effectiveness of policy on attracting and promoting investment. These aspects of the new type of investment policy are transformed into certain challenges at the national and global levels, which are presented in Table 1.3.

Table 1.3. Problems and tasks of investment policy at the national and international levels

Levels of investment policy	Problems / challenges	Tasks
National	Integration of investment policy into the national development strategy	Focus on investment in key industries and sectors to increase productivity and international competitiveness
		Ensuring coherence with other sectoral (sectoral) policies aimed at general development goals
	Inclusion of sustainable development goals into the investment policy	Maximizing the positive and minimizing the negative effects of investment
		Supporting responsible investor behavior
	Ensuring the effectiveness of the investment policy	Creating stronger institutions to implement investment policy
		Measuring the impact of investment on sustainable development
International	Strengthening and development of the investment space	Protection of the political space for the needs of the sustainable development
		Ensuring more favorable provisions for stimulating investment for sustainable development
	Balancing the rights and obligations of states and investors	Reflection of investor responsibilities
		Development and adherence to principles
	Management of systemic difficulties of the investment activities	Work with gaps, duplications and inconsistencies in international law, settlement of institutional issues and dispute resolution
		Ensuring effective interaction and consistency with other international ones policies (for example, on climate change, labor, taxation) and systems (for example, trade, finance)

Source: [[145], c. 54-56; [146], c. 74-75].

[145] Serzhanov V.V. Makroekonomichni umovy` formuvannya derzhavnoyi investy`cijnoyi polity`ky` [Macroeconomic conditions for the formation of state investment policy]. Pry`chornomors`ki ekonomichni studiyi. 2017. Vy`pusk 21. P. 53–57.

[146] Serzhanov V.V. Derzhavna investy`cijna polity`ka yak instrument modernizaciyi nacional`noyi ekonomiky` [State investment policy as a tool for modernization of the national economy]. Ekonomichny`j visny`k Zaporiz`koyi derzhavnoyi inzhenernoyi akademiyi. Vy`pusk 5(11). Chasty`na 1. P. 73–79.

In table 1.4. the scope and objectives of the principles of investment policy are given, taking into account their purpose - to promote investment to ensure comprehensive growth and sustainable development of the national economy. All these principles interact with each other, so they should not be applied and interpreted separately.

Table 1.4. Principles of the state investment policy

Name	Scope	Tasks
The principle of consistency	The sequence of implementation of the approved policy	Based on the general development strategy of the country. All policies affecting investment must be coherent and synergistic at both the national and global levels.
The principle of openness	Public administration and institutions	Development with the involvement of all stakeholders and built into the institutional structure, which is based on the principles of the rule of law, which adhere to high standards of public administration and provide predictable, efficient and effective principles.
The principle of reliability	Dynamic policy development	Regularity checks for efficiency and relevance, as well as to adapt to changes in the dynamics of development.
The principle of balance	Balanced rights and responsibilities	Balance in defining the rights and obligations of states and investors in the interests of joint development.
The principle of flexibility	The right to regulate	Sovereignty of the right to establish the conditions for receiving and using foreign investments under international obligations in the interests of the public good and to minimize potential negative consequences.
The principle of transparency	Openness to investments	Open, stable and predictable conditions the entry of investments, in accordance with the general development strategy of each country, should be established.
The principle of stability	Investment protection	Ensuring proper protection for investors. The selection of investors should be non-discriminatory.
The principle of purposefulness	Encouragement and promotion of investments	Consistency with the objectives of general economic development and aimed at minimizing the risk of unfair competition for investment.
The principle of effectiveness	International cooperation	Cooperation with the international community to attract joint investment in development policy challenges, especially in the least developed countries.

Source: [[147], c. 164].

Thus, the integration of investment policy into the strategy of national economic development requires a coordinated policy. Accordingly, public

[147] Serzhanov V.V., Shtuler I.Yu. Derzhavna polity`ka zaluchennya investy`cij v strategiyi rozvy`tku nacional`ny`h ekonomik [State policy of attracting investments in the strategy of development of national economies]. Naukovy`j visny`k Uzhgorods`kogo nacional`nogo universy`tetu. Seriya: Mizhnarodni ekonomichni vidnosy`ny` ta svitove gospodarstvo. 2017. Vy`pusk 16. Chasty`na 2. P. 162–166.

administration is necessary for its development and implementation. Economic development is a constant challenge that emphasizes the importance of developing investment policy. The structure of investment policy should include elements of investment regulation and corporate governance, on the one hand, and openness, protection and promotion, on the other hand, thus promoting investment rights.

Scientists argue that foreign direct investment began to play an important role in the international economy after World War II. The first theories to explain the role of foreign direct investment arose as a result of the growing activity of subsidiaries of American companies in the markets of Europe and Latin America in the 50s and 60s. Since then, the volume of foreign direct investment is constantly growing, which has led to the urgent need to study the peculiarities of the process of capital movements in world markets [148].

At the present stage of development of the world economy there is a need to mobilize capital and resources for their further preservation and increase. Of particular interest is entrepreneurial capital, as a form of international capital movement, which is based on direct and portfolio investment. Particular attention is paid to foreign direct investment, which is considered an international investment when a resident of one country buys long-term interests in an enterprise that is a resident of another country. Investments are considered direct only if the investor begins to own ten or more percent of the shares of the incorporated company, or has an equivalent share in the unincorporated enterprise [149; 150].

The most active participants in foreign direct investment are transnational corporations (TNCs).

Note that, in essence, there are two types of direct investment of TNCs:

1) direct investments of the «green zone», which form new subsidiaries (branches). For example, the construction of turnkey enterprises. In recent years, this type of investment accounts for less than 20% of the total volume of foreign direct investment, as their payment should be made mainly in «live» money;

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[148] By`rka M.I. Teorety`ko-metodologichni pidxody` do analizuvannya pryamy`h inozemny`h investy`cij v konteksti yih zaluchennya [Theoretical and methodological approaches to the analysis of foreign direct investment in the context of their involvement]. URL: http://jrnl.nau.edu.ua/ index.php/SR/article/view/4701/0.

[149] Yermilova K.V. Vy`znachennya osnov mizhnarodnoyi investy`cijnoyi diyal`nosti v umovax formuvannya global`nogo ekonomichnogo prostoru [Determining the basics of international investment activity in the context of the formation of the global economic space]. URL: http://www.nbuv.gov.ua/portal/soc_gum/Tiru/2009_28_1/6.pdf.

[150] Novak V. O. Deyaki aspekty` vply`vu finansovoyi transnacional`ny`h korporacij [Some aspects of the influence of financial transnational corporations]. URL: http://www.nbuv.gov.ua/e-journals/PSPE/2010_1/Novak_110.

2) cross-border mergers and acquisitions («brown investments») - a change in the management of assets and activities of the company, which joins as a result of the investment. In this case, the assets and operations of the two firms are combined to create a new company. Cross-border mergers and acquisitions account for more than 80% of the world's foreign direct investment [151]. In the case of a cross-border takeover, a foreign company buys a local company and then controls its assets. In the last decade, there has been an increase in the number of «aggressive» takeovers and, accordingly, a decrease in «friendly» ones. In the case of «aggressive» takeovers, TNCs initially resort to buying shares of a foreign company on the stock market, and then already interact with the general meeting of shareholders. In the case of a «friendly takeover», an agreement is first reached between the heads of the TNCs and the shareholders of the company being acquired to buy and sell shares. Then the shares of this company are exchanged for shares of TNCs. Another variant of «friendly» takeover is a takeover in the form of a transfer of a controlling stake in TNCs to a trust management [152].

World experience testifies to a certain transformation of views on the «pros» and «cons» of TNCs' investment in the national economy. Emphasis is shifted to the positive impact of TNC FDI, which is associated with the possibility of direct access to advanced technologies, as it not only reveals the export potential, but also creates new places. The negative impact of TNCs can be neutralized by measures to transnationalize the national economy, in particular by forming financial-industrial groups that can ensure the balance of national interests with motives [153, c. 43].

Among the obstacles to the investment activities of global TNCs in Ukraine, scientists identify: unregulated and instability of the legal framework; imperfection of the tax system and significant tax pressure; high level of bureaucracy and corruption of officials; low effective demand of Ukrainian consumers; insufficient transparency of the privatization process; inefficiency of the judiciary; slow development of the stock market. At the same time, domestic companies have a number of competitive advantages: excellent knowledge of the Ukrainian market, the status of a national

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[151] Lyendyel O.M. Inozemni investy`ciyi yak faktor rozvy`tku ekonomiky` derzhavy` [Foreign investment as a factor in the development of the state economy]. Efekty`vna ekonomika. 2016. #9. URL: http://www.economy.nayka.com.ua/?op=1&z=5156.

[152] Kozak Yu.G. Mizhnarodna ekonomika [International economy]: Navch. posibny`k. Vy`dannya 2-ge persrob. ta dop. Ky`yiv: Czentr uchbovoyi literatury`, 2008. S.18. URL: http://pidruchniki.ws/15931106/ekonomika/.

[153] Baula O.V., My`xal`chuk L.V. Pryami inozemni investy`ciyi TNK yak odna z form yih diyal`nosti na svitovomu ta nacional`nomu ry`nkax [Foreign direct investment of TNCs as one of the forms of their activity in the world and national markets]. Nastoyashhy` y`zsledovany`ya y` razvy`ty`e - 2012: Matery`aly` za 8-a mezhdunarodna nauchna prakty`chna konferency`ya (m. Sofiya, 17.01 – 25.01.2012r.). Tom 3. Y`konomy`ky`: Sofy`ya, «Byal GRAD-BG» OOD, 2012. P.43.

producer, well-established relations with government agencies, the presence of extensive branch networks, international.

In general, the formation of investment attractiveness of Ukrainian enterprises from the point of view of TNCs can be achieved through the measures shown in Fig. 1.2.

high readiness of the Ukrainian enterprise for introduction of new methods of management, readiness for exchange of experience with divisions of TNCs in other countries

honest, partnership business with TNCs

raising the level of knowledge of the staff of the Ukrainian company on international business

ensuring that foreign TNCs are aware of domestic enterprises

passing the international certification of product quality

Fig. 1.2. Promising measures to increase the attractiveness of domestic enterprises for TNCs

Course: [154, c. 127].

Attracting foreign direct investment in the country's economy at the appropriate level and on mutually beneficial terms for investors and the host country is not possible without the formation of an appropriate institutional environment. Institutional support of investment activity is a set of state and non-state institutions that ensure the existence of legal, organizational and economic conditions necessary for the implementation and development of investment [155]. One of the main places in the institutional support of the investment process belongs to the traditional legal framework, which forms and determines the legal field of interaction of its subjects. Legislation that forms the legal basis for institutional support of investment activities in Ukraine can be divided into two groups: legislative and normative acts of general nature and legislation.

154 Baula O.V., Visy`na T.M., Visy`n V.V. ta in. Transnacionalizaciya svitovoyi ekonomiky` [Transnationalization of the world economy]: kolekty`vna monografiya. Lucz`k: Vezha-Druk, 2018. 236 p.

155 Dovidka shhodo stanu insty`tucijnogo zabezpechennya investy`cijnoyi ta innovacijnoyi diyal`nosti v Ukrayini [Information on the state of institutional support of investment and innovation activities in Ukraine]. Ministerstvo ekonomichnogo rozvy`tku i torgivli Ukrayiny`. URL: http://me.kmu.gov.ua/control/publish/article/main?art_id =127481&cat_id=127480.

Table 1.5. Regulatory and legal framework for institutional support of investment policy and activities in Ukraine

Normative-legal acts of general character	Normative-legal acts in the sphere of investment activity
Constitution of Ukraine [156] Law of Ukraine «On Local Self-Government» [157] Law of Ukraine «On Public-Private Partnership» [158] Law of Ukraine «On Securities and Stock Market» [159] and other	Laws of Ukraine «On Investment Activity» [160] Laws of Ukraine «On the regime of foreign investment» [161] Laws of Ukraine «On preparation and implementation of investment projects on the principle of «single window» [162] Laws of Ukraine «On General Principles of Creation and Functioning of Special (Free) Economic Zones» [163] Laws of Ukraine «On state regulation of activities in the field of technology transfer» [164] Laws of Ukraine «On Science Parks» [165] Law of Ukraine «On Protection of Foreign Investments in Ukraine» [166] Law of Ukraine «On Stimulation of Investment Activity in Priority Sectors of Economy for the Purpose of Creating New Jobs» [167] Decree of the President of Ukraine «On additional measures to attract foreign investment in the economy of Ukraine2 [168] and other.

The next element of the institutional environment of investment activity is its subjects (Fig. 1.3).

[156] Konsty`tuciya Ukrayiny` [Constitution of Ukraine] vid 28 chervnya 1996 r. Vidomosti Verhovnoyi Rady` Ukrayiny`. 1996. #30.

[157] Pro misczeve samovryaduvannya v Ukrayini [About local self-government in Ukraine]: Zakon Ukrayiny` vid 21.05.1997 # 280/97-VR. URL: http://kodeksy.com.ua/pro_mistseve_ samovryaduvannya_ v_ukraini.htm.

[158] Pro derzhavno-pry`vatne partnerstvo [About public-private partnership]: Zakon Ukrayiny` vid 01.07.2010.   # 2404-VI. URL: http://kodeksy.com.ua/pro_derzhavno-privatne_partnerstvo.htm.

[159] Pro cinni papery` ta fondovy`j ry`nok [About securities and the stock market]: Zakon Ukrayiny` vid 23.02.2006 # 3480-IV. URL: http://kodeksy.com.ua/pro_tsinni_paperi_ta_fondovij_rinok.htm.

[160] Pro investy`cijnu diyal`nist` [About investment activity]: Zakon Ukrayiny` vid 18.09.1991 # 1560-XII. URL: http://kodeksy.com.ua/pro_investitsijnu_diyal_nist.htm.

[161] Pro rezhy`m inozemnogo investuvannya [About the regime of foreign investment]: Zakon Ukrayiny` vid 19 bereznya 1996 r. # 93/96-VR / Verhovna rada Ukrayiny`. URL: http://zakon4.rada.gov.ua/ laws/show/93/96-%D0%B2%D1%80.

[162] Pro pidgotovku ta realizaciyu investy`cijny`x proektiv za pry`ncy`pom «yedy`nogo vikna» [On preparation and implementation of investment projects on the principle of «single window»]: Zakon Ukrayiny` vid 21.10.2010 r. # 2623-VI. URL: https://zakon.rada.gov.ua/laws/show/2623-17.

[163] Pro zagal`ni zasady` stvorennya ta funkcionuvannya special`ny`x (vil`ny`x) ekonomichny`x zon [On the general principles of creation and functioning of special (free) economic zones]: Zakon Ukrayiny` vid 17.02.2006 r. # 2673-XII. URL: https://zakon.rada.gov.ua/laws/show/2673-12yu.

[164] Pro derzhavne regulyuvannya diyal`nosti u sferi transferu texnologij [About the state regulation of activity in the field of technology transfer]: Zakon Ukrayiny` vid 09.12.2015 r. # 143-V. URL: https://zakon.rada.gov.ua/ laws/show/143-16.

[165] Pro naukovi parky` [About science parks]: Zakon Ukrayiny` vid 05.12.2012 r. # 1563-VI. URL: https://zakon.rada.gov.ua/laws/show/1563-17.

[166] Pro zahy`st inozemny`h investy`cij na Ukrayini [About protection of foreign investments in Ukraine]: Zakon Ukrayiny` vid 10 veresnya 1991 r. #1540a-XII/ Verhovna rada Ukrayiny`. URL: https://zakon.rada.gov.ua › 1540a-12.

[167] Pro sty`mulyuvannya investy`cijnoyi diyal`nosti u priory`tetny`h galuzyah ekonomiky` z metoyu stvorennya novy`h robochy`h miscz` [About stimulation of investment activity in priority branches of economy with the purpose of creation of new workplaces]: Zakon Ukrayiny` vid 6 veresnya 2012 r. #5205-VI/ Verhovna rada Ukrayiny`. URL: http://zakon.rada.gov.ua/ laws/show/5205-17.

[168] Pro dodatkovi zahody` shhodo zaluchennya inozemny`h investy`cij v ekonomiku Ukrayiny` [On additional measures to attract foreign investment into the economy of Ukraine]: Ukaz Prezy`denta Ukrayiny` vid 7 ly`pnya 2003 r. # 580/2003/ Prezy`dent Ukrayiny`. URL: http://zakon.rada.gov.ua/laws/show/580/2003.

representative authorities	• The President of Ukraine, the Verkhovna Rada of Ukraine, regional, district councils and village, settlement and city councils are obliged to perform in the relevant territory
executive authorities	• Cabinet of Ministers of Ukraine, regional and district state administrations, Kyiv and Sevastopol city state administrations; executive bodies of village, settlement, city councils, which exercise self-government, as well as state-delegated powers.
authorized bodies of executive power in the sphere of investment activity	• Ministry of Economic Development and Trade of Ukraine; State Agency for Investment and Management of National Projects; State Environmental Investment Agency of Ukraine; National Commission on Securities and Stock Market.
other state institutions in the sphere of investment activity	• Regional Centers for Investment and Development, which are created for the organization of interaction of research, investment enterprises, institutions and organizations, public authorities for investment development of the economy; introduction of investments in the sectors of the Ukrainian economy; promotion of Ukrainian technologies and inventions on the world market. The coordinator of the network of regional centers for investment and development is the Interregional Center for Investment and Development (Kyiv) State Enterprise "State Investment Company".
advisory institutions	• advisory institutions under the President of Ukraine (Committee on Economic Reforms, Council of Domestic and Foreign Investors) and advisory bodies of the executive power (Commissions of the Executive Committee).
some scientific, public and professional institutions, organizations and projects in the field of investment activity	• National Academy of Sciences of Ukraine; Chamber of Commerce and Industry of Ukraine, Ukrainian Union of Industrialists and Entrepreneurs, Competitiveness Council of Ukraine, European Business Association, Ukrainian Association of Investment and Ukrainian Business; portal of the Ukrainian Association of Investment Business, etc.
business entities of investment and innovation activities	• technology parks, science park "Kyiv Polytechnic"; special (free) economic zones ("Azov", "Donetsk", "Transcarpathia", "Interport Kovel", "Kururtopolis Truskavets", "Nikolaev", "Porto-Franco", "Port Crimea" "," Yavorov "); Territories of priority development with a special regime of investment activity: In the Autonomous Republic of Crimea, in Volyn, Donetsk, Zakarpattia, Zhytomyr, Luhansk, Chernihiv regions.

Fig. 1.3. Entities of investment activity of Ukraine
Course: created by [169; 170, c. 193-195].

169 Perelik SEZ ta TPR. Oficijny`j veb-sajt Ministerstva ekonomichnogo rozvy`tku i torgivli Ukrayiny`. URL: http://me.gov.ua/Documents/Detail?lang=uk-UA&id=65af61ae-d9d8-48fc-b1f0-a8ee8094994b&title=Perelik SezTaTpr.

170 Pochernina N. V. Insty`tucijne zabezpechennya innovacijno-investy`cijnoyi diyal`nosti v Ukrayini [Institutional support of innovation and investment activities in Ukraine]. Zbirny`k naukovy`x pracz` Tavrijs`kogo derzhavnogo agrotexnologichnogo universy`tetu (ekonomichni nauky`). 2013. # 1(3). P. 192-199.

In addition to these subjects in Fig. 1.3 in Ukraine, the infrastructure of investment activities is formed, which includes business centers, business incubators, technology parks, self-regulatory organizations of professional participants in the market of valuable securities.

Given the rather extensive list of normative-legal acts that regulate and define investment activity, as well as a significant number of subjects of this process, it is possible to assert about significant achievements in the formation. However, given the existing realities in the investment sphere of Ukraine, the institutional environment of investment processes in Ukraine needs to be improved, in particular in the field of bringing the country in line with world standards. Confirmation of this is the inefficient investment foreign economic activity of Ukraine, which faces many obstacles that hinder more effective attraction of foreign investment.

The government supports attracting foreign investment into the state's economy, but there are many difficulties for foreign investors in investing in the domestic economy. The task of the investment policy of the state is the regulation of investment activity, in particular financial. The system of financial regulation includes subjects of budgetary, social, tax, customs, foreign economic sphere, that is, state legal bodies, which determine the principles of implementation of the principles. The main problem of investing today is to reduce the demand for manufactured products. This is due to both the low solvency of the population in the domestic market and the decline in export prices on world commodity exchanges. The main risks of investment also lie in certain institutional conditions, such as: political and economic instability, corruption at the state and household levels, inefficient public administration, unorganized and unorganized. All this affects the prospect of attracting investment to the country as a whole and to regions in particular [171].

Thus, in recent years, the solvency of the population has deteriorated significantly, which has reduced the consumer activity of most enterprises, as almost all of them are focused on the domestic market. However, some companies that specialize in the production of certain groups of goods (pharmaceutical, textile industry), due to the fall of the market and rising prices of imports and the conditions of attracting foreign investment, have bad prospects. Today, Ukraine continues to attract new sources of foreign

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[171] Lyendyel O.M. Inozemni investy`ciyi yak faktor rozvy`tku ekonomiky` derzhavy` [Foreign investment as a factor in the development of the state economy]. Efekty`vna ekonomika. 2016. #9. URL: http://www.economy.nayka.com.ua/?op=1&z=5156.

investment, which will ensure the development of certain industries and the creation of new, innovative industries that will enter the state.

For potential investors, the protection of their own interests, proper support from the state, as well as minimization of risks - financial, political, legal, legal, are paramount in the implementation of the decision on investment deposits. On May 1, 2016, the Law «On Amendments to Certain Legislative Acts of Ukraine Concerning the Protection of Investors' Rights» [172], entered into force in Ukraine. This document envisages taking into account the interests of the owners of even small stakes and a significant increase in the responsibility of management companies. Law of Ukraine «On Amendments to Certain Legislative Acts of Ukraine Concerning the Abolition of the Obligation of State Registration of Foreign Investments» [173] significantly simplifies the activity of foreign investors on the territory of Ukraine and reduces administrative and bureaucratic barriers that stood in the way of effective implementation of investment activities.

This had a positive impact on investment activity in the country. Economists identify the following priority areas in the field of institutional support of investment and foreign economic activity: improvement of legislation and creation of a single system of investment.

1.3. Methodological approaches to economic assessment of interaction systems in innovation processes in the conditions of implementation of Ukraine's European integration direction

In economics and theories of innovative development, the problem of assessment in innovation processes is relevant and highly debatable, as such a duality is associated with a variety of assessment mechanisms and multifaceted assessment objects.

The development of the innovation ecosystem is accompanied by a review of the meaning and essence of establishing interaction in regulatory documents. Thus, the adoption of the Law of Ukraine «On Stimulating

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172 Pro vnesennya zmin do deyaky`h zakonodavchy`h aktiv Ukrayiny` shhodo zahy`stu prav investoriv [On Amendments to Certain Legislative Acts of Ukraine Concerning the Protection of Investors' Rights]: Zakon Ukrayiny` vid #289-VIII/ Verxovna rada Ukrayiny`. Vidomosti Verxovnoyi Rady` Ukrayiny`. 2015. # 25. P.188.

173 Pro vnesennya zmin do deyaky`h zakonodavchy`h aktiv Ukrayiny` shhodo skasuvannya obov'yazkovosti derzhavnoyi reyestraciyi inozemny`h investy`cij [On Amendments to Certain Legislative Acts of Ukraine Concerning the Abolition of the Obligation of State Registration of Foreign Investments]: Zakon Ukrayiny` vid 31 travnya 2016 r. # 1390-VIII/ Verxovna rada Ukrayiny`. URL: http://zakon2.rada.gov.ua/laws/show/1390-19.

Regional Development»[174] was accompanied by the introduction of such an instrument of regional development as an agreement - a mechanism of contractual relations between the Cabinet of Ministers of Ukraine and local governments in the field of regional development. The conclusion of regional agreements should be accompanied by an assessment of the results of «the implementation of joint measures provided for in the agreement on regional development and the resources aimed at achieving them» [175].

The implementation of public-private partnership, which is actively pursued in the innovation processes of Ukraine, also requires constant monitoring of the effectiveness of implementation and improvement of the existing Methodology for evaluating efficiency [176] in connection with reviewing the challenges of globalization and knowledge economy.

The problem of assessment becomes especially important in modern conditions in connection with the development of models of open innovation, which is based on the priority of interaction as a component of international competitiveness in the implementation of Ukraine's European integration direction. Therefore, the indicators of the development of the innovation process are now determined by the indicators of the level of development of interaction, partnership, exchange of various objects (resources) for the implementation of the innovation process. Instead, the researched scientific sources do not have methodological provisions for assessing the state and development of interaction processes in innovation processes, and existing developments do not take into account the impact and importance of factors and processes of partnership to ensure efficiency and productivity of innovation processes.

Appropriate assessment of indicators of cooperation will contribute to the formation of mechanisms for managing innovative development as an integral element of international competitiveness in the implementation of Ukraine's European integration direction on the basis of methodological validity. Given the importance of the outlined problem for the formation of the mechanism of well-established interaction, identification of problems of evaluation of innovation indicators, indicators of innovation activity

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174 Zakon Ukrayiny` «Pro sty`mulyuvannya rozvy`tku regioniv» [Law of Ukraine «On Stimulating the Development of Regions»]. # 2850 vid 08.09.2005 r. *Oficijny`j visny`k Ukrayiny`*. 2005. # 40. P. 25—29.

175 Postanova Kabinetu Ministriv Ukrayiny` vid 16.11.2011 r. # 1187 «Pro zaprovadzhennya ocinky` efekty`vnosti zdijsnennya spil`ny`h zahodiv, peredbacheny`h ugodoyu shhodo regional`nogo rozvy`tku» [On the introduction of an assessment of the effectiveness of the implementation of joint measures provided for in the agreement on regional development]. URL: http:// zakon4.rada.gov.ua/laws/show/1187-2011-%D0%BF.

176 Deyaki py`tannya provedennya analizu efekty`vnosti zdijsnennya derzhavno—pry`vatnogo partnerstva [Some questions of the analysis of efficiency of realization of public-private partnership]. URL: https://zakon.rada.gov.ua/laws/show/z0399—12.

development and establishment of joint activities in innovation processes, research of many Ukrainian and foreign scientists is devoted to the requirements of innovation evaluation. Thus, the assessment of innovation processes can be carried out through a certain system of indicators in the forms of statistical reporting.

There are the following groups of indicators that describe some aspects of the implementation of the innovation process [177, p.101]:

- statistics of scientific and scientific-technical activity;
- patent statistics;
- bibliometric data on scientific publications;
- technological balance of payments, which characterizes the international transfer of technology.

Statistics of scientific and scientific-technical activity allows to estimate indicators of scientific researches and indicators of R&D, and the following stages of innovative process remain out of attention, in particular the level of development and commercialization of scientific and technical developments is unknown.

Patent statistics allow us to assess the level of activity of entities in the field of licensing and patenting the results of the innovation process, but also focuses on the first stages of the innovation process. It should be noted that patenting mechanisms need to be revised and reformed, as many R&Ds become available for use in the innovation market without intellectual property rights due to the need to accelerate commercialization. Patents for numerous intermediate results of the innovation process are not issued due to trade secrets, because the patent discloses too much information [178].

Bibliometric data allow us to assess the performance of basic research, but do not allow the analysis of indicators of their use in the innovation market.

Indicators of the technological balance of payments characterize the flows of investment and technology in various forms, but do not allow to «assess the impact of these flows on technological evolution in the country and innovation climate, as well as economic, environmental and technological security» [143, p.103].

Such a methodology of collecting information on the indicators of the innovation process leads to limited opportunities for its use, specific

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[177] Lazutin G. I. Suchasni tendenciyi rozvy`tku innovacijnoyi diyal`nosti [Current trends in innovation]. *Ekonomika i prognozuvannya.* 2003. # 2. P. 99—113.

[178] Ivashhenko O. V. Monitory`ng naukovo—texnichnoyi j innovacijnoyi diyal`nosti v Ukrayini [Monitoring of scientific, technical and innovative activities in Ukraine]. *Visny`k Zaporiz`kogo nacional`nogo universy`tetu.* 2012. # 4. P. 16.

analytical indicators obtained on their basis, and, accordingly, unfounded conclusions and decisions. Statistical forms of information collection and monitoring in Ukraine allow us to analyze such important indicators as indicators of innovation activity. These groups of indicators allow us to assess the development of the innovation market at the macro level (state), regional level, the level of certain types of economic activity.

Innovation monitoring in accordance with the requirements of the «Oslo Guidelines» is considered in a narrow and broad sense. Monitoring of innovations in the narrow sense consists in tracking the course and results of a particular innovation project. In a broad sense, the monitoring of innovation covers all areas, types or areas of scientific, technical and innovation activities, state innovation policy, the state of development of innovation structures (research centers, innovation firms, technology parks, etc.). Such monitoring is carried out mainly at the level of the country as a whole, a particular region, region, production or type of economic activity in accordance with the classification of types of economic activities (CTEA) [179].

The Ukrainian analogue of monitoring the innovation activity of enterprises of different types of activity is the observation of the form №1-НН - inspection of the innovation activity of the organization (enterprise) for the corresponding two-year period. The inspection program provides quantitative and qualitative data on the innovative activity of enterprises in 11 main sections and is similar to the relevant European monitoring.

However, according to domestic scientists, most indicators of macroeconomic assessment of the innovation process of industrial enterprises are mostly quantitative in nature and practically do not correlate with cost indicators, allow analysis and evaluation of only one of the manifestations of innovation and development – innovation activity

Examining the work of leading scientists on this vector, it should be noted that G. Lazutin identifies groups of indicators that describe some aspects of innovation [180, p.103]; P. Pererva notes the need to develop scientific and methodological foundations for the creation and

179 Kerivny`cztvo Oslo. Rekomendaciyi zi zboru ta analizu dany`h stosovno innovacij [Oslo Guide. Recommendations for collecting and analyzing data on innovation] / pereklad z anglijs`koyi G.O. Androshhuk. UkrINTEI, 2009. 164 p.
180 Lazutin G. I. Suchasni tendenciyi rozvy`tku innovacijnoyi diyal`nosti [Current trends in innovation]. *Ekonomika i prognozuvannya*. 2003. # 2. P. 99—113.

operation of a system for monitoring innovation of industrial enterprises based on the use of indicators of innovation potential, a comprehensive solution to the problems of multi-source resource provision of innovation [181, p.110]; I. Fiegenbaum, D. Podmetina, R. Teplov, E. Albats investigate the system of evaluating the effectiveness of the interaction system through the use of the approach to the assessment of open innovations [182, p.90]; V. Morozov determines the effectiveness of the process of interaction of different types of economies that make up the national economy [183, p.7]; M. Dziallas, K. Blind investigated a set of indicators and factors during the implementation of the innovation process in research for 35 years at the national level and industry level [184, p.12]; S. Romanyuk notes the need to develop procedures for coordinating the programming and implementation of development policy, thus laying the foundations of multilevel governance, when the introduction of subsidiarity in the definition of tasks on development issues [185, p.11].

Summarizing the experience, it can be stated that the most developed are the approaches to assessing the indicators of innovation and innovation as a result of innovation. It should also be noted that modern research focuses on the problems of determining the indicators of interaction in the chain «developer – manufacturer – investor», sometimes involving consumers or the university, another limitation of existing methodological approaches is the exclusive focus of investment or economic indicators. However, the issues of determining the indicators of interaction systems in innovation processes as a component of international competitiveness in the implementation of Ukraine's European integration direction remain poorly understood, which does not ensure the proper quality of management and establishment of various forms of joint activities at the regional level.

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[181] Pererva P. G., Gladenko I. V. Monitory`ng innovacijnoyi diyal`nosti: interpretaciya rezul`tativ [Monitoring of innovation activity: interpretation of results]. Markety`ng i menedzhment innovacij. 2010. #2. P. 108—116.

[182] Selyakova S. A. Organy`zacy`ya mony`tory`nga nauchno-y`nnovacy`onnoj deyatel`nosty` [Organization of monitoring of scientific and innovative activity]. Ekonomy`chesky`e y` socy`al`nыe peremeny v regy`one. 2002. Vyp. 19. P. 28—34. URL: http://library.vscc.ac.ru/Files/articles/130286511928.PDF.

[183] Morozov V. A. Ekonomika vzayemodiyi [Economics of interaction]. Kreaty`vna ekonomika. 2014. 8 (92). P. 34—49.

[184] Dziallas M., Blind K. Innovation indicators throughout the innovation process: An extensive literature analysis. Technovation, 2019. 80. P. 3—29.

[185] Romanyuk S. A. Ugody` shhodo regional`nogo rozvy`tku yak instrument derzhavnoyi polity`ky` [Agreements on regional development as an instrument of public policy]. Ekonomika i region. 2012. 6. P. 9—15.

The formation of a significant array of indicators for the components of the innovation process necessitates their systematization in the direction of finding indicators that will most fully characterize the object of study - the process of interaction to identify problem areas at the present stage of development, the study also identifies objects, subjects , tasks, functions and principles of assessment.

Due to the importance of evaluating the indicators of interaction for a comprehensive evaluation of innovation processes, it is advisable to clarify the place of this selected process in the overall system of innovations assessment. (Fig. 1.3).

Input indicators (innovative resources and opportunities)

Innovation process (supported by input indicators)

Results of innovation process / development (related to goals)

Indicators of interaction (expediency of adjustment, possibilities of adjustment, distribution of

The results of the innovation process

(individual works / stages)
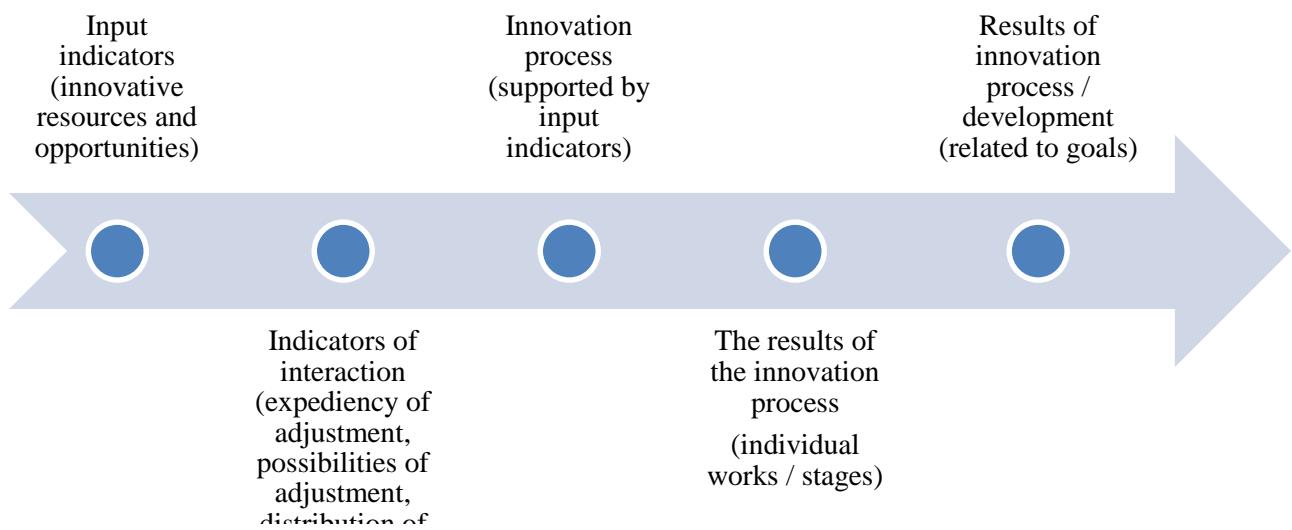
Fig. 1.3. The place of interaction evaluation indicators in the logical model of innovation assessment (formed by the author using [186, p.233])

The presented scheme determines the main assessment objects identified according to the recommendations of the Oslo-2018 statistical observations. Along with the above-mentioned objects of «innovation» and «innovation process», the management of Oslo identifies two more: input indicators (innovation resources and opportunities); results of innovation process / development (concerning goals). Accordingly, innovations are considered as the results of the innovation process, so in the form of indicators that evaluate the results of the logical model understand the system of indicators for evaluating the innovative development of the participant in the innovation process or the result of its participant in the

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[186] OECD. Oslo Manual (2018). Guidelines For Collecting, Reporting Aand Using Data on Innovation (4th edition). The Measurement of Scientific, Technological and Innovation Activities, OECD Publishing, Paris/Eurostat, Luxembourg. Retrieved from: https://doi.org/10.1787/9789264304604—en

innovation process (missions, goals of innovation development and innovation strategies).

According to the requirements of international standards, a separate group of input indicators is allocated, which can be considered as a system of indicators of the availability of innovative resources and opportunities for their use. This group of indicators includes indicators for assessing the innovation potential of the participant in the innovation process, indicators for assessing the innovation environment of the region. In Fig. 1.3 we also identified a group of indicators for assessing the interaction, the place of which is presented after the group of input indicators of the beginning of the innovation process. Based on the results of the evaluation of the innovation potential of the participant of the innovation process, one of the following management decisions must be made:

- sufficiency of innovation potential to achieve the goals of innovation development and independent implementation of the innovation process;

- lack of innovation potential to achieve the goals of innovation development and implementation of the innovation process and interaction with other participants;

- inefficiency of independent implementation of the innovation process.

To form a methodical approach to economic evaluation of interaction systems in innovation processes, the following components must be substantiated: object and subject of economic evaluation, technologies (methods and methodology), indicators, criteria, parameters of economic evaluation of interaction systems in innovation processes.

Traditionally, according to the results of research analysis, the purpose of assessing the effectiveness of innovation is «comprehensive analysis of innovation efficiency, determining the feasibility and optimal implementation of innovations, prompt adjustment of innovation projects and support for strategic innovation decisions» [187, p.152].

An element of the methodological basis of economic evaluation of interaction systems is the substantiation and definition of indicators that allow to form a comprehensive description of the results achieved through joint implementation of stages of the innovation process as a component of international competitiveness in Ukraine's European integration direction.

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[187] Ammari A. O. Klasy`fikaciya stejkholderiv na osnovi vzayemny`h ochikuvan` [Classification of stakeholders based on mutual expectations]. Aktual`ni problemy` ekonomiky`. 2012. #8. P. 150—155.

Thus, the result of the study was the selection of the following objects of economic assessment of interaction systems in innovation processes: innovations; innovation process; the process of interaction (Fig. 1.4).

Innovations	the end result of the process	idea	intermediate result	result of implementation (use)
Innovation process	innovation potential	implementation parameters	results of stages (process)	development results
Interaction	tooling	implementation	realization	interaction potential
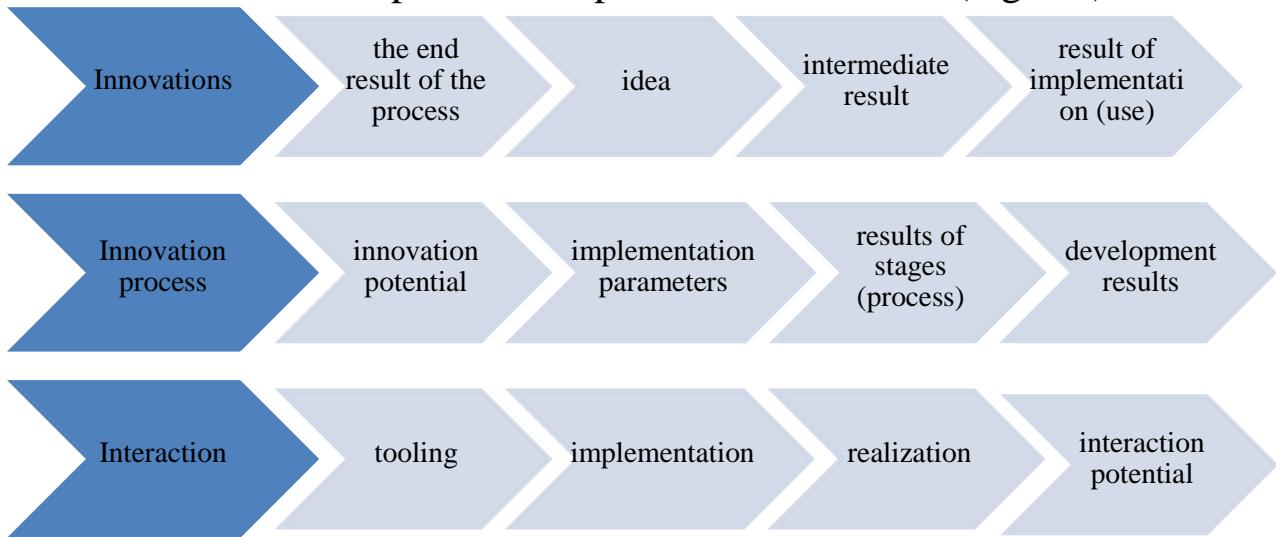
Fig. 1.4. Objects of economic assessment of interaction systems in innovation processes (formed by the author)

The selected three evaluation objects are closely related to each other and determine the overall result of the assessment of interaction systems in innovation processes.

To form the conceptual foundations of economic evaluation of interaction systems, the model of innovation logic, described in Fig. 1.4, is the basis for building a methodological basis for measuring the parameters of the interaction system. Measurements can reflect evidence of events, conditions, and behaviors that can be considered as elements of an overall sequence of tooling and interaction.

Innovation, as an object of assessment, can be defined as at the level of a new idea (new knowledge), an intermediate result obtained after the stage of the innovation process, the final result of the innovation process in the form of a planned type of innovation, or the result of practical use in the market. Indicators for evaluating innovations are also divided by thematic areas (Table 1.5).

Thus, we can generalize that the purpose of evaluating innovations, as a result of the innovation process, is to measure in such areas as: determining the level of novelty; identification of expected areas of application and use of innovations; determination of expected value indicators for the consumer; determining the level of new knowledge.

Table 1.5. Thematic directions of assessment of the innovation process of the region by indicators

Direction	Indicators
Frequency of innovations and their characteristics (for example, type, novelty)	Number of enterprises that introduced product (technological) innovations. Number of enterprises that introduced new (improving) innovations. Number of new products. Number of new technological processes.
Innovation and investment (activities and resources for each activity)	Number of enterprises engaged in innovation activities. The cost of innovation. Number of innovative projects / programs
Innovative opportunities within the region	The share of firms that use advanced, favorable or latest technologies. The share of firms that use highly qualified personnel, by level of education or by field of education.
Innovative connections and knowledge flows	The share of firms that have cooperated with other parties in innovation activities (by type of partner or location of the partner). The share of firms indicating this type of partner as the most important. The share of firms engaged in the original licensing activities. The proportion of firms that have a contract to develop products or business processes for other firms or organizations. Proportion of firms that have disclosed useful knowledge about innovations in products or business processes of other firms or organizations. The share of firms engaged in specific activities for the exchange of knowledge with institutions of higher education or public research institutions. Proportion of firms reporting barriers to interaction with other parties in production or knowledge sharing
External impact on innovation (including regional policy) and framework conditions for business innovation (including knowledge infrastructure)	The share of enterprises that sell innovations to specific groups (other enterprises, the state). The share of firms selling products in international markets Proportion of firms that received regional support for the development or use of innovations (by type of support). Proportion of firms reporting selected positions as barriers to innovation
The results of innovation	The share of turnover from product innovations and innovations in the market Number of new products (processes, services, products)
Economic and social results of innovative development	The level of competitiveness of activities (products). Sales market share. Customer loyalty. Business reputation

Note: formed by the author using [188, p.224].

[188] Cy`ganova N. V. Vzayemodiya sub'yektiv finansovogo ry`nku v umovah povedinkovoyi ekonomiky` [Interaction of financial market entities in a behavioral economy]. Naukovy`j poglyad: ekonomika ta upravlinnya. 2019. 2. P. 174—184.

The innovation process can be evaluated by a system of indicators of an innovation project or innovation program. According to the structuring of the innovation process, we can identify systems of indicators used to evaluate innovative projects [189, p.118].

Then the economic assessment of interaction processes can be considered as a partial or intermediate evaluation of such a comprehensive evaluation, which includes indicators of effectiveness and efficiency.

Generalizing indicators of innovation interaction are indicators of efficiency and productivity of the innovation process (stage).

Effectiveness can be defined as the degree of implementation of planned activities and achievement of planned results [190, p. 18]. The effectiveness of the innovation process shows the extent to which the goal was achieved through the introduction of innovative actions in the enterprise, that is the quantitative level of innovation, and efficiency will characterize the qualitative degree of satisfaction in the implementation of innovative measures in the enterprise [191].

Accordingly, the concept of «effectiveness of interaction» should be understood as the value of the result obtained from joint activities in innovation processes. Unity and coherence of interests, unity of goals of all participants, absence of conflicts of interests and regulation of interaction of participants are parameters of growth of efficiency of functioning of system of interaction. The efficiency of the system of interaction in innovation processes is characterized by a system of indicators calculated in the form of the ratio of costs and results. The effect characterizes the result, the consequence of a change in the state of a particular object under the influence of external or internal factors and, above all, the factor of use (consumption) of innovation. To measure the effects of the innovation process, firstly, it is necessary to formulate criteria and indicators by which the results of the process can be evaluated and, secondly, it is necessary to take into account objectively existing relationships and hierarchical ordering effects of the innovation process as a component international competitiveness in the implementation of Ukraine's European integration direction.

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[189] Terebux A. A., Lisovs`ka L. S. Predpossylky` oceny`vany`ya effekty`vnosty` hozyajstvennyx resheny`j [Prerequisites for evaluating the effectiveness of business decisions.]. *Visny`k Chernivecz`kogo torgovel`no-ekonomichnogo insty`tutu.* 2015. 4. P. 114—123.

[190] Goncharova E. N., Poklonsky`j F. E. Kachestvo, rezul`taty`vnost`, effekty`vnost`, kvaly`taty`vnost`: termy`nogogy`chesky`e aspekty [Quality, efficiency, effectiveness, qualitativeness: terminological aspects]. *Ekonomika promy`slovosti.* 2009. # 44. URL: http://www.nbuv.gov.ua/portal/Soc_Gum/ EProm/2009_44/st_44_03.pdf.

[191] Sy`stemy` upravlinnya yakistyu [Quality management systems]. Zbirny`k normaty`vno-pravovy`h dokumentiv. L`viv : Vy`d-cztvo LDCzSMS, 2001. Vy`pusk 2. 162 p.

Thus, we can generalize that the effectiveness of the interaction system is a concept that reflects the compliance of the results of the joint implementation of the innovation process to the goals and interests of its participants. That is why it is necessary to evaluate the effectiveness of the implementation of the interaction system as a whole, as well as to evaluate the effectiveness of participation of each participant.

It is obvious that the performance indicators of the innovation process do not reflect and do not replace the performance indicators. Performance indicators make it possible to characterize the qualitative degree of achieving the effect in the process of implementing innovative measures in accordance with the calculated quantitative indicators of the innovation process.

Performance without taking into account efficiency can lead to unreasonable decisions, because «any activity has a result that may not necessarily be positive» [[192] , p.89]. Interaction is based on the implementation of actions that are agreed in time and space between the participants. The unity and coherence of interests, the unity of goals of all participants, the absence of conflicts of interest and the regulation of interaction of participants are the parameters of increasing the efficiency of the interaction system.

«The effect of relations can be characterized by the degree of rational uniformity (repetition of actions), which reflects the order in the system of interaction. Factors such as the degree of coordination, flexibility and stability, heterogeneity and maneuverability, innovation and variability and some others determine the effectiveness of the process of interaction of different types of economies that make up the national economy» [[193], p.89].

The formation of a system of indicators of interaction efficiency should be based on the model of open innovation, which provides for the selection of such indicators as «volume of external knowledge involved, volume of technologies involved, indicators of breadth and depth of external information sources of innovation process».

The processes of interaction, as an object of economic assessment, should involve the separation of the following three components (Fig. 1.5):

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[192] Druker P. Effekty`vnost` upravleny`ya. Ekonomy`chesky`e zadachy` y` opty`mal`nye resheny`ya [Management efficiency. Economic problems and optimal solutions] / P. Druker: [per. s angl.]. M. : FAY`R–PRESS, 1998. 288 p.

[193] Morozov V. A. Ekonomika vzayemodiyi [Economics of interaction]. *Kreaty`vna ekonomika.* 2014. 8 (92). P. 34—49.

- tooling processes;
- implementation processes;
- realization processes.

Tooling

Forms of establishing joint activities.
Level of coordination of interests
conflict of interest.
Coordination of tasks.
Division of activities into components
identification and evaluation.
Factors that motivate participation in the system of interaction.

Implementation

Processes, functions and tasks of the innovation process.
Parameters of joint performance.
parameters of formation of managerial decisions in the system of interaction.
Indicators for evaluating individual participants (organizational formations, their structural units) of the innovation process.
Coordinated implementation.
System of awards and incentives.

Realization

System implementation.
Participation of subjects.
Reconciliation of a single result.
Coordination of shares
Evaluation of the synergistic effect of the interaction.

Fig. 1.5. Interaction as an object of economic assessment
(generated by the author)

Critical analysis of the considered methodological approaches to assessment of indicators of innovation activity and indicators of interaction in innovation processes became the basis for development of conceptual bases of economic estimation of systems of interaction (tab. 1.6).

Table 1.6. Methodical basis of economic assessment of interaction systems in innovation processes

Principles	Conceptual approaches				
	Efficiency			Productivity	
	Assessment levels				
Task	National		Regional / TEA		Entity of the IP
	Assessment objects				
Functions	Tooling. Implementation of the innovation process	Implementation of the innovation process	Interaction	The result of innovation development	The result of innovation development
	Evaluation methods				
	dynamic			static	

Note: generated by the author.

The need to evaluate systems of interaction in innovation processes is due to the following tasks: the need to monitor the implementation of individual works of the innovation process, performed jointly by participants or separately, achieving consistency and synchronization of efforts of participants in the innovation process; identification of contradictory tendencies and contradictions in joint activity; conducting a comparative analysis of indicators in space, areas and time; constant monitoring of changes for active adaptation; providing a control system in connection with the ever-increasing complexity of the innovation process; ensuring the preservation of property of the participant of the interaction system, efficient use of resources, compliance with regulatory (planned) indicators (cost, time, etc.) of the interaction; study of stimulators and stimulators of innovation development in the market.

Subjects of economic assessment of interaction systems in innovation processes should be potential and actual participants, direct participants in the innovation process (employees of enterprises and associations, individual developers (scientists), indirect participants in the innovation process (collective and collegial bodies or individual participants in the innovation infrastructure) , indirect participants (regional, departmental bodies, public organizations), each of which has its own goals and objectives when evaluating indicators.

The system of indicators for evaluating the system of interaction must meet the requirements of relevance, accuracy, reliability, timeliness, consistency and accessibility, so the interaction can be described by indicators of evaluation of the process of establishing joint activities or indicators of evaluation of the agreement on joint activities. To be useful, evaluation indicators must have several quality characteristics. In particular, as scholars point out [194 , p.217], «accurate, reliable and accessible indicators will be of limited value if delays in timeliness mean that they are not taken into account in political discussions or decisions». That is, the purpose of economic evaluation of interaction systems in innovation processes of the region should be a comprehensive analysis of the effectiveness of the interaction system and its impact on key indicators of

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194 OECD. Oslo Manual (2018). Guidelines For Collecting, Reporting Aand Using Data on Innovation (4th edition). The Measurement of Scientific, Technological and Innovation Activities, OECD Publishing, Paris/Eurostat, Luxembourg. Retrieved from: https://doi.org/10.1787/9789264304604—en

innovative development of the region, determining the feasibility and optimal options for interaction system, operational adjustment of interaction processes.

The main tasks of economic assessment of interaction systems in innovation processes are the following:

- identification, analysis and evaluation in the external and internal environment of the region of those factors and phenomena that have a high probability of occurrence and can have a significant impact on the formation and implementation of joint implementation of the innovation process in the region;

- evaluation of performance and efficiency indicators: innovations for a certain period of time, efficiency and reliability of its management system, interaction, participation in the interaction system.

In this regard, the main functions of economic evaluation of interaction systems in innovation processes are:

- diagnostic - the need to study the level of innovative potential of the participant and his potential for interaction;

- feedback - information about the progress of the stages / works of joint tasks, gives the opportunity to influence the process;

- indicative - economic evaluation is carried out at points of special importance;

- disclosure of opportunities and threats for the combination of resources during the joint implementation of the innovation process in the region;

- determination of probabilities of conflict of interests of participants of the regional system of interaction and their preventive elimination;

- stimulating - aimed at the implementation and involvement in the innovation process of unused reserves of participants;

- corrective - related to the clarifications made in management decisions based on the results of evaluation;

- educational - assessment promotes productive and conscientious work;

- preventive and protective - economic assessment is carried out in compliance with the law during the implementation of business transactions, certain rules and regulations of the innovation process, as well as standards for resource consumption.

The functions of economic assessment of interaction systems in innovation processes are implemented using different methodological approaches, evaluation methods. Two groups of methods are used to evaluate innovation indicators: static (method of profit comparison), cost comparison method, cost comparison method (profitability), payback method, dynamic (net discounted value method, internal rent method, annuity method, payback method, the method of the final cost of capital).

Mechanisms of dynamic methods allow flexible consideration of financing conditions; substantiate the instruments of additional investments and alternative financing; display the conditions for forming the discount rate. The conducted research allowed to single out the principles of economic assessment of the system of interaction in innovation processes as the basic conceptual principles that ensure the rationality and objectivity of the construction of the system of indicators:

1. Systematic - taking into account the existing structure of the required indicators.

2. Consistency - harmonization of criteria and indicators of indicators between all participants.

3. Purposefulness - conducting evaluation according to the established goals of system formation and evaluation goals.

4. Optimality - the choice of a methodological basis of evaluation based on the established criteria.

5. Adequacy - taking into account the important characteristics and parameters of the object of evaluation in order to obtain objective results.

6. Complexity - ensuring the completeness of the level of coverage of the elements of the system of interaction in innovation processes, the ability to take into account their most complete list.

7. Logic - ensuring the sequence of evaluation between the individual stages of evaluation.

8. Variances - the ability to choose evaluation methods.

9. Integration - combining diverse indicators in order to obtain a comprehensive result.

10. Decomposition - the required level of detail of indicators, their analytical dismemberment.

11. Objectivity - provides a reliable reflection of the potential as an economic phenomenon, the main trends of its development.

12. Information accessibility - the formation of an accessible information base, which will be the basis for calculating the relevant indicators.

13. Rationality - the choice of the most significant indicators and the avoidance of excessive detail, which leads to unproductive resource costs.

After substantiation of conceptual bases and on the basis of generalization of existing methodological provisions of innovation estimation the methodical approach to economic estimation of systems of interaction in innovation processes as a component of the international competitiveness in the conditions of realization of the European integration direction of Ukraine which provides monitoring of processes of adjustment, implementation and realization of joint activity of participants of innovation process on the grounded directions and indicators (fig. 1.6).
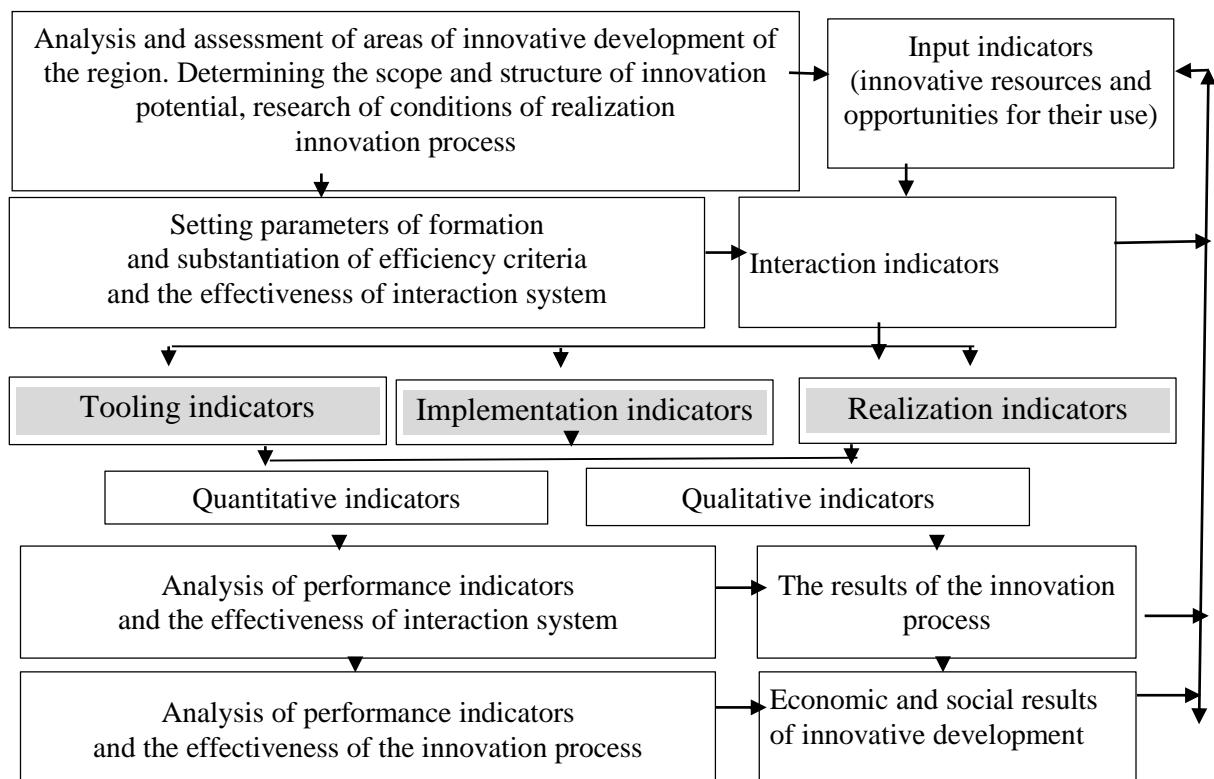
Fig. 1.6. Methodical approach to economic assessment of interaction systems in innovation processes (author's development)

Quantitative indicators of evaluation of the interaction system are the efficiency and productivity of the innovation process (stage); qualitative indicators include the usefulness of interaction, the cost of interaction, the value of interaction.

The process of economic evaluation of interaction systems in innovation processes requires compliance with the dialectical unity of five successive stages:

1. Setting evaluation goals in accordance with the goals of forming a system of interaction.

2. Development of a system of criteria and indicators for control (standards).

3. Proof and coordination of evaluation criteria to participants.

4. Evaluation of the actual functioning in accordance with the established criteria and indicators.

5. Comparison of performance with standards and development, if necessary, of corrective measures.

Thus, the methodological approach of economic assessment of interaction in innovation processes under the conditions of development of open innovation models includes such elements as evaluation principles, evaluation tasks and functions, subjects and objects, evaluation stages. Substantiated conceptual methodological approach to the assessment of systems of interaction in innovation processes, in contrast to the existing provisions for the evaluation of innovation, provides monitoring of the processes of establishment, implementation and implementation of joint activities of participants in innovation processes.

The developed methodological approach can be used to improve the procedure for evaluating the effectiveness of regional development programs and projects and public-private partnerships by both representatives of the business environment and local governments.

CHAPTER 2

DIAGNOSIS OF INNOVATION AND INVESTMENT COMPONENT OF THE INTERNATIONAL COMPETITIVENESS OF UKRAINE IN MODERN CONDITIONS OF ECONOMY

2.1. Organizational and financial determinants of the innovative component of the country's competitiveness

In the conditions of aggravation of the world competition, constant modernization of technologies, increase of a role of partnership and strategic alliances, the most important factor capable to provide efficiency of the industrial enterprise becomes innovative activity. The global innovation system is currently characterized by increased dynamism: the growing intensity of innovation processes, reducing the time to create innovations, developers and consumers are new actors in innovation, changing their relationships and, consequently, functions. Transformations in the world innovation system and its dynamism dictate the need to build an up-to-date model of innovation. The current model of economic development of Ukraine is characterized by the dominance of vertical relations within the outdated «double spirals», which complicates the transition to a new trajectory of the innovation system. Achieving the sustainability of innovative development requires the transformation of the institutional matrix aimed at organizational and financial support of innovation activity of economic entities in the development of their own technological innovations. The above determines the relevance of the chosen topic and objectives of the study.

Theoretical and practical aspects of the problems of financing innovation and development are devoted to a large number of scientific works of domestic and foreign scientists, namely: M. Abramovytsia, L. Antonyuk, Y. Bazhala, V. Heitz, E. Denison, P. Drucker, V. Zanko, A. Kazantseva, I. Manaenko, G. Mensha, R. Mueller, R. Nelson, A. Lieutenant, J. Sey, N. Syrotynska, B. Twiss, S. Tyvonchuk, M. Tugan-Baranovsky, J. Schumpeter, R. Foster and others. Despite the considerable amount of scientific work on the development of the innovation paradigm,

the issues of financial support of the innovative component of the country's competitiveness need further research to improve in the context of ensuring the country's competitiveness.

The impact of sources of funding for innovation in the country and the cost of funding its own research and development or external research on economic growth can be determined by economic and mathematical justification and construction of regression equations between GDP and innovation funding indicators and cost research.

Among the financial determinants of the innovative component of increasing the country's competitiveness, it is advisable to single out the indicators of capital investment from own funds of enterprises / organizations, capital investment from state and local budgets, research and development costs, as well as costs for financing external research and acquisition of foreign knowledge in 2010-2019 [8].

One of the main criteria for determining the level of innovation of the national economy is the volume of capital investment from own funds of enterprises and organizations, as well as capital investment flows from state and local budgets (Fig. 2.1).
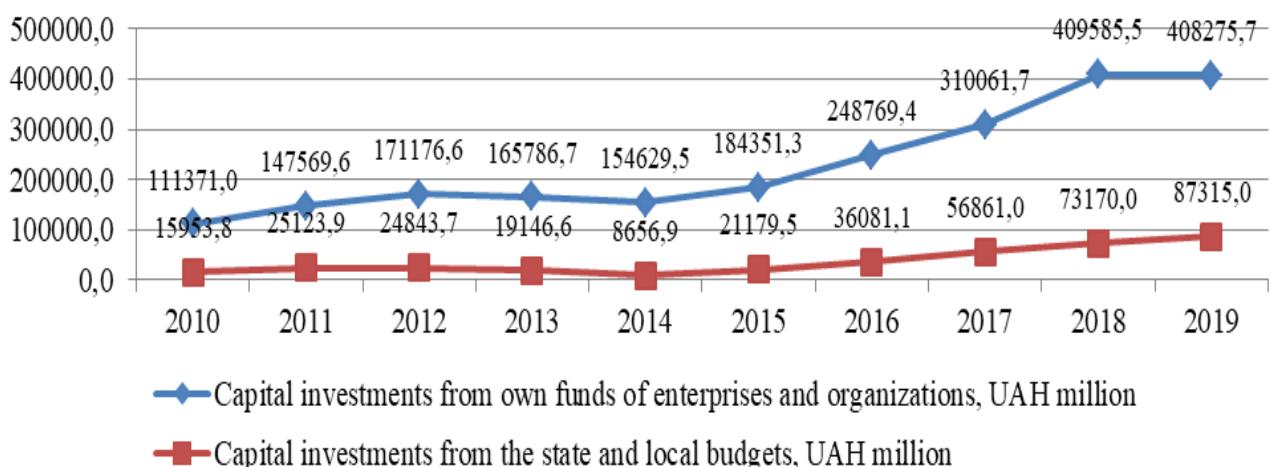
Fig. 2.1. Volumes of capital investments from own funds of enterprises / organizations and from state and local budgets for 2010-2019
(source: built according to [195])

According to the State Statistics Service of Ukraine (Fig. 2.1) for the period 2010-2019 there is a gradual increase in capital investment from own funds of enterprises / organizations and from state and local budgets.

195 Ekonomichna staty`sty`ky`. Nauka, texnologiyi ta innovaciyi [Economic Statistics. Science, Technology and Innovation]. Derzhavny`j komitet staty`sty`ky`. URL: http://www.ukrstat.gov.ua/.

Expenditures on research and development, as well as expenditures on financing external research and acquisition of external knowledge for 2010-2019 are shown in Fig. 2.2.
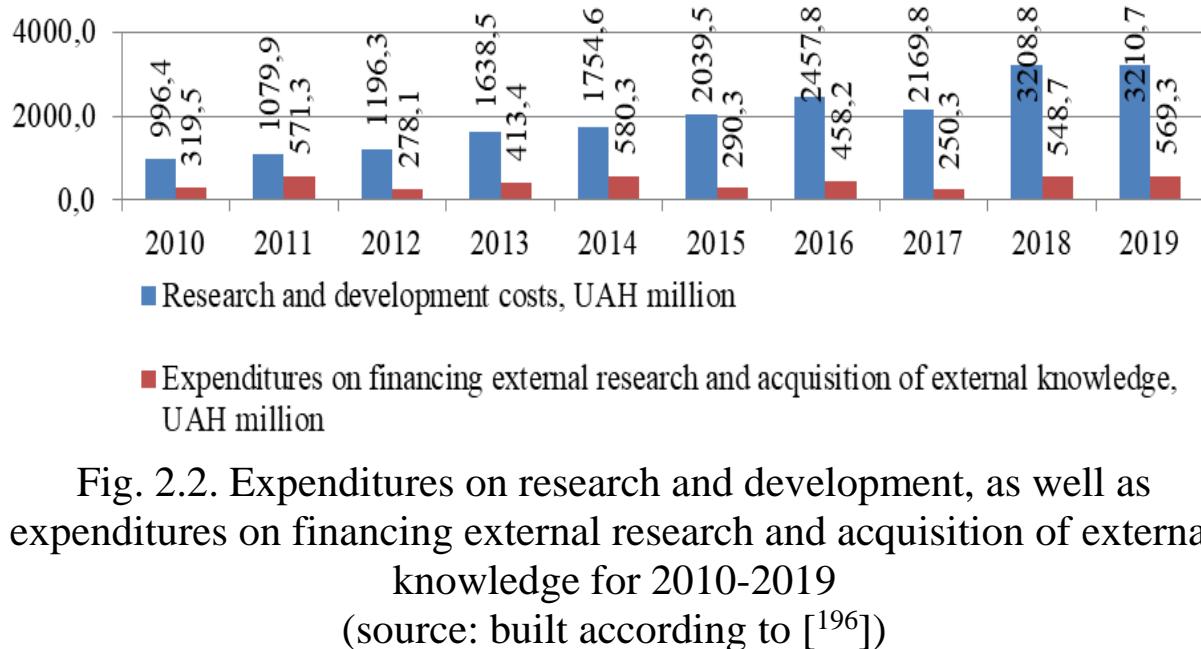
Fig. 2.2. Expenditures on research and development, as well as expenditures on financing external research and acquisition of external knowledge for 2010-2019
(source: built according to [196])

The use of economic and mathematical tools «Data Analysis» in general and the function «Regression» in particular on the indicator «Volumes of capital investments from own funds of enterprises / organizations» are reflected in figure 2.3.
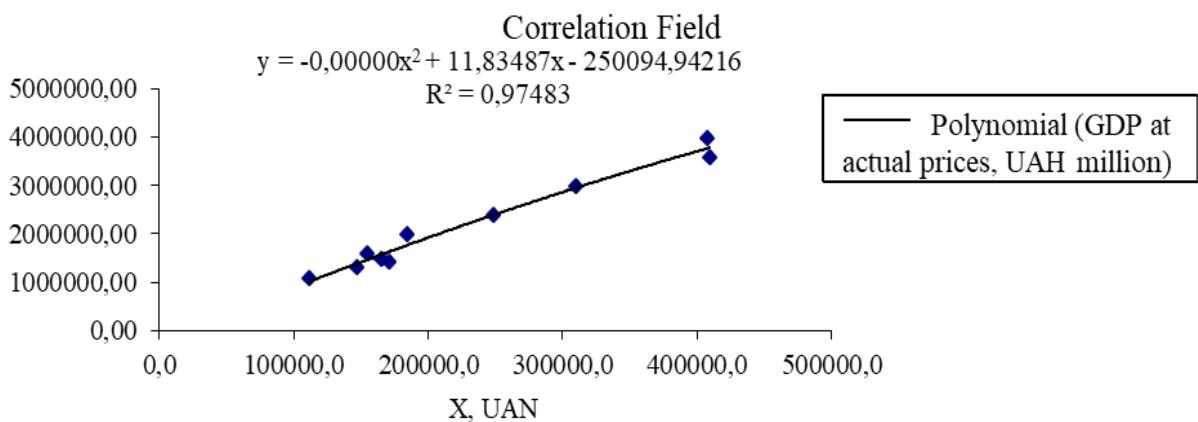
Fig. 2.3. Graphical representation of economic and mathematical modeling of the impact of capital investment from own funds of enterprises / organizations on GDP

Sums of statistical and estimated values of GDP in actual prices, UAH million differ only by 14% (21729072,0 and 24856263,93 million UAH)

196 Ekonomichna staty`sty`ky`. Nauka, texnologiyi ta innovaciyi [Economic Statistics. Science, Technology and Innovation]. Derzhavny`j komitet staty`sty`ky`. URL: http://www.ukrstat.gov.ua/.

and their dynamics coincide, which confirms the reliability and correctness of the selected equation, which describes the dependence. We analyze the compliance of the constructed model, in particular, check its adequacy to statistical data, using Fisher's criterion. To do this, calculate the calculated value of the criterion by the formula:

$$Fcalc. = \frac{R^2}{1-R^2} * \frac{n-m-1}{m}.$$

(1)

accordingly $F_{calculated} = 309{,}838697$

Since the inequality Fcalculated> Ftable (309,838697> 5,32), then with probability p = 0,95 we state that the constructed model is adequate to statistical data and is suitable for further analysis and forecasting.

Value of the correlation coefficient r [x; y] = 0,986608.

From the obtained value we make the following conclusion: since r [x; y]> 0, the relationship between X and Y is direct, with an increase in capital investment from own funds of enterprises / organizations, GDP in actual prices will increase, because 0,7 <| r [x; y] | <1, the relationship between X and Y is strong. Evaluate the effect of variation of factor X on the variation of Y, using the coefficient of determination, which is: $R^2 = 0{,}97483$, that is the variation of 97,48% due to variation of the factor.K el.av. = 1,125095915. Thus, with increasing dynamics of capital investment from own funds of enterprises / organizational 1%, GDP in actual prices will increase by 1,13%.

Analyzing figure 2.4 it should be noted that K el. av. is 0,549509506, with an increase in the level of capital investment from state and local budgets (CIb) in Ukraine 1%, GDP in actual prices will increase by 0,55%.
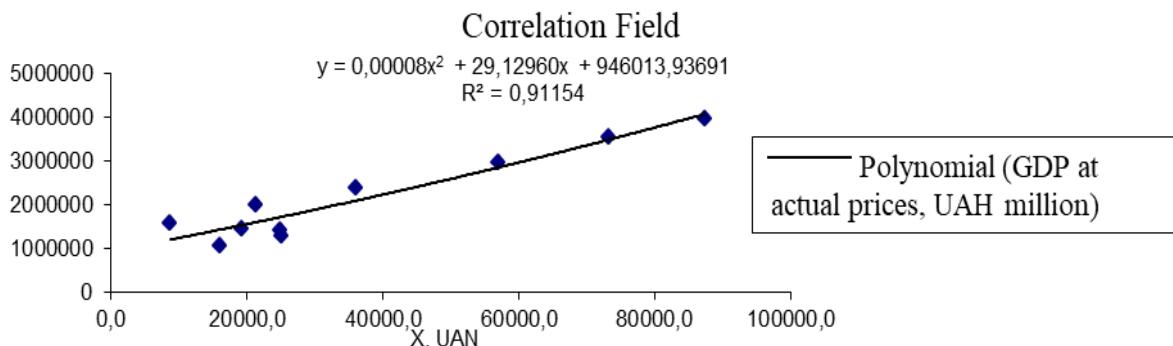
Fig. 2.4. Graphic representation of economic and mathematical modelling of the impact of the level of capital investment from the state and local budgets (CIb) of GDP

Fisher's calculation criterion is 22,252609, which is more than the tabular value and confirms the adequacy of the model, the coefficient of

determination $R^2 = 0,91154$, that is the variation of B (GDP at actual prices, UAH million) by 91,15% due to the variation of the factor CIb. The correlation coefficient r [x; y] = 0,953974431, that is the relationship between X and Y is straight and strong.

Under the current dynamics of globalization of the economy and the environment, the level of priority of intellectual capital is increasing, the effectiveness of which is directly related to the volume of research and development (Vrd).

Table 2.1 shows the results of economic and mathematical modelдing of the interdependence between GDP and the dynamics of spending on research and development, table 2- between GDP and the dynamics of expenditures on financing external research and acquisition of external knowledge in Ukraine for 2010-2019.

Table 2.1. The results of economic and mathematical modelling of the relationship between GDP and the dynamics of spending on research and development (Vrd) in Ukraine in 2010-2019

The equation that describes the relationship of GDP million UAH from the dynamics of research and development costs in Ukraine in 2010-2019	Coefficient of determination
$y = 1196,98771x - 191418,82880$	$R^2 = 0,90142$
$y = 2202564,58405\ln(x) - 14369467,90407$	$R^2 = 0,83540$
$y = 0,21177x^2 + 298,67818x + 632822,38182$	$R^2 = 0,91455$
$y = 966,43039x^{1,01513}$	$R^2 = 0,89917$
$y = 684727,37361e^{0,00054x}$	$R^2 = 0,91974$

As can be seen from Table 2.1, are characterized by a high level of coefficient of determination, which confirms the presence of the relationship and the correctness of the model. In addition, the correlation coefficient is 0,94943, that is the relationship between the factors is strong and direct.

As can be seen from Table 2.2, are characterized by a low level of coefficient of determination, which confirms the lack of connection and inadequacy of the model. Confirmation of this statement is also the low value of the calculated value of the Fisher coefficient: 1,169685 <5,32 (F table = 5,32).

Deepening the analysis in this area, it is advisable to build the equation of GDP dependence on a group of indicators that are financial determinants of the innovative component of increasing the country's competitiveness, the strong impact of which on Ukraine's GDP was determined by two-factor economic and mathematical modelling:

Table 2.2. The results of economic and mathematical modelling of the relationship between GDP and the dynamics of expenditures for financing external research and acquisition of external knowledge in Ukraine for 2010-2019

The equation that describes the relationship of GDP million UAH from the dynamics of costs for financing external research and acquisition of external knowledge in Ukraine for 2010-2019	Coefficient of determination
$y = 2068{,}39017x + 1287760{,}30878$	$R^2 = 0{,}07552$
$y = 746464{,}96097\ln(x) - 2313605{,}01296$	$R^2 = 0{,}06058$
$y = 23{,}76399x^2 - 18016{,}12394x + 5140630{,}07983$	$R^2 = 0{,}12756$
$y = 369772{,}07694x^{0{,}27903}$	$R^2 = 0{,}04289$
$y = 1412840{,}38876e^{0{,}00079x}$	$R^2 = 0{,}05534$

volumes of capital investments from own funds of enterprises / organizations (CIofe)(X1), level of capital investments from state and local budgets (CIb) (X2), volumes of expenses for research and development (Vrd) (X3).The results of using the software product Excel – DataAnalysis - Regression are shown in Figure 2.5. The equation of the interdependence of GDP on selected indicators is characterized by the following content:
$$Y = 102460{,}3717 + 2{,}443737422*X1 + 13{,}98692402*X2 + 501{,}3976276*X3$$

SUMMARY OUTPUT

RegressionStatistics	
Multiple R	0,992236864
R Square	0,984533994
Adjusted R Square	0,976800992
Standard Error	154836,1311
Observations	10

ANOVA

	df	SS	MS	F	Significance F
Regression	3	9,1569E+12	3,0523E+12	127,3158721	8,04542E-06
Residual	6	1,43845E+11	23974227484		
Total	9	9,30074E+12			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%
Intercept	102460,3717	187572,4592	0,54624422	0,60459946	-356512,9017
X Variable 1	2,443737422	3,907167561	0,625449865	0,554703722	-7,116757188
X Variable 2	13,98692402	10,7809361	1,297375654	0,242149303	-12,39307629
X Variable 3	501,3976276	241,9453082	2,072359374	0,083614024	-90,62121442

Fig. 2.5. The results of regression analysis of the multifactor model

The most significant impact on the resulting indicator have such independent variables as capital investment from state and local budgets and research and development costs. It is quite logical to conclude that the growth of such indicators will characterize the innovation of the economy and its competitiveness.Method of extrapolation according to the current trend predicts a moderate increase in independent factors, including capital investment from own funds of enterprises and organizations will increase by 24,08%, capital investment from state and local budgets by 28,42%, research costs and developed 22,76% for the analyzed period.

Predicting independent indicators using the method of extrapolation, we can determine GDP growth over the next 4 years (table 2.3).

Table 2.3. GDP forecasting based on a multifactor model

Predictivedependent and independent variable equations	2020	2021	2022	2023	Absolute changes	Relative changes, %
Capital investments from own funds of enterprises and organizations, UAH million	413802,7	447010,8	480219,0	513427,2	99624,5273	24,08
Capital investments from state and local budgets, UAH million	76899,4	84184,1	91468,9	98753,6	21854,2927	28,42
Research and development costs, UAH million	3389,9	3647,2	3904,4	4161,6	771,66	22,76
Estimated GDP in actual prices, UAH million	4023664,6	4335677,6	4647690,6	4959703,6	936039,0	23,26

Subject to compliance with the projected values of the financial determinants of the innovative component of increasing the country's competitiveness, the volume of estimated GDP in actual prices for the forecast period will increase by 936039,0 million UAH or 23,26%.

Thus, to achieve the maximum positive synergetic effect in the innovation sphere, the activities of entities should be based on the growth of investment in innovation in proportion to the volume of innovative products, which should be directed primarily to the first stage of the innovation process - research and development.

One of the reasons for the low level of the state of the innovation sphere in the domestic economy is the underdevelopment of the market of

innovative products due to low rates of development of integration processes in it. The formation of market relations in this sector is complicated by difficulties associated, on the one hand, with the specifics of scientific and technical products as a commodity and, on the other hand, the weakness of relations that determine the innovative nature of economic development.

Analysis of foreign experience in conducting scientific, technical and innovation policy [9-10], as well as the commercialization of innovations, revealed the following: high-tech industrial complex is seen as a generator of scientific, technical and innovative development, as a growth point of the national economy; the level of innovation activity in the country directly depends on the participation and support of the state; creation and development of innovation infrastructure in the form of a network of technology parks, clusters, business incubators, etc .; increasing the level of motivation of participants in innovation and the role of intellectual capital in the innovation sphere; shifting the emphasis to the project approach to innovation management, taking into account the economic efficiency of innovative developments; institutional support of innovation activity; accelerating innovation processes and expanding the boundaries of their implementation through the active use of information and communication technologies; active use in innovation activities and management of innovation processes of methods of benchmarking, technical and economic analysis and controlling [197; 198, p. 30-31; 199, p. 17-21; 200].

The model of innovative development of Ukraine can be better described as a «supply model», which provides for such phases as: research, pilot production, industrial production and marketing. However, as the analysis of successful innovation economies has shown, the innovation process does not begin with research, but with a preliminary assessment of the potential of innovation. This is a model of «demand attraction», which includes a number of stages: studying the prospects for growth and

[197] Androshhuk G.O. Ocinka rivnya innovacijnogo rozvy`tku nacional`ny`h ekonomik [Assessment of the level of innovative development of national economies]. *Nauka, texnologiyi, innovaciyi.* 2017, # 3. URL: http://dspace.nbuv.gov.ua/bitstream/handle/123456789/150773/04-Androshchuk.pdf?sequence=1.

[198] Py`ly`p'yuk Ya.V. Shlyaxy` pidvy`shhennya efekty`vnosti finansovogo zabezpechennya innovacijnogo rozvy`tku v Ukrayini [Ways to increase the efficiency of financial support for innovative development in Ukraine]. «Ekonomika v konteksti innovacijnogo rozvy`tku: stan ta perspekty`vy`». Mizhnarodna nauk.-prakt. konf. (lyuty`j 2016 r., m. Uzhgorod). Uzhgorod, 2016. S. 29–31.

[199] Badri G., Panchenko Ye., Ruduxa N. Global`ni determinanty` i modeli finansuvannya innovacij [Global determinants and models of innovation financing]. Mizhnarodna ekonomichna polity`ka. 2018. # 1 (28). S. 7–31.

[200] Hajek P., Henriques R. Modelling innovation performance of European regions using multi-output neural networks. 2017. URL: PLoS ONE 12(10): e0185755. URL: https://doi.org/10.1371/journal.pone.0185755.

development for business, preliminary analysis of the market and the possibility of finding a market niche, or forming a new market, investment evaluation, preliminary feasibility study, marketing research, testing product within the organization, product development, preparation of technical and economic and design documentation (only at this step research work begins), product testing in the market, experimental production, preliminary business analysis of the product and production before the main production, production start, market introduction.

Another important problem of the domestic economy is the weak motivation of the industrial sector in innovative development. The supply of technological innovations created by national industrial companies and research institutions is limited in the domestic market. The reasons for this situation are: high cost of development and implementation, high interest rates on the investment portfolio, long payback period, the focus of financial institutions on the issuance of «short loans», usually consumer loans to the detriment of technological renewal of industrial sectors.

A whole set of measures is needed to resolve such contradictions. The main system-forming factors of this complex:

- creation of new organizational structures - networks, clusters, integrated corporations, including scientific, educational institutions and industrial enterprises, which combine innovation potential, resources, personnel, knowledge, information and competencies to create and transfer technologies;

- involvement of private financial institutions, marketing agencies, investment, brokerage companies, banks in the process of integration of scientific, educational and industrial sectors for innovative development. Comprehensive investment, marketing and management support of commercialization and technology transfer projects is required;

- creation of effective tools and mechanisms for managing the integration processes of innovation networks [201, p. 79; 202, p. 345-347].

Ukraine needs to advance in the development of the market of technology transfer and commercialization of innovations in order to

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[201] Baula O., Galaziuk N., Zelinska O. Conceptual framework for organizational and economic mechanism formation to increase the region competitiveness with the globalization of the world economic relations. *Markety`ng i menedzhment innovacij.* №2. 2017. P. 76-84.

[202] Bogatyrov O., Baula O., Liutak O., Galaziuk N. Conceptual Foundations of Financial Support for Increasing the Innovative Component of Ukraine's International Competitiveness. *Finansovo-kredy`tna diyal`nist`: problemy` teoriyi ta prakty`ky`. Universy`tet bankivs`koyi spravy.* 1 (36) (2021). P. 341-350.

increase the level of its competitiveness: to form a database of scientific, technical, innovative projects; to establish the process of selection of innovative projects for state funding; develop a network of regional technology parks, business incubators, transfer support centers and technology commercialization. The concept of organizational and financial support for the effectiveness of the innovative component of Ukraine's competitiveness should be based on strategic, tactical and operational levels. To ensure a sustainable level of competitiveness of the country by increasing the innovation of the economy, it is advisable to introduce a set of measures to monitor threats at the stage of their emergence. That is why, among the tools for implementing the concept of organizational and financial support for the effectiveness of the innovation component of Ukraine's competitiveness should be: economic mechanisms (direct budget investments; concessional lending; integration with foreign institutions to finance innovation; increase the share of GDP aimed at financing innovation processes; an effective set of measures to attract international grants and household savings as investments to implement the concept of innovative development of the country's economy, etc.); organizational mechanisms (formation of integration clusters using the potential of education, business, government, public; state support for innovation infrastructure, etc.).

2.2. Factor signaling the components of Ukraine's international competitiveness

Assessing the quality of the innovation and investment component of international competitiveness in the implementation of Ukraine's European integration course, it is advisable to focus on the most important factors of its formation and provision. In our opinion, it is expedient to single out Ukraine's participation in international labor migration processes and the quality of information and communication technologies among them.

Modern global socio-economic transformations contribute to the fact that the quality of the country's participation in international migration processes is an important component of its competitiveness.

Globalization is in fact the root cause of the growth of external labor migration and provokes an even greater lag of less developed countries from the leading states.

The highly developed countries of the world are centers of attraction for a large number of migrants, who thus seek better conditions for self-realization. At the same time, the consumer attitude of migrants to recipient countries is increasing, when migrants, regardless of the level of professional training, claim a significant increase in their standard of living only because they live or stay in one of the economically developed countries.

The most massive and significant for Ukraine migration flow is the labor migration of citizens abroad, as among the labor emigrants the lion's share falls on highly qualified professionals and young people. Since 2014, there has been an intensification of migration processes through environmental protection in eastern Ukraine. The scale of external labor migration in the country could be clearly seen in early 2020, when as a result of the COVID-19 pandemic and the declaration of quarantine, thousands of Ukrainians returned en masse from abroad and after easing quarantine restrictions also went abroad en masse for employment.

Ukraine is traditionally considered one of the largest exporters of labor to Central and Western Europe. Labor migration in Ukraine is commonplace and commonplace. The reasons for such trends are disappointing: low wages compared to other countries, high unemployment, sharp stratification of the population, etc. In addition, the consequences are no less attractive: increased fiscal burden; the problem of financing the Pension Fund; inefficient use of funds for the education of citizens working to create prosperity in other countries; brain drain; reducing the level of investment attractiveness and competitiveness of the country on the world market; impossibility of generating economic growth, etc.

Problems of studying the level of national competitiveness are reflected in many scientific publications. This is due to the increasing role of economic innovation, the state's strategy to reach the appropriate level in the world market. Fundamental research devoted to the study of these issues is

reflected in the works of scientists - L.Antonyuk [203], I.Bagrova [204], V.Geyets [205], N.Grazhevskaya [206], V.Dergacheva [207], A.Poruchnyk [208], L.Fedulova [209], O.Shvydanenko [210] and others.

Comprehensive analysis of the domestic migration situation, research of theoretical and applied problematic aspects of labor migration, assessment of the impact of migration on demographic and socio-economic development of the country is reflected in the works of economists: L.Boyko [211], V.Kyfyak, M.Vasilychuk, D.Skriblyak [212], E.Libanova [213], Y.Litkovets [214], O.Malynovskaya [215], M.Ruhs, K.Tamas, J.Palme [216], Y.Kozak, D.Lukyanenko, Y.Makogon [217], U.Sadova [218] and others. These scientists have established the essence, causes of migration, identified its dependence on the characteristics of socio-economic development of

[203] Antonyuk L.L. Mizhnarodna konkurentospromozhnist` krayin: teoriya ta mexanizm realizaciyi [International competitiveness of countries: theory and implementation mechanism]: monografiya. Ky`yiv, 2004. 273 p.

[204] Bagrova I. V., Nefedova O. G. Skladovi ta faktory` konkurentospromozhnosti [Components and factors of competitiveness]. *Visny`k ekonomichnoyi nauky` Ukrayiny`*. 2007. #1. P. 11 — 16.

[205] Geyecz V. M. Problemnost` strukturnyh transformacy`j ekonomy`ky` stran s razvy`vayushhy`my`sya rynkamy` [Problems of structural transformations of the economy of countries with emerging markets]. *Ekonomika ta prognozuvannya.* 2009. # 1. P. 54 — 69.

[206] Grazhevskaya N. Obespecheny`e konkurentosposobnosty` nacy`onal`noj ekonomy`ky` v global`nom posty`ndustry`al`nom y`zmereny`y` [Ensuring the competitiveness of the national economy in the global post-industrial dimension]. *Ekonomika Ukrayiny`*. 2008. # 9. P. 54 — 63.

[207] Dergachova V. V. Mizhnarodna konkurentospromozhnist` nacional`noyi ekonomiky` v konteksti zabezpechennya ekonomichnogo zrostannya [International competitiveness of the national economy in the context of economic growth]: monografiya. Donecz`k : DonDUET, 2006. 392 p.

[208] Poruchny`k A. M., Bry`kova I. V. Regional`na innovacijna sy`stema yak osnova pidvy`shhennya mizhnarodnogo konkurentnogo statusu nacional`ny`h regioniv [Regional innovation system as a basis for increasing the international competitive status of national regions]. Mizhnarodna ekonomichna polity`ka. 2006. Vy`p. 5. P. 134 — 173.

[209] Fedulova L. I. Ukrayina v mizhnarodny`x rejty`ngovy`h ocinkah: chy`nny`k innovacijno-texnologichnogo rozvy`tku [Ukraine in international ratings: a factor of innovation and technological development]. Aktual`ni problemy` ekonomiky`. 2009. # 5. P. 39 — 53.

[210] Shvy`danenko O. A. Global`na konkurentospromozhnist`: teorety`chni i pry`kladni aspekty` [Global competitiveness: theoretical and applied aspects] : monografiya. K. : KNEU, 2007. 307 p.

[211] Bojko L. Cina migrantiv dlya suchasnoyi ekonomiky` Ukrayiny` [The price of migrants for the modern economy of Ukraine]. *STATY`STY`KA.* 2018. URL: https://mi100.info/2018/05/26/tsina–migrantiv–dlya–suchasnoyi–ekonomiky–ukrayiny–statystyka/.

[212] Ky`fyak V.I., Vasy`ly`chuk M.I., Shkriblyak D.Yu. Problema trudovoyi migraciyi v Ukrayini ta shlyahy` vy`rishennya [The problem of labor migration in Ukraine and ways to solve it]. Demografiya, ekonomika praci, social`na ekonomika i polity`ka. 2019. Vy`pusk 37. P. 169-170.

[213] Libanova E.M. Zovnishnya trudova migraciya ukrayinciv: masshtaby`, pry`chy`ny`, naslidky` [External labor migration of Ukrainians: scale, causes, consequences]. Demografiya ta social`na ekonomika. 2018. # 2 (33). P. 11—26.

[214] Litkovecz` Yu.O. Zovnishnya trudova migraciya ta yiyi naslidky` dlya ukrayins`koyi ekonomiky` [External labor migration and its consequences for the Ukrainian economy]. Ekonomika ta upravlinnya nacional`ny`m gospodarstvom. 2019. Vy`pusk 31. P.131- 136.

[215] Maly`novs`ka O.A. Migracijna polity`ka: global`ny`j kontekst ta ukrayins`ki realiyi [Migration policy: global context and Ukrainian realities]: monografiya. Ky`yiv: NISD, 2018. 472 p.

[216] Martin Ruhs, Kristof Tamas, and Joakim Palme. (2019). Bridging the Gaps Linking Research to Public Debates and Policy Making on Migration and Integration. URL : https://global.oup.com/academic/product/bridging-the-gaps-9780198834557?lang=en&cc=eg (дата звернення: 21.10.2020).

[217] Mizhnarodna migraciya robochoyi sy`ly [International labor migration]. [Yu.G. Kozak, D.G. Luk'yanenko, Yu.V. Makogon ta in.]. Centr uchbovoyi literatury`. 2009. URL: https://subject.com.ua/pdf/199.pdf.

[218] Ukrayins`ka migraciya v umovah global`ny`h i nacional`ny`h vy`kly`kiv XXI stolittya [Ukrainian migration in the context of global and national challenges of the XXI century]: naukove vy`dannya / nauk. red. U.Ya. Sadova. Lviv, 2019.110 p.

society, identified areas and drivers of labor emigration. However, the question of the relationship between external labor migration of the domestic population and the effectiveness of the country's innovation policy is not properly reflected in the works of scientists and requires detailed consideration and analysis.

Global socio-economic transformations in themselves, as well as their deepening, have led to labor migration becoming an integral feature of the modern world economy. In the general structure of migrants from Ukraine, it is predominant and mass. In fig. 2.6 presents the average indicators of the structure of migrants from Ukraine for the purpose of staying abroad for 2017 - 2019. As can be seen, more than 80% of domestic emigrants are workers looking for work abroad. Historically, Ukraine has been a donor country in world labor migration flows.
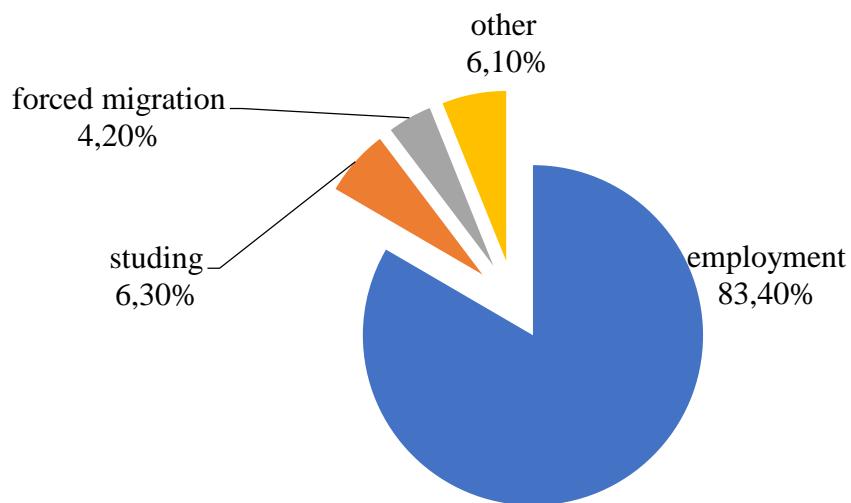
Fig. 2.6. Structure of migration flows of Ukrainians for emigration, 2017-2019

Course: created based on [219; 220].

Regarding the geographical structure of labor migration, since 2001 there has been an increase in the number of labor migrants from Ukraine to EU countries (Fig. 2.7).

[219] MOM v faktax y` cy`frah [IOM in facts and figures]. URL: http://moscow.iom.int/russian/documents/facts_figures_ru.pdf.

[220] Migraciya v Ukrayini. Cy`fry` i fakty` [Migration in Ukraine. Facts and figures]. 2019. URL: https://iom.org.ua/sites/default/files/iom-ukraine_facts-ukr_2019.pdf.
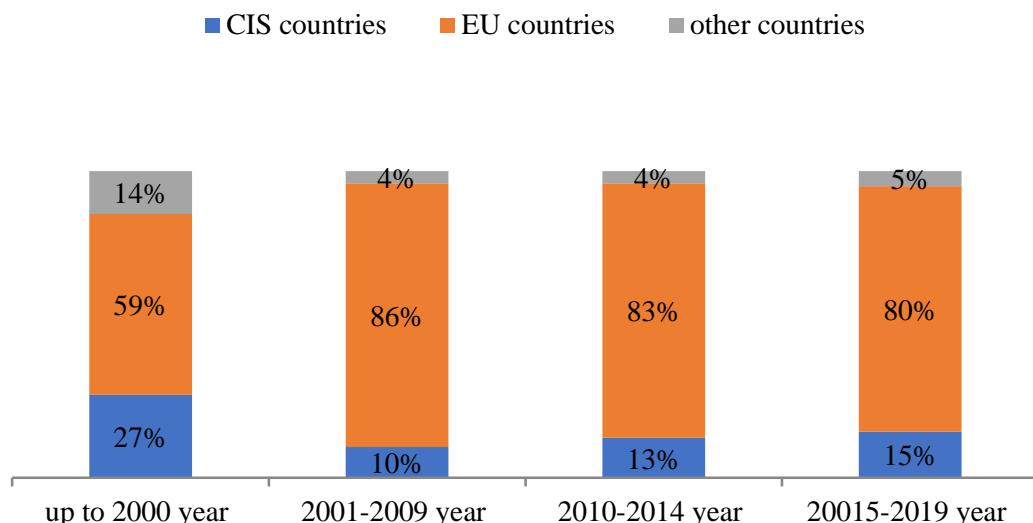
Fig. 2.7. Geographical structure of long-term labor emigration
of Ukrainians

Course: created based on [221].

The main sectors of employment of Ukrainian workers are construction,
restaurant and hotel business, agriculture and work at home (Fig. 2.8).
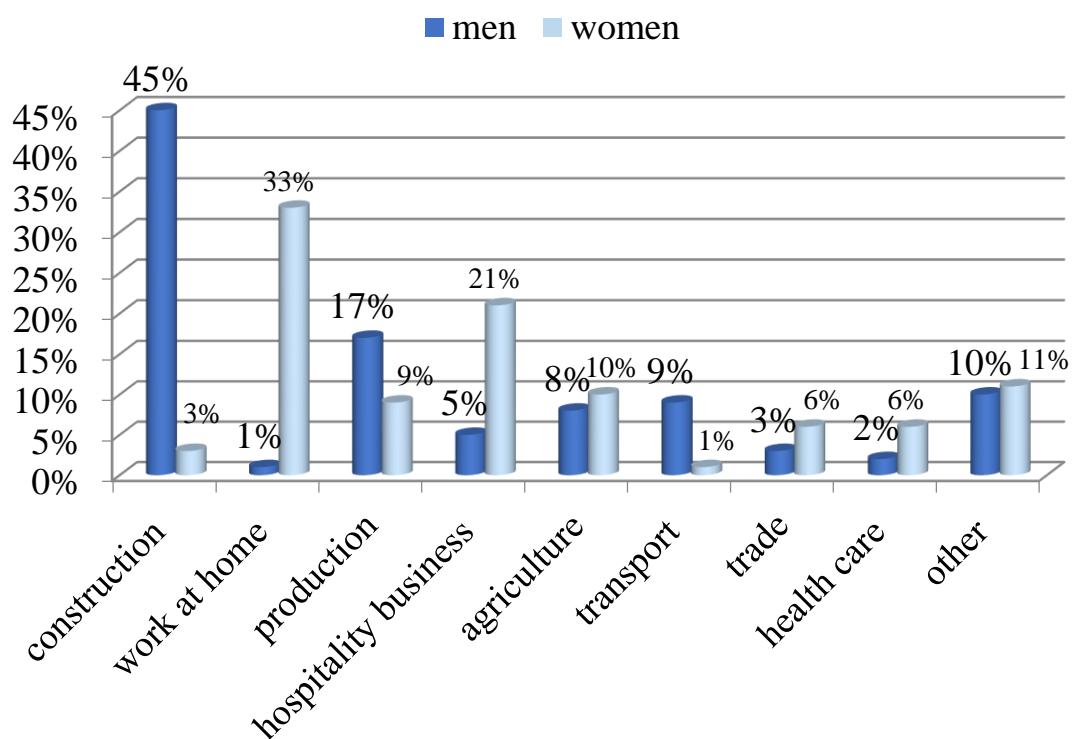
Fig. 2.8. Sectoral and gender employment of Ukrainian emigrants, 2019
Course: created based on [222; 223].

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221 Migraciya v Ukrayini. Cy`fry` i fakty` [Migration in Ukraine. Facts and figures]. 2019. URL:
https://iom.org.ua/sites/default/files/iom-ukraine_facts-ukr_2019.pdf.

222 Migraciya v Ukrayini. Cy`fry` i fakty` [Migration in Ukraine. Facts and figures]. 2019. URL:
https://iom.org.ua/sites/default/files/iom-ukraine_facts-ukr_2019.pdf.

223 World Migration Report 2020. URL: https://publications.iom.int/books/world-migration-report-2020.

According to IOM estimates in 2019, Ukrainian migrants in long-term labor migration predominate in the age group of 30-44 years, and Ukrainian migrants - in the category of 45-65 years. In the age group 18-29 years, the number of men / women is more balanced (17% / 22%). In general, the majority of short- and early-term labor migrants are between the ages of 18 and 44 [224; 225].

The status of Ukrainians - migrant workers abroad is not always legal (Fig. 2.9).
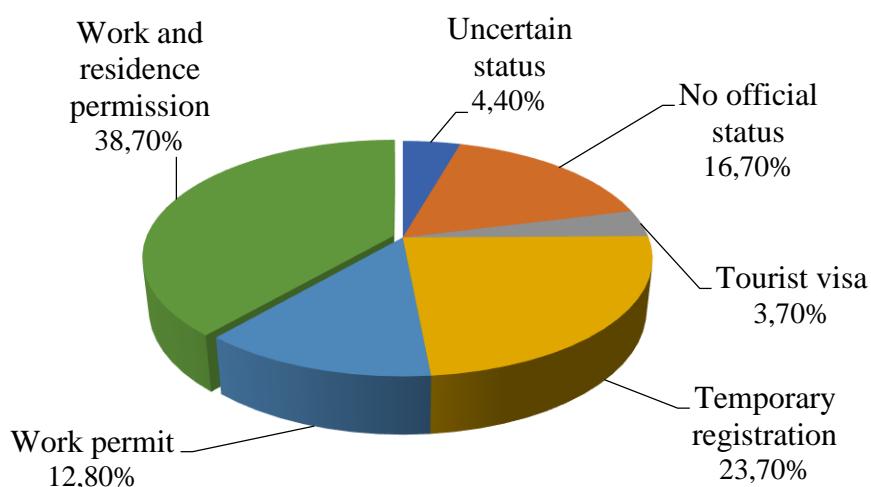
Fig. 2.9. Status of Ukrainian labor migrants abroad in 2015-2019
Course: created based on [226; 227].

External labor migration is not a new phenomenon for Ukraine. Ever since the proclamation of independence, Ukrainians have been attracted abroad. And there are logical explanations for these processes.

First of all, the primary reason for the labor migration of Ukrainians is the fact that countries with a higher level of welfare and wages are located around Ukraine. Evidence of this can be a comparison of the size of the minimum wage in Ukraine and the main countries of attraction of Ukrainian migrant workers.

224 World Migration Report 2020. URL: https://publications.iom.int/books/world-migration-report-2020.
225 World Migration Report 2020. URL: https://publications.iom.int/books/world-migration-report-2020.
226 Migraciya v Ukrayini. Cy`fry` i fakty` [Migration in Ukraine. Facts and figures]. 2019. URL: https://iom.org.ua/sites/default/files/iom-ukraine_facts-ukr_2019.pdf.
227 World Migration Report 2020. URL: https://publications.iom.int/books/world-migration-report-2020.

Table 2.4 shows the size of the minimum wage and the cost of basic foodstuffs in Ukraine and the main countries of attraction of domestic labor migrants at the beginning of 2020.

Countries that offer higher wages, countries that have better economic dynamics attract labor. This is a natural process that cannot be stopped in a globalized world, but can be curbed if effective economic policies are pursued to increase the well-being of the country's citizens.

In addition to the low level of the minimum wage, the average salary in Ukraine is also one of the lowest in Europe (in December 2020 it amounted to UAH 14,179 or approximately USD 480) [228].

Table 2.4. The minimum wage and basic food costs in Ukraine and the countries with the largest number of Ukrainian labor migrants at the beginning of 2020

Country (% of labor migrants from Ukraine)	The amount of the minimum wage as of the beginning of 2020, USD US (after taxes)	% change in the minimum wage compared to 2019	The cost of basic food as of the beginning 2020,% of the ratio with the minimum wage
Ukraine	157	+13,2	42,1
Poland (38,9)	485	+14,9	15,5
Russia (26,3)	166	+6,5	44,8
Italy (11,3)	1320*	+3,2	14,8
Czech Republic (9,4)	525	+7,6	18,3
Portugal (1,6)	626	+5,8	15,5
Hungary (1,3)	357	+8,1	21,8
Spain (0,9)	1163	-	9,2
Germany (0,8)	1358	+1,9	9,3

There is no minimum wage in Italy. The average salary for low-skilled work at the beginning of 2020 was at the level of 1320 dollars. USA

Course: created based on [229; 230].

There is also a high level of wage differentiation by type of economic activity and by region. Despite the fact that inflation processes have relatively stabilized in Ukraine (inflation index in 2015 was 43.3%, in 2018 - 9.8%, in 2019 - 4.3%), nominal income growth in part offset by rising prices.

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[228] Serednya zarplata v Ukrayini [The average salary in Ukraine]. URL: https://index.minfin.com.ua/ua/labour/salary/average/.

[229] Derzhavna sluzhba staty`sty`ky` Ukrayiny`. Migracijny`j rux naselennya [State Statistics Service of Ukraine. Migration movement of the population]. URL: http://www.ukrstat.gov.ua/.

[230] Minimal`na zarobitna plata v sviti ta Ukrayini (doslidzhennya) [Minimum wage in the world and in Ukraine (research)]. URL: https://news.finance.ua/ua/news/-/463322/u-yakyh-krayinah-minimalka-zrosla-na-25-i-bilshe-doslidzhennya.

According to Vice Speaker Olena Kondratyuk, «studies by international organizations have shown that the poverty rate in Ukraine in 2020 has risen to 50%» [231].

Also among the reasons for high rates of labor migration of Ukrainians are the reduction and aging of the population in the EU, the presence of hidden unemployment in Ukraine, the problem of youth employment after education, the lack of specific measures in Ukraine to repatriate Ukrainians and, instead, the presence of such measures in foreign countries. , political instability in Ukraine, a hybrid war with Russia. The signing of the Association Agreement between Ukraine and the European Union also contributes to increasing the number of migrant workers, in particular by simplifying the visa regime and promoting population mobility [232].

Labor migration of the country's citizens abroad has a diverse impact on the country's economy:

- reduces tensions in the labor market, promotes the well-being of many families, is a source of foreign exchange earnings and intangible transfers of new knowledge and experience that can contribute to the development of the state, there is a stabilization of the national currency;

- causes a shortage of workers in some industries and regions, negatively affects family relationships, raising children, birth rates; migrant earnings, aimed at consumption, provoke rising prices, inflation, rising imports.

So, if we focus only on economic factors, on the one hand, labor migration provides foreign exchange earnings from abroad, and on the other hand there is a loss of value added in the country.

Remittances from migrant workers really make it possible to reduce poverty in the country, increase current consumption by relatives at home, etc. According to the NBU, workers transferred $ 12.1 billion to Ukraine in 2020. US dollars, which compared to 2019 increased by 0.2 billion dollars. USA (and this does not take into account the transfer of funds through informal channels - drivers, friends, etc.) [233]. These numbers are much

231 Ponad 19 mil`joniv ukrayinciv za mezheyu bidnosti – vicespikerka [More than 19 million Ukrainians below the poverty line are vice-speakers]. URL: https://www.ukrinform.ua/rubric-society/3181895-ponad-19-miljoniv-ukrainciv-za-mezeu-bidnosti-vicespikerka.html.

232 Lejs A. Mizhnarodna trudova migraciya ukrayinciv do krayin Yevropejs`kogo soyuzu: faktory` vply`vu [International labor migration of Ukrainians to the countries of the European Union: factors of influence]. URL: https://pandia.ru/text/ 80/096/10642.php.

233 Zarobitchany` use bil`she groshej perekazuyut` do Ukrayiny`: yaka suma nadijshla torik [Workers are transferring more and more money to Ukraine: what amount was received last year]. URL:

higher than the foreign investment in Ukraine's economy. Thus, in 2015, Ukraine received $ 4.3 billion. US direct investment, in 2016 - 4.4 billion dollars USD, in 2017 - 2.5 billion dollars USD, in 2018 - 2.9 billion dollars. USD, and in 2019 - 2.5 billion dollars USA [234].

According to experts, to ensure 5-7% of GDP growth, Ukraine needs an additional 5 million workers and about 2-3 million small entrepreneurs. In addition, expert calculations show that while maintaining the current trend of labor migration of Ukrainians abroad, as well as given the demographic situation in Ukraine, in 2025 we can expect a complete collapse of the social security system - one working Ukrainian will have three retirees [235].

Therefore, if you choose between currency transfers of workers and the creation of appropriate conditions for their return home, the obvious correct solution would be the second option. Cash inflows have a short-term effect that fails to ensure sustainable economic development of the country, and creating conditions for the return of migrant workers will stabilize the labor market, create added value on a much larger scale and, as a result, increase competitiveness, investment attractiveness, innovation of the national economy. achieving indicators of the average European level of well-being of citizens.

At present, according to experts, a new wave of labor migration is gaining alarming proportions in Ukraine, which includes well-educated young people who see migration not as an economic process but as a way of life [236, p.8].

It is possible to understand the reasons of this phenomenon at studying of rating places of Ukraine in the international ratings: economic freedom (Index of Economic Freedom), ease of doing business (Doing Business / Ease of Doing Business), the safest countries (Index The Global Peace Index), global competitiveness (The Global Competitiveness Index), the

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https://tsn.ua/groshi/zarobitchani-use-bilshe-groshey-perekazuyut-do-ukrayini-yaka-suma-nadiyshla-torik-1717420.html.

[234] Pryami inozemni investy`ciyi v Ukrayini: dy`namika 2015-2019 rokiv [Foreign direct investment in Ukraine: the dynamics of 2015-2019]. URL: http://dia.dp.gov.ua/pryami-inozemni-investici%D1%97-v-ukra%D1%97ni-dinamika-2015-2019-rokiv

[235] Povernennya trudovy`h migrantiv: shho ne tak roby`t` derzhava [Return of migrant workers: what the state is doing wrong]. URL: https://www.slovoidilo.ua/2019/10/18/kolonka/aleksandr-radchuk/suspilstvo/povernennya-trudovyx-mihrantiv-ne-tak-robyt-derzhava.

[236] Ukrayins`ka migraciya v umovah global`ny`h i nacional`ny`h vy`kly`kiv XXI stolittya [Ukrainian migration in the context of global and national challenges of the XXI century]: naukove vy`dannya / nauk. red. U.Ya. Sadova. L`viv, 2019. 110 s.

index of investment attractiveness, the Global Index of Innovation (GII) (table 2.5).

Table 2.5. Ukraine in international rankings that reflect the quality of life and level of economic development

Years	Ranking of economic freedom [237]*	Ranking of ease of doing business [238]**	International Index of the Safest Countries (Global Peace Index) [239]***	Global Competitiveness Index [240, 241]****	Index of Investment Attractiveness of Ukraine [242] *****	Global Innovation Index [243]******
2010	46,4	147	97	82	3,28	61
2011	45,8	145	69	89	2,56	60
2012	46,1	152	71	82	2,12	63
2013	46,3	137	111	73	1,81	71
2014	49,3	112	141	84	2,50	63
2015	46,9	96	150	77	2,57	64
2016	46,8	83	156	79	2,85	56
2017	48,1	80	154	85	3,03	50
2018	51,9	76	152	81	3,10	43
2019	52,3	71	149	83	2,90	47
2020	54,9	64	148	85	2,46	45

* The index of Economic Freedom is based on 10 indices, which are evaluated on a scale from 0 to 100, and the indicator 100 corresponds to the maximum freedom.
** The ranking of Ease of Doing Business determines the country's place among 190 countries.
*** The International Index of the Safest Countries ranks among 163 countries.
**** The Global Competitiveness Index ranks among an average of 140 countries.
***** Investment Attractiveness Index: maximum value 5.0; a value of 4.0-5.0 means a positive attitude of investors; values in the range of 3.0-4.0 means a neutral attitude of investors; value less than 3.0 - a negative attitude of investors.
****** The Global Innovation Index (GII) provides detailed indicators of the effectiveness of innovation in 131 countries and economies around the world, indicated in points from 0 to 100. The table shows the place of Ukraine among the evaluated countries.

[237] Ukray`na — y`ndeks ekonomicheskoj svobody [Ukraine is an index of economic freedom]. Knoema. URL: https://knoema.ru/atlas/Ukray`na/Y`ndeks-эkonomy`cheskoj-svoboды?_ga=2.155881272.204584354.1551111127-477900222.1517845736.

[238] The Doing Business Report. The World Bank. URL: http://russian.doingbusiness.org/ru/rankings.

[239] Ukraine - Global peace index. URL: https://knoema.com/atlas/Ukraine/topics/World-Rankings/World-Rankings/Global-peace-index.

[240] Pozy`ciya Ukrayiny` v rejty`ngu krayin svitu za Indeksom global`noyi konkurentospromozhnosti 2017—2018 [Ukraine's position in the ranking of countries according to the Global Competitiveness Index 2017-2018]. Ekonomichny`j dy`skusijny`j klub. URL: http://edclub.com.ua/analityka/pozyciya-ukrayiny-v-reytyngu-krayin-svitu-za-indeksom-globalnoyi -konkurentospromozhnosti-2.

[241] World. Economic Forum. URL: https://www.doingbusiness.org/en/rankings.

[242] Indeks investy`cijnoyi pry`vably`vosti Ukrayiny` [Index of investment attractiveness of Ukraine]. URL: https://eba.com.ua/wp-content/uploads/2020/12/EBA-InvestIndex_2H-2020.pdf.

[243] The Global Innovation Index. URL: https://www.wipo.int/publications/en/details.jsp?id=247.

Assessing Ukraine's place in international rankings that reflect the quality of life and level of economic development, the reasons for significant volumes of labor migration from the country become obvious: the level of economic freedom is growing, but is assessed at a mediocre level; ease of doing business has significantly improved during the study period, but its level is far from the level of developed countries; according to the international index of the safest countries for life, as of 2020 Ukraine is on the 148th place with 163 positions (this is one of the worst indicators in the world); rating positions of Ukraine according to the global competitiveness index for 2010-2020. in fact have not changed and as of 2020. 85th place out of 140 countries; Ukraine's investment attractiveness index is in the negative (as of the end of 2020, 78% of CEOs of member companies of the European Business Association consider the current investment climate unfavorable, and this figure has increased significantly since the beginning of the year - by 16%. Another 16% of respondents believe the current investment. Only 6% of respondents consider the investment climate favorable, compared to 4% in the first half of 2020).

According to an annual survey of foreign investors conducted by the European Business Association, Dragon Capital and the Center for Economic Strategies, it was named «Top 10 Barriers to Foreign Investment in Ukraine»: widespread corruption, distrust of the judiciary, volatile monetary and financial system, market monopolization and seizure of power by oligarchs, military conflict with Russia, burdensome and changing legislation, repressive actions of law enforcement agencies, restrictions on capital movements and foreign exchange transactions, complex tax administration, revival of labor migration [244; 245].

From the considered rating indicators, only the values of the Global Innovation Index inspire hope: according to 2020. 45th place out of 131. According to a number of individual sub-indices, Ukraine in 2020 is in higher positions - the development of higher education 32nd place, knowledge formation and online creativity 39th place, research and development 44th place, trade, competition and market scale 45th place. In addition to these indicators, Ukraine's position on the export of information and communication technology services (11th place), the coverage of the

[244] Doslidzhennya: korupciya, nedovira do sudiv ta finansovoyi sy`stemy` – osnovni gal`ma dlya investy`cij [Research: Corruption, distrust of the courts and the financial system are the main obstacles to investment]. Radio svoboda. URL: https://www.radiosvoboda.org/a/news-opytuvannia-investoriv/29496035.html.

[245] Lyutak O.M., Baula O.V. Organizacijno-insty`tucijni napryamy` opty`mizaciyi pozy`cij Ukrayiny` v mizhnarodnij investy`cijnij diyal`nosti [Organizational and institutional directions of optimizing Ukraine's position in international investment activities]. *Mizhnarodna ekonomichna polity`ka.* KNEU, #2 (31). 2019. S.147-165. DOI 10.33111/iep.2019.31.06.

population with higher education (14th place), gross domestic expenditures on research and development funded abroad (15th place), patent applications are worthy, intangible assets and the creation of new knowledge (17th place), the cost of computer software, the creation of mobile applications (19th place), ease of obtaining credit (29th place), competition and market scale (42nd place), ease of starting a business), electricity generation (55th place) [246].

Given the obvious competitive advantages of Ukraine in the field of innovation, in our opinion, they have the potential to best adjust labor migration from Ukraine.

Summarizing the causes and preconditions of migration processes in Ukraine, we will form a conceptual scheme for optimizing labor migration flows from Ukraine (Table 2.6).

The vast majority of the economically active and competitive population of Ukraine determines their motives for going abroad for employment, based not only on the state of personal life and well-being, but also due to the low level of economic development of the country. This motive is extremely dangerous in relation to the desire to implement an individual strategy in the global labor market, because it threatens the non-repatriation of skilled immigrants. The loss of such categories of workers will negatively affect the age and educational characteristics of the workforce and inhibit economic growth. Therefore, the main task of the state migration policy of our state should be to protect weaknesses and threats using strengths and opportunities to overcome the negative consequences of modern migration processes.

It is only possible to eliminate the negative aspects of excessive labor migration from the country through the use of innovation potential. Compared to national economies, which do not pay attention to the development of innovations, innovatively developed countries show higher rates of economic growth in the long-term trend and the lack of outflow of human capital. This is especially evident in those countries that build their own national innovation systems based on a combination of stimulating state innovation policy, science, education, business community and the country's participation in international innovation clusters to create and implement innovation as a priority of economic development.

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246 The Global Innovation Index. URL: https://www.wipo.int/publications/en/details.jsp?id=247.

Table 2.6. Conceptual scheme of optimization of labor migration flows from Ukraine

FACTORS OF INFLUENCE ON LABOR MIGRATION FLOWS WORLDWIDE		
	globalization and openness of the national economy, increasing labor mobility	
	neoprotectionism	
	structural and innovative changes in the world economy	
	transition of countries to «Industry 4.0» due to the intensification of labor migration and strengthening the role of international organizations as coordinators of international economic relations: the world labor market is gradually «dying out» such traditional for the twentieth century professions such as: vehicle driver, postman, guide, courier, builder, traditional engineering specialties, as well as professions that require high labor costs	
	regulatory influence of international organizations that define standard «rules of the game» for the countries of the world on the national and world labor market	
STRATEGIC PRIORITIES FOR ORDERING LABOR MIGRATION FROM UKRAINE		
Addressing the employment of the most «vulnerable» sections of the labor market - young people and people of pre-retirement and retirement age who seek and can work	Dissemination of dual education; introduction of special state programs to provide the «first job», providing grant support to «freelancers» and the self-employed; training and retraining of employees (based on the system of «lifelong learning» (LLL)); training of the workforce for the service sector based on the skills of working with IT technologies; institutional support for the development of the creative economy (culture, exhibitions, show business, art projects, etc.) with appropriate preferential taxation of «freelancers»; spreading the practice of tax benefits for the taxation of profits of entrepreneurs who create new jobs and hire young people.	
Addressing Structural Unemployment in Industry 4.0	Reorientation of the training system to fundamentally new specialties: engineers in the field of robotics, operators of robotic machines and equipment, operators of unmanned vehicles; training of specialists in specialties of interdisciplinary profile (for example, specialists serving «health economics»); development of bio-engineering, bio-technology, etc.	
	reforming the system of social protection of the population (including the system of pensions, social assistance and social benefits) through the introduction of a system of payments of «unconditional basic income».	
General priorities of labor market reform in Ukraine	protection of the rights of the working population	
	counteracting all forms of discrimination and «shadowing» of the processes of hiring and receiving income in the labor market	
	prevention of child labor exploitation	
	introduction in Ukraine of international standards for the protection of workers' rights; raising the level of wages to EU standards; non-discrimination and «shadowing» of the labor market	
	legalization of income of employers and employees	
	protection of rights and freedoms, observance of social guarantees for all employees working in the Ukrainian market, as well as for Ukrainian labor migrants	
	providing assistance, accommodation, employment, access to health care, education, social services for internally displaced persons	
	health care and pension reform	
	modernization of objects of the real sector of the economy and implementation of technological solutions in the social sphere	
OF STRATEGIC PRIORITIES OF UKRAINE'S INNOVATION POLICY FOR OPTIMIZATION OF LABOR MIGRATION FLOWS		
• Increasing human potential in the field of innovation through the creation of an effective system of continuing education and encouragement to work in sectors of the economy that determine the innovative development of the country • Technological modernization of key sectors of the economy and increasing the level of perception of innovation by business - consideration of innovation as an integral element of company development • Introduction of innovations in all spheres of public administration and formation by the state of a balanced sector of research / development, favorable conditions for the use of innovations in all spheres of the economy • Increasing the openness of the national innovation system, the degree of integration of the country into global innovation processes, the development of interstate innovation clusters		

Source: created by authors.

Increasing human potential in the field of innovation is possible through international innovation cooperation in the higher education system, which forms a platform for building human relationships, socio-cultural exchange and strengthening business ties with other countries.

One of the main opportunities for rapid innovation development of Ukraine is participation in international innovation clusters. The application of cluster policy will help increase the competitiveness of economic entities by realizing the potential for effective interaction of its participants due to their close geographical location, expanding access to innovation, technology and highly qualified personnel, as well as reducing transaction costs. Clustering is also an effective mechanism for attracting foreign direct investment. The inclusion of national clusters in global value chains allows to significantly raise the level of the national technological base, increase the speed and quality of economic growth by increasing the international competitiveness of enterprises that are part of the cluster. Further research will be aimed at finding the most rational ways to ensure the competitiveness of Ukraine in the context of the identified innovative benefits.

The next factor influencing the international competitiveness of Ukraine, which will be assessed, is the impact of global transformations of the world market of information and communication technologies.

Over the last few decades, technology has progressed very rapidly, and today it permeates all aspects of business and society. The introduction of information technology has not only become commonplace due to the rapid penetration of mobile phones and the Internet, but has also become an integral part of the lives of billions of people. Progress of key technologies continues at a rapid pace, and disruptions in technology open up new opportunities for countries and firms to innovate and increase competitiveness. Technology has also improved the lives of billions by providing new services in education, health, finance, trade and other key areas. Despite the intangible basis, the information space as a tool for the development of the services market is becoming an important element of creating added value in many segments. One of the key aspects is that digital technologies are becoming a weapon, which is a challenge for many countries and takes into account the factor of information security. In these conditions, the implementation of a comprehensive study related to the rationale for global transformations of the global market of information and communication technologies becomes especially important and relevant.

It should be noted that the issues of the global information space, its role in modern international economic relations and the intensification of countries' participation in global information markets have been raised by leading Ukrainian and foreign scholars. Among them are such scientists as O. Kulinych, S. Voitko [247], O. Kosogov [248], K. Ladychenko [249], S. Sardak [250], K. Sokol [251], A. Stavytska [252] and leading statistical reports [253; 254; 255; 256; 257]. These scientists have identified the role of the information space as an object of management in the system of state information policy, the direction of development of the ICT sphere in ensuring the appropriate level of competitiveness. However, the issues of global transformation of the world market of information and communication technologies in modern conditions have not been properly reflected in the works of scientists and need detailed consideration.

The information space in modern conditions is formed due to digital technologies that have been actively developing in recent years. Their rapid progress over the past few decades has led them to permeate all aspects of business and society, opening up new opportunities and bringing many benefits. Industry 3.0 has led to the definition of the fundamental role of information resources and the development of information and

247 Kuly`ny`ch O. O., Vojtko S. V. Napryamy` rozvy`tku IKT-sfery` u zabezpechenni nalezhnogo rivnya konkurentospromozhnosti na mizhnarodnomu ry`nku IT-poslug [Directions of ICT development in ensuring the appropriate level of competitiveness in the international market of IT services]. *Ekonomika. Upravlinnya. Innovaciyi.* 2014. # 1. URL: http://nbuv.gov.ua/j-pdf/eui_ 2014_1_60.pdf.

248 Kosogov O.M. Informacijny`j prostir yak ob'yekt upravlinnya v sy`stemi derzhavnoyi informacijnoyi polity`ky` [Information space as an object of management in the system of state information policy]. *Zbirny`k naukovy`x pracz` Harkivs`kogo universy`tetu Povitryany`h Sy`l*, 2016, vy`pusk 3(48). P.54-56.

249 Lady`chenko K.I. Suchasni tendenciyi rozvy`tku svitovogo ry`nku informacijno-komunikacijny`x poslug [Current trends in the global market of information and communication services]. *Efekty`vna ekonomika.* 2015. # 2. URL: http://www.economy.nayka.com.ua/?op=1&z=3830.

250 Sardak S. E., Stavy`cz`ka A. V. Doslidzhennya struktury` i tendencij rozvy`tku svitovogo ry`nku informacijny`x texnologij [Research of structure and tendencies of development of the world market of information technologies]. *Texnology`chesky`j audy`t y` rezervy proy`zvodstva.* 2015. # 4/5. P. 96-100.

251 Sokol K.M. Svitovy`j ry`nok informacijny`x texnologij v konteksti globalizaciyi svitovoyi ekonomiky` [The world market of information technologies in the context of globalization of the world economy]. *Visny`k My`kolayivs`kogo nacional`nogo universy`tetu imeni V.O. Suxomly`ns`kogo.* 2015. Vy`pusk 3. p. 78-83.

252 Stavy`cz`ka A. V. Ocinka pozy`cionuvannya krayin na svitovomu ry`nku informacijny`h texnologij: staty`sty`chni vy`miry` indeksnogo analizu [Assessment of the positioning of countries in the global information technology market: statistical measurements of index analysis]. *Naukovy`j visny`k Uzhgorods`kogo nacional`nogo universy`tetu. Seriya «Mizhnarodni ekonomichni vidnosy`ny` ta svitove gospodarstvo».* 2017. # 12(2). P. 126-130.

253 Technological impact on the global marketing environment. URL: https://globalmarketingprofessor.com/technological-influence-on-global-marketing-environment.

254 Trends in the Information Technology sector. URL: https://www.brookings.edu/research/trends-in-the-information-technology-sector.

255 World's leading information technology research and advisory company URL: www.gartner.com.

256 The Global Information Space as a Source of Formation of Threats and Dangers. URL: https://link.springer.com/chapter/10.1007/978-3-030-00102-5_108.

257 The World Economic Forum The Global Information Technology Report 2015. URL: http:// www3.weforum.org/ docs/WEF_Global_IT_Report_2015.pdf.

communication technologies, automation and robotization of production processes as key elements of international competitiveness. Assessing the potential of the market, it should be noted its constant growth, so according to international statistical publications, revenue from global information and communication technologies from 2005 to 2019 increased from 2307 to 4460 billion euros (Fig. 2.10).
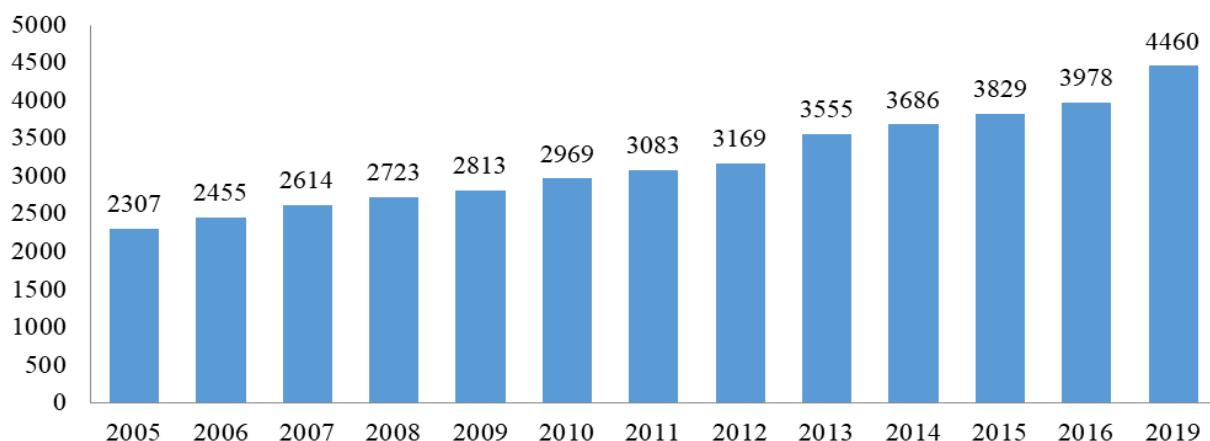
Fig. 2.10. Revenue from global information and communication technologies in 2005 to 2019, billion euros

Source: created by authors based [258].

In turn, the costs of the global technology market are much lower and in 2019 amounted to 3360 billion (Fig. 2.11).
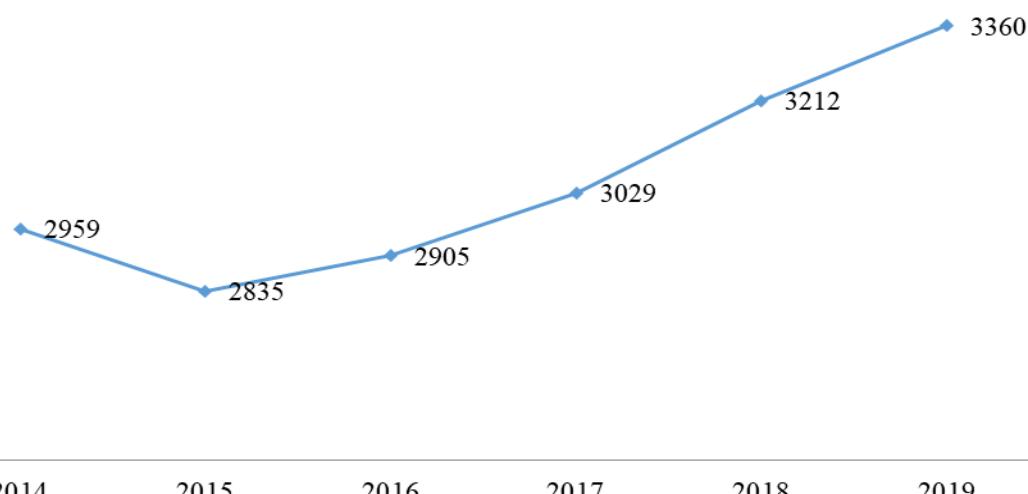
Fig. 2.11. Expenditures on the world market of information and communication technologies in 2014-2019, billion dollars

Source: created by authors based [259].

258   Global   technology   market   spending   from   2014   to   2019.   URL: https://www.statista.com/statistics/886397/total-tech-spending-worldwide.
259   Global   technology   market   spending   from   2014   to   2019.   URL: https://www.statista.com/statistics/886397/total-tech-spending-worldwide.

One of the key tools for assessing the development of information markets is the Network Readiness Index (NRI). The history of the methodology of its calculation began in 2000, when some experts of the World Economic Forum to create a framework for assessing the impact of information and communication technologies on the development and competitiveness of countries. The result was the creation of the Network Readiness Index (NRI), which for the first time provided a holistic basis for assessing the multifaceted impact of information and communication technologies on society and the development of countries. Initially, the index identified three key ICT stakeholders: people / society, business, governments, and included new elements of ICT applications, such as a focus on the political environment and the quality of regulations. Many countries have used NRI to develop their ICT strategies. Over the next two decades, the structure of the NRI underwent a major overhaul, which allowed for a clear focus on the impact of information and communication technologies. Despite the challenges of collecting data from more than 120 economies, NRI retains its broad global coverage and has become a trusted global benchmark for the use of information and communication technologies for development and competitiveness.

Today, NRI is based on four structural elements: technology, people, management and influence, each of which defines its subsystems (Fig. 2.12). Each element consists of three subpoles as shown in the figure below. People and technology will increasingly interact as employees and partners, and to ensure a positive and comprehensive impact on society and business, it is necessary through the introduction of management mechanisms to address issues related to trust, security and the inclusion of information flows.
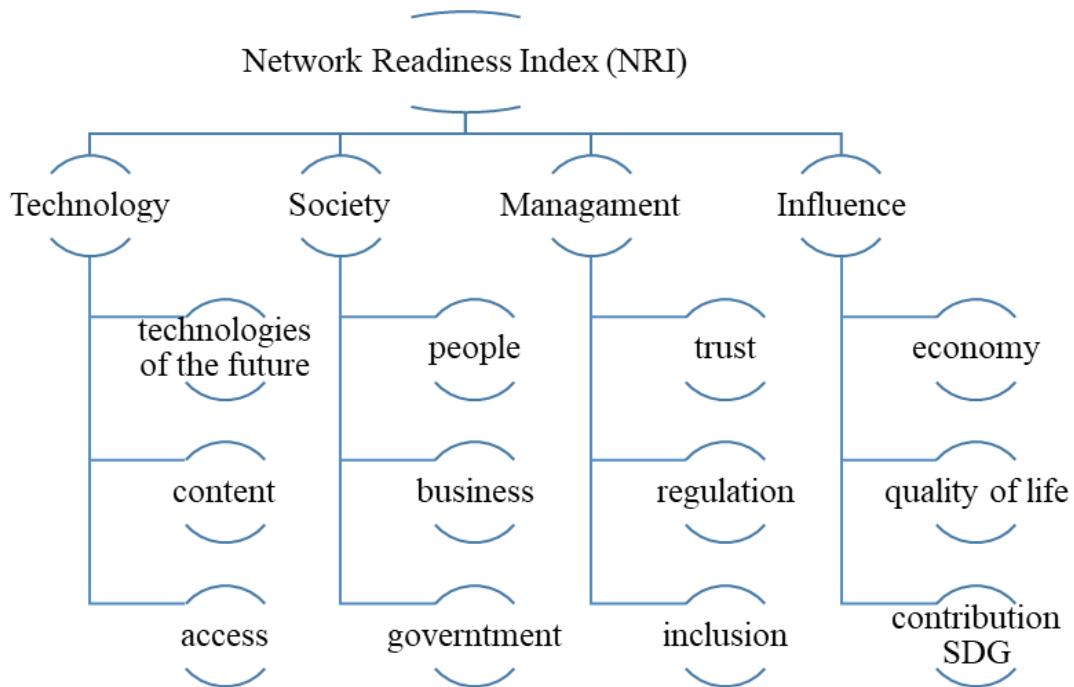
Fig. 2.12. Components of the Network Readiness Index (NRI)

Characterizing the components of the NRI model index, we can determine that technology is the basis of the network economy, so the desire to assess the level of technology is a prerequisite for the country's participation in the global economy. The next three sub-sectors have been identified for this purpose and are based on access as a fundamental level of NRI in countries, including on communication infrastructure and accessibility; content, ie the type of digital technology produced in countries and the content of programs that can be deployed locally; technologies of the future, which determine the degree of readiness of the country for the future network, economy and new technological trends, such as artificial intelligence and the Internet of Things, and generally characterize the level of competitiveness of the country in such innovative and progressive development.

Availability and level of technology as an index is a representation of interest, ie how important access, resources and skills of their productive use are for the population, government agencies, enterprises and organizations. As a result, this indicator takes into account NRI levels of analysis, namely: individuals, enterprises (businesses) and governments. Accordingly, people's interests are taken into account, ie how people use technology and how they use their skills to participate in the network economy, how businesses use NRIs and participate in the network economy, and how governments use and invest in NRIs for the general public.

The governance index takes into account the readiness of the country's network, as transformation does not take place in a vacuum and is a function of the national context within. As a result, this indicator takes into account how favorable the national environment is for the country and its participation in the network economy based on issues of trust, regulation and inclusion. Trust determines how secure individuals and firms are in the context of the network economy. This applies not only to actual crimes and security, but also to expectations and perceptions of security and confidentiality. The regulation discloses the level of government support for participation in the network economy through regulation. Inclusion as a coefficient makes it possible to determine the digital divide within countries where governance can address issues such as inequality based on gender, disability and socio-economic status.

Impact is the fourth aggregate indicator that takes into account the impact on the economy, quality of life and the achievement of sustainable development goals (SDG). After all, readiness for a network economy is a means to improve growth and prosperity in society and the economy, so this index seeks to assess the economic, social and human impact of participation in a network economy. As a result, 62 indicators were identified to fill these 12 coefficients and estimate their value, which is shown in Table 2.7.

Table 2.7. Network readiness index in 2019

Name of the country	Place in the ranking	Indicator value	Name of the country	Place in the ranking	Indicator value
Sweden	1	82,65	Russia	48	54,77
Singapore	2	82,13	Turkey	51	53,75
Netherlands	3	81,78	Kuwait	54	56,39
Norway	4	81,30	Brazil	59	51,07
Switzerland	5	81,08	Belarus	61	50,34
Denmark	6	81,08	Ukraine	67	48,92
Finland	7	80,34	Georgia	68	48,81
USA	8	80,32	Jordan	73	46,97
Germany	9	78,23	India	79	44,81
Great Britain	10	77,73	Egypt	92	38,58
Lithuania	31	61,13	Tajikistan	99	34,90
China	41	57,63	Yemen	121	12,33

Source: created by authors based on [260].

[260] The Network Readiness Index 2019: Towards a Future-Ready Society. URL: https://networkreadinessindex.org/wp-content/uploads/2020/03/The-Network-Readiness-Index-2019-New-version-March-2020.pdf.

As can be seen from the table, the leading countries are the world's leading developed countries, characterized by significant economic potential (USA, Germany, UK) and technological opportunities that have given them significant competitive advantages in modern conditions (Singapore, Norway, Sweden).

Europe dominates the NRI rankings, with eight countries in the top 10, in addition to the highly rated Sweden and the Netherlands, other countries are also showing excellent results. Switzerland, which ranks 5th in the overall ranking, shows high performance (2nd place) in the sub-index «Impact», primarily as a result of high performance in the economy (3rd place) and the SDG sub-index (2nd). In North America, after the United States, Canada (14th) is a reliable performer in all four sub-indices, ranking first in the 20th. It is one of the leading countries in terms of including different groups in the network economy, which together with a high level of trust (14th) and regulation (15th) - leads to good governance (11th). Canada ranks 10th in two sub-indices related to governments and quality of life, but the relatively low use of ICT among individuals (47th) reduces efficiency and overall rankings. The group of Arab states also shows a large variance of the overall scores in the NRI, despite the fact that this region is represented in the index by only 13 countries. In fact, the region could be divided into the Middle East and North Africa, where most of the former countries clearly outperform the latter. The regional leader, the United Arab Emirates (29th place), is the only Arab state in the top quarter. High ICT use makes it the highest-performing country in the Individuals index, but firms and national governments have low use of digital technologies and skills (34th in Business; 59th in Government). As for Ukraine, its place among 121 objects of analysis is determined by 67 place. Given the indicators that underlie the calculations, we can say that there is significant potential for the development of the information society and the integration of our country into the global information space [261].

The analysis of the dynamics of the global IT market involves taking into account not only market actors and market infrastructure, but also a powerful IT industry, which includes many components of other sectors of the economy. Accordingly, costs, investments, revenues, capacity of the IT

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[261] The Network Readiness Index 2019: Towards a Future-Ready Society. URL:https://networkreadinessindex.org/wp-content/uploads/2020/03/The-Network-Readiness-Index-2019-New-version-March-2020.pdf

market must be considered in time (past and future periods) and territorial dimensions (countries, regions, world) [262].

A separate element of the development of the information society is the ability to access the network and coverage. In international statistics, the share of Internet users in% of the country's population is popular. This indicator includes all users who have access to the Internet from all possible gadgets (Table 2.8).

Table 2.8. Analysis of the share of Internet users in 2015-2018,%

Name of the country	2015	2016	2017	2018	2018/2015	
					Absolute changes	Relative changes
Qatar	92,9	95,1	97,7	99,7	6,8	7,32
Kuwait	78,7	72,0	100	99,6	20,9	26,56
Iceland	98,2	98,2	98,3	99,0	0,8	0,81
Bahrain	93,5	98,0	95,9	98,6	5,1	5,45
UAE	90,5	90,6	94,8	98,5	8	8,84
Denmark	96,3	97,0	97,1	97,6	1,3	1,35
Luxembourg	96,4	98,1	97,4	97,1	0,7	0,73
Norway	96,8	97,3	96,4	96,5	-0,3	-0,31
South Korea	89,9	92,8	95,1	95,9	6	6,67
Great Britain	92,0	94,8	94,6	94,9	2,9	3,15
Ukraine	48,9	53,0	58,9	61,2	12,3	25,15
Nigeria	2,5	4,3	5,2	5,3	2,8	112,00

Source: created based on [263].

As can be seen from the table, the top ten countries include countries with significant scientific potential or financial resources, which provide their citizens with 95% or more of access to global information flows. Ukraine ranks 61st in this ranking and increases the pace of informatization - the share of Internet users has increased by 25.15% over the past 4 years, and closes the ranking of Nigeria, where the share of citizens with Internet access is only 5.3%, although in relative terms indicators for the reporting period, their share increased by 112%.

With regard to the institutional and technological support for the integration of certain countries into the global information space, the main indicator here is the number of secure Internet servers (Table 2.9).

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262 The Global Information Space as a Source of Formation of Threats and Dangers. URL: https://link.springer.com/chapter/10.1007/978-3-030-00102-5_108
263 Data made accessible. URL: https://knoema.com/

Table 2.9. Estimation of the dynamics of the number of protected Internet servers in 2015-2018, thousand

Name of the country	2015	2016	2017	2018	2018/2015	
					Absolute changes	Relative changes
USA	2039	3694	9863	21517	19478	10,55
Germany	351	957	2825	4676	4325	13,32
Great Britain	285	570	1400	1811	1526	6,35
Netherlands	164	410	1206	1733	1569	10,57
Japan	191	267	758	1476	1285	7,73
France	126	446	991	1367	1241	10,85
Kanada	121	369	970	1147	1026	9,48
Australia	108	237	530	822	714	7,61
Russia	46	168	511	749	703	16,28
Italy	38	79	468	740	702	19,47
Ukraine	6	85	177	268	262	44,67

Source: created based on [264; 265].

Commenting on Table 2.9, it should be noted that the unprecedented leader is the United States, the number of servers is greater than the next in the ranking of the country at least three times, and the increase during the reporting period was 10.5 times. In this ranking, as of 2018, Ukraine ranks 24th and is rapidly rising, as the number of protected Internet servers has increased more than 44 times during the analyzed period.

Thus, the development of information space in the context of globalization is characterized by a rapid increase in quantitative and qualitative indicators of institutional support for access to information resources. The financial capacity of many countries allows them to actively use Internet access as a tool to increase competitiveness and a relevant component of the network readiness index [266]. The main messages in the network readiness index report in 2019 relate to the fact that the rating reflects the results of efforts in the economies of leading countries, the priority of investment in digital technologies, while providing support for the created ecosystem; the ability to integrate people and technology with the right management into structures that are key to a collectively prosperous future; technology can have an important positive impact on the national economy in the context of achieving sustainable development

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[264] Data made accessible. URL: https://knoema.com/

[265] The Global Competitiveness Report 2017–2018. URL: https://www.weforum.org/reports/the-global-competitiveness-report-2017-2018.

[266] Zoroja J. Fostering Competitiveness in European Countries with ICT: GCI Agenda. URL: https://journals.sagepub.com/doi/10.5772/60122.

goals; the technological gap remains key globally, as high-income countries traditionally have greater opportunities to invest heavily in their technology infrastructure and continue to monitor and invest in future technological innovations; information and communication technologies are the main drivers that distinguish the innovative potential of the world's macro-regions. The global information space is a system of constructions for the accumulation, exchange, distribution and consumption of information resources with the existing infrastructure and market of information technologies, the level of development of which depends on the integration of entities at different levels on a global scale.

One of the defining characteristics of information technology is that it significantly reduces the impact of geographical remoteness or other constraints that allow people around the world to communicate and share information and ideas, deepen specialization and global integration, and promote economic growth. In such an integrated and intertwined world, information technology contributes to the development of segments such as health care and environmental protection, and information and communication technologies and related technological innovations will contribute to global economic growth far more than the natural comparative advantages. fundamental [267]. As a result, significant transformations of the global market of information and communication technologies determine the consideration of current trends in the development of the index of readiness for the network while increasing the competitiveness of countries.

2.3. Cluster analysis of interaction systems in innovation processes of the regions of Ukraine

Today, the innovative development of the region and the intensification of innovation activities in particular depend on the level of interaction between the subjects of the innovation process, which produce knowledge, develop innovative products or ensure the production and sale of innovative products.

According to the statistics of the Ministry of Education and Science of Ukraine, during 2014-2018 in Ukraine 18121 agreements on technology transfer were concluded for the total amount of UAH 494.24 million, and there is a tendency to increase the amount of funds received under the agreements on technology transfer with simultaneous reduction of the number of concluded contracts [268, p.2]. This trend is explained by the increase in the average cost of one technology transfer agreement, and hence by the increase in the level of technological readiness of scientific and technical development for commercialization [269, p.261].

Activation of transfer processes took place at different rates with foreign partners: in the domestic market in 2018 compared to 2017 there was an increase in the number of transferred technologies by 1.7%, on the foreign - by 5.6% [270, p.181] .

In our opinion, one of the important tasks to be performed for the development of the regional innovation system is to establish cooperation in innovation processes, and information support of the interaction mechanism should include determining the relationship between the level of innovation cooperation and the level of innovation activity, more precisely, with indicators of the effectiveness of innovation processes in the regional market, their study to identify patterns of change in their characteristics in different economic and social conditions.

The study of differentiation of the level of development of innovative cooperation according to different criteria involves the classification of regions at different levels of partnership into relatively homogeneous groups, determining the characteristics of these groups, the main trends in group composition and their qualitative characteristics.

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[268] Ministerstvo osvity` i nauky` Ukrayiny`. Anality`chna dovidka shhodo napryamiv vy`kory`stannya koshtiv, oderzhany`h u rezul`tati transferu tehnologij, stvoreny`h za rahunok koshtiv derzhavnogo byudzhetu [Ministry of Education and Science of Ukraine. Analytical information on the use of funds received as a result of technology transfer created at the expense of the state budget]. 2019. URL: https://mon.gov.ua/storage/app/media/innovatsii-transfer-tehnologiy/2019/05/03/ dovidka052019.pdf.

[269] Chukhray N., Shakhovska N., Mrykhina O., Bublyk M., & Lisovska L. Methodical approach to assessing the readiness level of technologies for the transfer. In book: Advances in Intelligent Systems and Computing IV. Shakhovska N., Medykovskyy, M. (eds.). Springer Nature Switzerland AG, Cham, Switzerland 2019. Pp. 259—282. URL: https://doi.org/10.1007/978—3—030—33695—0_19.

[270] Lazarenko Yu. O. Peredumovy` zaprovadzhennya vidkry`ty`h innovacij u pidpry`yemny`cz`komu sektori Ukrayiny` [Prerequisites for the introduction of open innovations in the business sector of Ukraine]. *Molody`j vcheny`j.* 2014. # 12 (1). S. 179—183.

Cluster analysis has recently become especially popular in economic research. L. Galkiv [271, p.20] uses cluster analysis to study the regional features of the Ukrainian market. O. Knjas uses the tools of cluster analysis to determine the factors influencing the innovative activity of enterprises [272, p.130], O. Ryadno and O. Berkut – to study the differentiation of socio-economic development of regions [273, p.62] and S. Yermak - for grouping the regions of Ukraine by indicators of innovative development [274, p.37]. However, the study of research has shown that the regional analysis of innovation in Ukraine is mostly limited to assessing the effectiveness of innovation. Scientists do not pay attention to the problems of establishing and developing cooperation in innovation, which arise between partners in different regions of Ukraine and with foreign partners, as well as determining the impact of cooperation indicators on the level of innovative development of regions. Therefore, the task is to group the regions of Ukraine by level of innovation activity and level of innovation cooperation in terms of foreign partners by cluster analysis, determining the characteristics of these groups, the main trends in the composition of groups and their qualitative characteristics.

The main source of data for the study was the statistical collection «Regions of Ukraine» for 2008-2018, the official website of the State Statistics Service of Ukraine, the official websites of regional state administrations of Ukraine, which reflect indicators of innovation cooperation, the object of cooperation were technological innovations.

The objects of observation are indicators of innovative cooperation, which are presented in terms of types of countries of origin of partners, regions of Ukraine, types of economic activity.

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271 Gal`kiv L. I., Kuly`nyak I. Ya., Gerbut M. V. Sanatorno-kurortna diyal`nist`: ry`nok poslug sanatoriyiv u regionah Ukrayiny` [Sanatorium-resort activity: the market of sanatorium services in the regions of Ukraine]. *Visny`k Nacional`nogo universy`tetu «L`vivs`ka politexnika».* Seriya «Problemy` ekonomiky` ta upravlinnya». L`viv : Vy`davny`cztvo L`vivs`koyi politexniky`, 2017. Vy`pusk 873. S. 18–26.

272 Knyaz` O. V. Analiz ta ocinyuvannya faktoriv, yaki vply`vayut` na riven` innovacijnogo rozvy`tku pidpry`yemstv [Analysis and evaluation of factors that affect the level of innovative development of enterprises]. *Ekonomika promy`slovosti.* 2006. # 3. S. 128–135.

273 Ryadno O. A., Berkut O. V. Doslidzhennya struktury` ta dy`namiky` dy`ferenciaciyi social`no-ekonomichnogo rozvy`tku regioniv Ukrayiny` na osnovi klasternogo analizu [Research of structure and dynamics of differentiation of social and economic development of regions of Ukraine on the basis of the cluster analysis]. *Ekonomichny`j visny`k Donbasu.* 2016. 1. S. 60—67.

274 Yermak S. O. Klasterny`j analiz regioniv Ukrayiny` za klyuchovy`my` indy`katoramy` rivnya innovacijnogo rozvy`tku [Cluster analysis of the regions of Ukraine according to key indicators of the level of innovative development]. *Ekonomika rozvy`tku.* 2017. # 3. S. 34—43.

The State Statistics Service of Ukraine recorded that enterprises with technological innovations in different regions implemented innovation processes for the following types of partners:

1) with the participation of enterprises that are members of the same business groups;

2) suppliers of equipment, materials, components, software;

3) customers or buyers of the business sector;

4) clients or buyers of the public sector;

5) competitors or other enterprises of the same industry;

6) consultants and commercial laboratories;

7) universities and other educational institutions;

8) research institutes.

As can be seen from table. 2.10, the activity of cooperation of enterprises with technological innovations differed significantly not only by regions, but also by types of partners within one region.

The lowest number of partnerships within their group of enterprises was applied in Transcarpathian oblast (0,5%) and Poltava oblast (5,6%), most - in Vinnytsia oblast (29,1%), Luhansk oblast (26,3%).

Suppliers of equipment, materials, components, software are traditionally considered the most frequent partners for Luhansk oblast (50,7%), Rivne oblast (38,7%), but in Cherkasy oblast (9,8%) and Ivano-Frankivsk oblast (18,5%) these partners were less involved.

Clients of the business sector entered into innovative cooperation most often in Transcarpathian oblast (36,7%) and Donetsk oblasts (19%), clients of the public sector generally held an inactive position, but in Lviv oblast (6,8%) and Transcarpathian oblast (15%) their partnership was most tangible.

Competitors or enterprises of the industry also took part in joint innovation projects not very actively, on average up to 1%, only in Chernivtsi region their share was 1,2%.

Among educational institutions and scientific organizations, the most active was cooperation with research institutes, especially in Donetsk oblast (18,7%) and Luhansk oblast (17,6%).

Table 2.10. Regional distribution of enterprises with technological innovations in Ukraine by type of partner with which innovation activity was carried out during 2008-2020, %

Region	Oblast	within its group of enterprises	suppliers of equipment, materials, software components	customers or buyers of the business sector	public sector customers or buyers	competitors, other enterprises in the same industry	consultants, commercial laboratories	universities and other higher education institutions	research institutes
West	Lviv	11,6	20,9	17,7	6,8	0,3	0,3	5,5	6,1
	Ivano-Frankivsk	9,7	18,5	9,3	0,2	0,4	0,2	1,1	5,0
	Transcarpathian	0,5	19,8	36,7	15	0	0,5	1,6	0
	Rivne	21,3	38,7	16,1	0	0,2	0,9	0,7	2,5
	Ternopil	13,7	31,3	12,6	0,5	0,5	0,5	2,8	2,2
	Volyn	20,2	26,1	17,3	1,6	0,4	0	0,4	1,7
	Chernivtsi	10,4	24,0	11,6	1,2	1,2	1,2	0	11,9
	Khmelnytsky	9,2	26,9	7,3	0	0	1,1	2,6	3
Northern	Zhytomyr	10,4	31,9	10,6	0	0	1,3	4,1	7,6
	Kyiv	19,2	38,0	17,9	0,1	0,3	0	7,8	9,8
	Chernihiv	17,8	24	8,7	0	0	0	4,0	5,1
	Sumy	20,7	29,4	17,5	1,5	1,0	1,0	6,8	12,9
Southern	Zaporozhye	9,8	16,8	10	0,3	1,0	1,2	6,7	9,5
	Dnepropetrovsk	13,3	31,3	14,0	0	0,8	1,4	5,5	9,2
	Kherson	18,7	31,0	9,4	0	1,5	0,7	4	9,7
	Odessa	19,0	31,7	8,7	0,7	0,5	0,7	6,5	8,3
	Mykolayiv	20,4	34	9,1	0	0,4	0,8	4,8	7,7
	Crimea	0	0	0	0	0	0	0	0
East	Kharkiv	10,8	27,9	12,9	0,5	1,0	0,4	5,0	6,1
	Donetsk	25,3	37,5	19,0	0,0	2,1	2,1	10,9	18,7
	Luhansk	26,3	50,7	11,6	0,0	0,0	0,0	9,9	17,6
Central	Vinnytsia	29,1	30,6	8,5	0,8	0,6	0,6	4,2	8,7
	Kirovograd	22,1	31,7	7,5	0,4	0,8	0,4	1,7	3,3
	Poltava	5,6	24,6	7,8	1,0	0,0	0,5	3,9	6,8
	Cherkasy	7,8	9,8	2,3	0,5	0,5	0,0	1,1	3,0

Note: calculated by the author on the basis of [275].

Using the data of table 2.10, we will study the relationship between such an indicator as «the number of enterprises with technological innovations» in the regions of Ukraine and the indicator of cooperation of these enterprises with partners, respectively, to perform this task we will use cluster analysis tools arrange objects into homogeneous groups.

[275] Derzhavna sluzhba staty`sty`ky` Ukrayiny`, 2020. Naukova ta innovacijna diyal`nist` Ukrayiny` [State Statistics Service of Ukraine, 2020. Scientific and innovative activity of Ukraine]. URL: https://ukrstat.org/uk/druk/publicat/ kat_u/publnauka_u.htm.

Solving the problem of cluster analysis is performed in the following sequence:

1. Sampling for analysis.

2. Selection of a set of features that characterize the object.

3. Choosing the degree of similarity (distance) between objects and their calculation.

4. Formation of clusters.

5. Analysis of the received information.

Sampling for analysis involves the construction of the original data matrix (Table 2.11).

Table 2.11. Output data matrix,% *

Oblast	Average values of regional distribution of enterprises with technological innovations in Ukraine,% to the total number of enterprises during 2008-2020.	Types of partners							
		within its group of enterprises	suppliers of equipment, materials, components, software	Customers or buyers of the business sector	customers or buyers public sector	competitors, other enterprises in the same industry	consultants, commercial laboratories	universities and other higher education institutions	research institutes
Lviv	31,175	11,6	20,9	17,7	6,8	0,3	0,3	5,5	6,1
Ivano-Frankivsk	18,785	9,7	18,5	9,3	0,2	0,4	0,2	1,1	5,0
Transcarpathian	38,40333	0,5	19,8	36,7	15	0	0,5	1,6	0
Rivne	41,7	21,3	38,7	16,1	0	0,2	0,9	0,7	2,5
Ternopil	38,05	13,7	31,3	12,6	0,5	0,5	0,5	2,8	2,2
Volyn	37,65333	20,2	26,1	17,3	1,6	0,4	0	0,4	1,7
Chernivtsi	23,93333	10,4	24,0	11,6	1,2	1,2	1,2	0	11,9
Khmelnytsky	33,65667	9,2	26,9	7,3	0	0	1,1	2,6	3
Zhytomyr	58,705	10,4	31,9	10,6	0	0	1,3	4,1	7,6
Kyiv	39,25333	19,2	38,0	17,9	0,1	0,3	0	7,8	9,8
Chernihiv	32,45	17,8	24	8,7	0	0	0	4,0	5,1
Sumy	41,90833	20,7	29,4	17,5	1,5	1,0	1,0	6,8	12,9
Zaporozhye	22,66167	9,8	16,8	10	0,3	1,0	1,2	6,7	9,5
Dnepropetrovsk	40,43	13,3	31,3	14,0	0	0,8	1,4	5,5	9,2
Kherson	35,145	18,7	31,0	9,4	0	1,5	0,7	4	9,7
Odessa	33,285	19,0	31,7	8,7	0,7	0,5	0,7	6,5	8,3
Mykolayiv	36,47	20,4	34	9,1	0	0,4	0,8	4,8	7,7
Crimea	9,516667	0	0	0	0	0	0	0	0
Kharkiv	35,83333	10,8	27,9	12,9	0,5	1,0	0,4	5,0	6,1
Donetsk	46,86667	25,3	37,5	19,0	0,0	2,1	2,1	10,9	18,7
Luhansk	54,9	26,3	50,7	11,6	0,0	0,0	0,0	9,9	17,6
Vinnytsia	42,15667	29,1	30,6	8,5	0,8	0,6	0,6	4,2	8,7
Kirovograd	41,28667	22,1	31,7	7,5	0,4	0,8	0,4	1,7	3,3
Poltava	34,03667	5,6	24,6	7,8	1,0	0,0	0,5	3,9	6,8
Cherkasy	13,24333	7,8	9,8	2,3	0,5	0,5	0,0	1,1	3,0

Note: calculated by the author on the basis of [276].

[276] Derzhavna sluzhba staty`sty`ky` Ukrayiny`, 2020. Naukova ta innovacijna diyal`nist` Ukrayiny` [State Statistics Service of Ukraine, 2020. Scientific and innovative activity of Ukraine]. URL: https://ukrstat.org/uk/druk/publicat/ kat_u/publnauka_u.htm.

For the procedure of cluster analysis, we use an isomorphic distribution (a method of dividing a group of objects), because the groups include objects that are close in structure, that means the proportions of the features differ little.

Isomorphic distribution is usually performed by normalizing the scales by the formula:

$$Z_{ij} = \frac{X_{ij} / \sum_{i=1}^{n} X_{ij}}{\sum_{j=1}^{m} \frac{X_{ij}}{\sum_{i=1}^{n} X_{ij}}},$$

(2.1)

where is the value of the j-th feature for the i-th object.

Isomorphic data analysis involves grouping a set of objects based on the similarity of their structure. In our case, the signs of similarity of objects are the presence of enterprises with technological innovations and the presence of typical partners for the implementation of innovative projects [277, p.243]. The distance between two objects under the conditions of using an isomorphic distribution is determined by the formula:

$$d_{ik} = \sqrt{\sum_{j=1}^{m} (Z_{ij} - Z_{kj})^2}.$$

(2.2)

In the isomorphic transformation, the distance will be minimal if the vectors are collinear, and maximum if the vectors are perpendicular.

The concepts of distance between objects are used to determine the similarity between objects. The smaller the distance between objects, the more similar the objects.

Based on this original data matrix, using the PPP Excel, we construct a matrix of isomorphic distances (see Addition A).

Information about the smallest isomorphic distances between factors is needed to establish a critical point that will break the data set by region into clusters.

After determining the distance, we will divide the objects into groups using the method of balls. Using this method assumes that the critical distance (critical radius) determines the distance that determines the object's membership in the cluster.

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277 Lapach S. N., Chubenko A. V., Baby`ch P. N. Staty`sty`ka v nauke y` by`znese [Statistics in science and business]. K. : MORY`ON, 2002. 640 s.

The critical distance is the distance beyond which the clusters are considered unrelated. The critical distance is taken equal to the maximum distance between adjacent elements in one cluster.

The critical distance between objects can be determined by the following formula:

$$C_l(p) = \frac{1}{K} \sum_{l=1}^{G} \sum_{p=1}^{P_1} C_l(p),$$

(2.3)

$$\text{where} \quad C_l(p) = \min_{q \in g_1} C_{ll}(p,q), p = 1, 2 \dots P_l, K = \sum_{l=1}^{G} P_l;$$

$C_{ll}(p,q)$ - the distance between the elements p and q belonging to the l-th group; $C_l(p)$ - the distance between the element p to the neighbouring element in the group l; P_l - the number of elements in group l; G - the number of groups.

To select a critical point, you must select the minimum values in each column, and later select the maximum value from the minimum. The results of this choice are given in table. 2.12.

The calculations given in table 2.12, allowed to graphically represent the formed clusters on the basis of «partner type», which is presented in Fig. 2.13. Based on Fig. 2.13 (a, b, c, d, e, f, g, h) all objects (areas) are divided into 3 clusters.

The first of them cover almost all regions of Ukraine, except for Crimea, the Mykolayiv and the Poltava oblasts. That is, in general, there is reason to believe that companies with technological innovations in the West, North and South of Ukraine implement innovative projects mainly on equal terms with companies in their group, suppliers of equipment, materials, software components, customers or buyers of the business sector, customers or buyers public sector, as well as research institutes.

Table 2.12. Critical points, fractions of a unit

Oblast	Partners							
	within its group of enterprises	suppliers of equipment, materials, software components	customers or buyers of the business sector	public sector customers or buyers	competitors, other enterprises in the same industry	consultants, commercial laboratories	universities and other higher education institutions	research institutes
1. Lviv	0,011569	0,011749	0,011749	0,079738	0,044439	0,002175	0,007382	0,018828
2. Ivano-Frankivsk	0,003804	0,005991	0,005991	0,023154	0,025388	0,015739	0,057165	0,049762
3. Transcarpathian	0,042226	0,090897	0,017897	0,079738	**0,33727**	0,003188	0,003237	0,260335
4. Rivne	0,003804	0,00159	0,00159	0,095241	0,133531	0,005684	0,06044	0,009001
5. Ternopil	0,011569	0,009783	0,010179	0,002073	0,047198	0,003188	0,016425	0,009001
6. Volyn	0,000775	0,004228	0,004228	0,041619	0,010951	**0,494033**	0,06044	0,065681
7. Chernivtsi	0,001706	0,006295	0,006295	0,057427	0,221948	0,014784	**0,119347**	0,051116
8. Khmelnytsky	0,033261	0,000396	0,000396	0,095241	**0,33727**	0,018536	0,016425	0,032165
9. Zhytomyr	0,033261	0,017897	0,017897	0,095241	**0,33727**	0,003314	0,017471	0,066585
10. Kyiv	0,021424	0,005715	0,005715	0,095241	0,074921	**0,494033**	0,005728	0,000418
11. Chernihiv	0,005568	0,018653	0,000189	0,095241	**0,33727**	**0,494033**	0,023109	0,02795
12. Sumy	0,003437	0,004228	0,004228	0,018863	0,038781	0,029308	0,028523	0,013663
13. Zaporozhye	0,001706	0,000641	0,000641	0,002073	0,004125	0,014784	0,071937	0,015411
14. Dnepropetrovsk	0,030275	0,002923	0,002016	0,095241	0,007302	0,018536	0,034729	0,001589
15. Kherson	0,002867	0,017872	0,016143	0,095241	0,009091	0,019139	0,002378	0,01253
16. Odessa	0,007024	0,005715	0,005715	0,033537	0,019068	0,009096	0,026557	0,000418
17. Mykolayiv	0,006787	0,00159	0,00159	**0,304686**	0,010951	0,003314	0,01162	0,008057
18. Crimea	0,042226	**0,563024**	**0,563024**	**0,095241**	**0,33727**	**0,494033**	**0,119347**	**0,317015**
19. Kharkiv	0,030275	0,002016	0,002016	0,01494	0,051744	0,015739	0,008903	0,02795
20. Donetsk	0,002173	0,009647	0,000396	0,095241	0,004125	0,031651	0,050546	0,015411
21. Luhansk	0,007327	0,001729	0,001729	0,095241	**0,33727**	**0,494033**	0,007382	0,013663
22. Vinnytsia	0,053793	0,001518	0,001518	0,033537	0,019068	0,011056	0,046974	0,008057
23. Kirovograd	0,002948	0,002923	0,002923	0,023154	0,007302	0,002175	0,003237	0,246414
24. Poltava	**0,159111**	0,001518	0,001518	0,088481	**0,33727**	0,011056	0,002378	0,007358
25. Cherkasy	0,010795	0,000189	0,000189	0,018863	0,034661	**0,494033**	0,04123	0,001589

Note: critical values are highlighted in bold
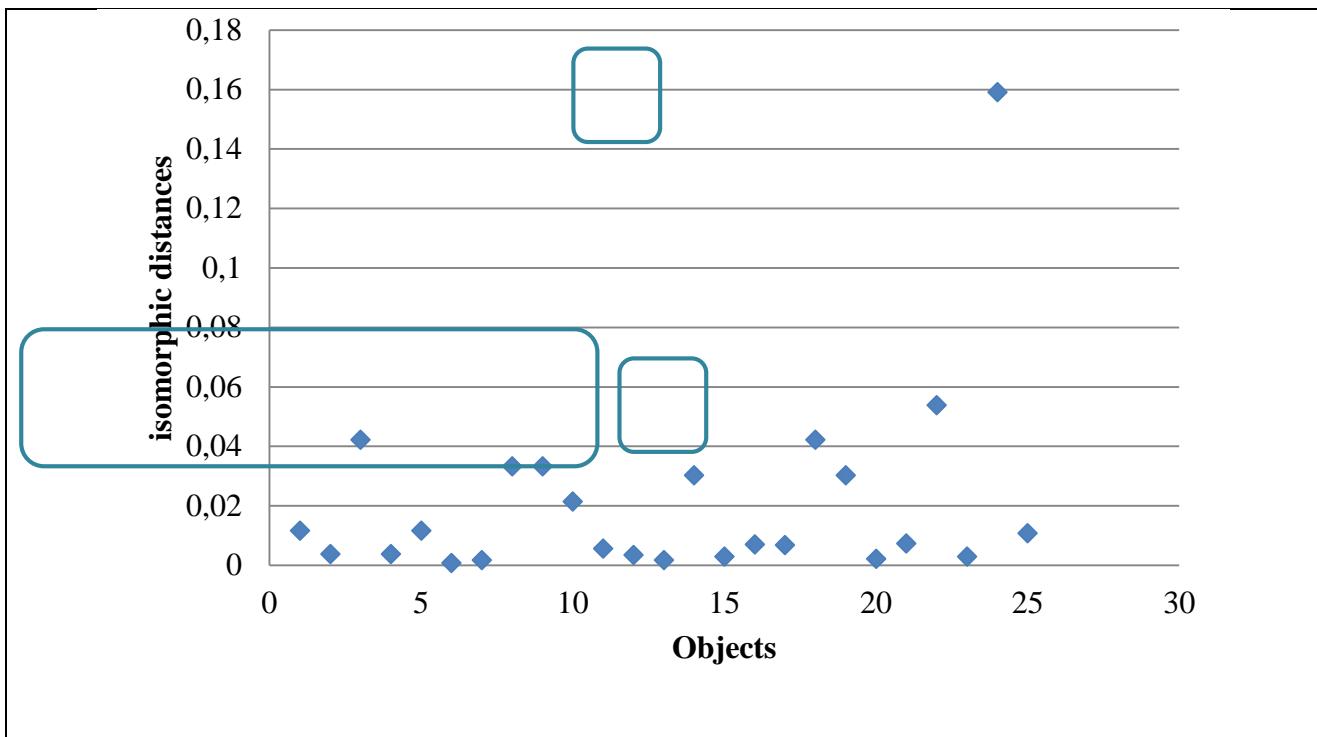
Fig. A. Clusters built on the basis of enterprises interaction with technological innovations with enterprises within their group of enterprises
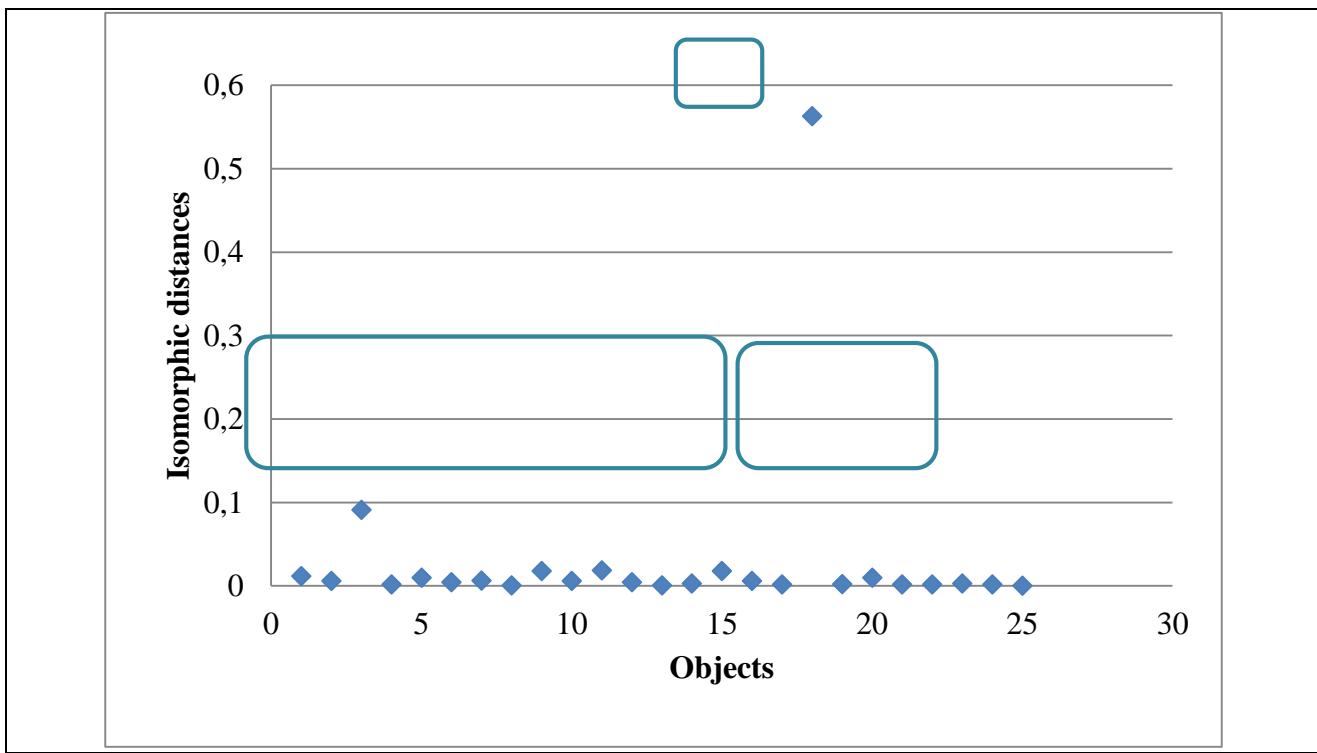
Fig. B. Clusters built on the basis of enterprises interaction with technological innovations with suppliers of equipment, materials, components, software
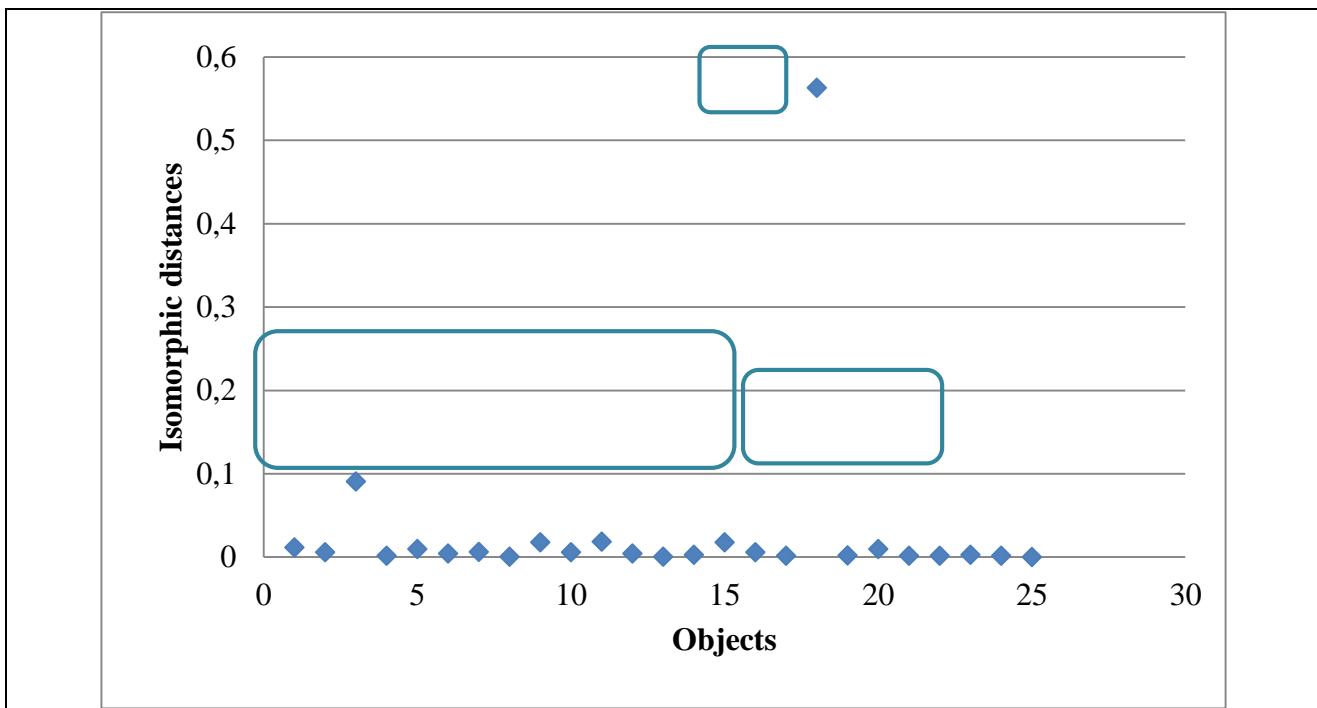
Fig. C. Clusters built on the basis of enterprises interaction with technological innovations with customers or buyers of the business sector
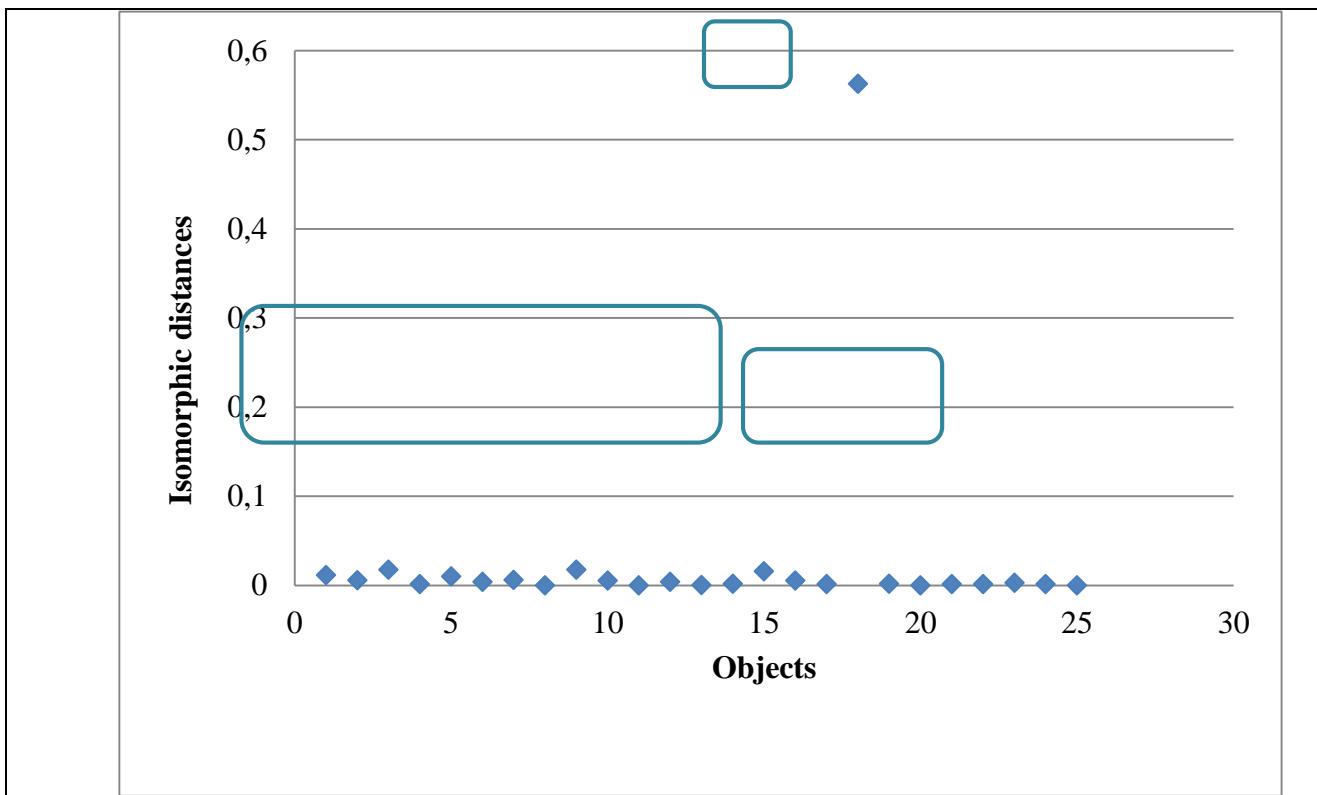
Fig. D. Clusters built on the basis of enterprises interaction with technological innovations with customers or buyers of the public sector
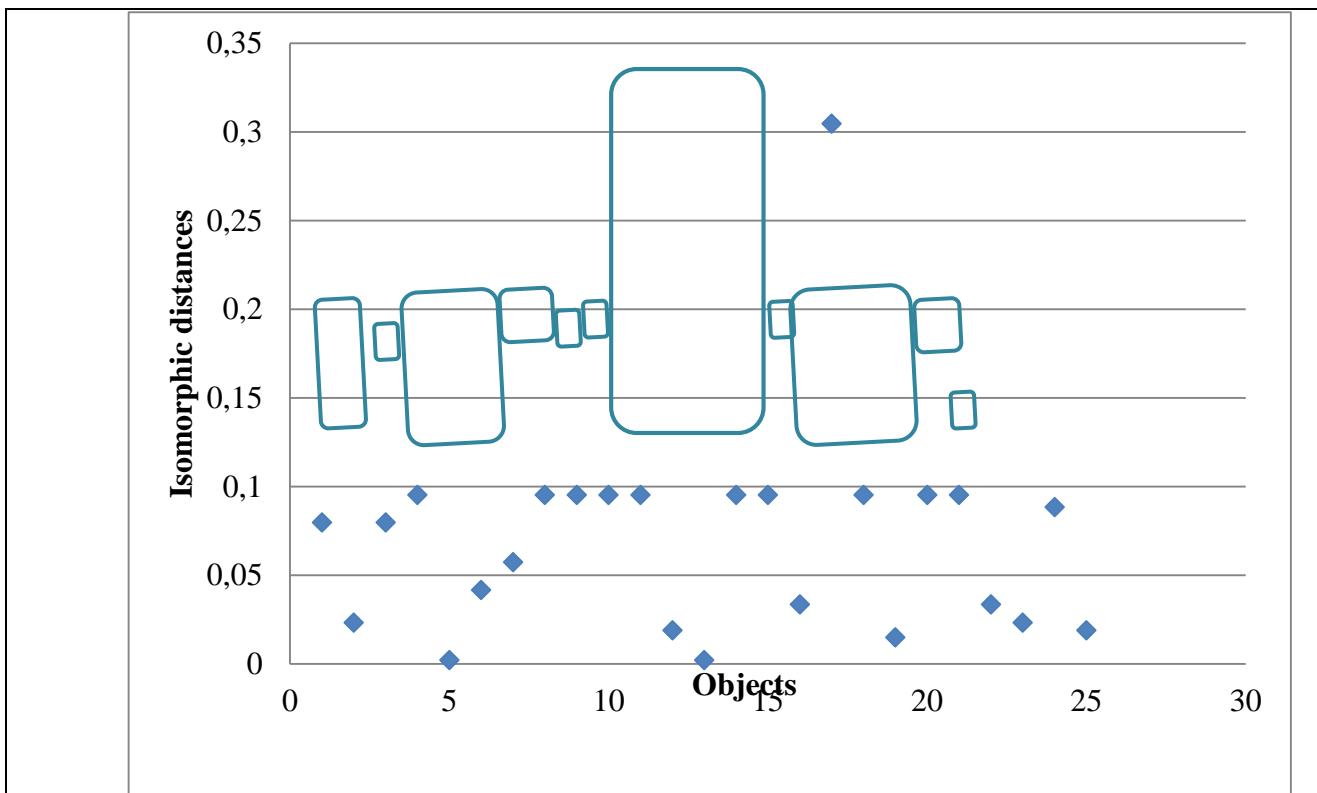
Fig. E. Clusters built on the basis of enterprises interaction with technological innovations with competitors and other enterprises in the same industry
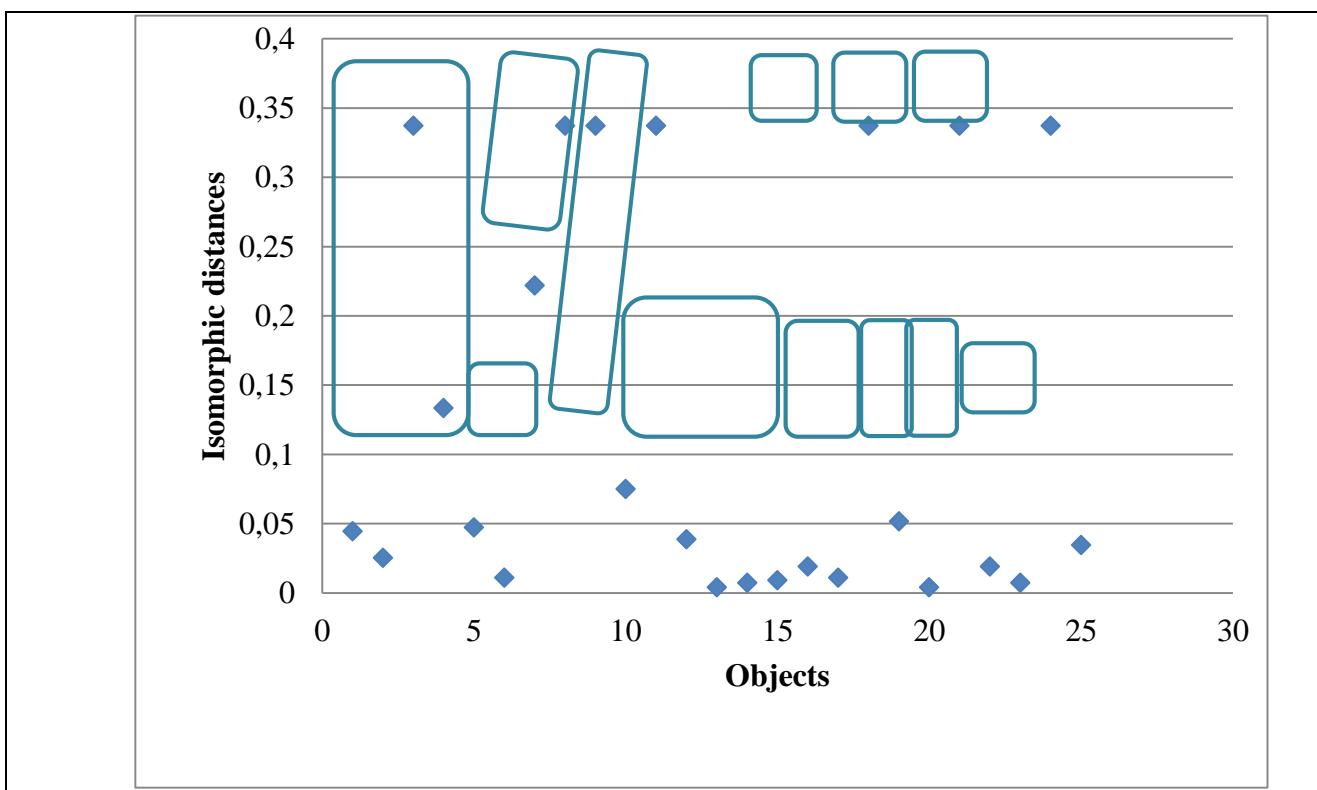
Fig. F. Clusters built on the basis of enterprises interaction with technological innovations with consultants and commercial laboratories
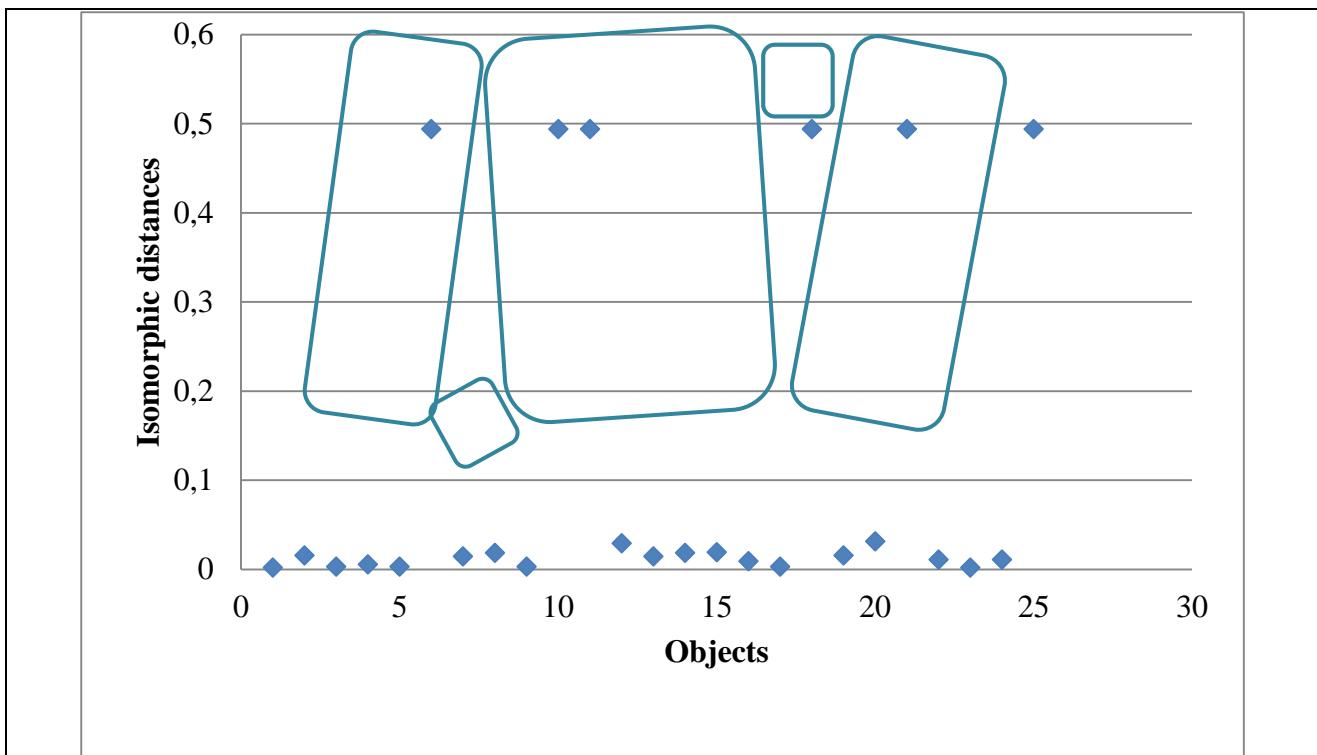
Fig. G. Clusters built on the basis of enterprises interaction with technological innovations with universities and other free economic zones

Fig. H. Clusters built on the basis of enterprises interaction with technological innovations with research institutes

Fig. 2.13. Clusters built on the basis of enterprises interaction with technological innovations with different partners

(generated by the author)

Given that the data on the Autonomous Republic of Crimea were only partial, it is generally correct to assume that partnerships with suppliers of equipment, materials, software components, customers or buyers of the business sector, as well as research institutes are equally common to all enterprises with technological innovations in Ukraine. In the case of partnerships with competitors and other enterprises in the same industry, consultants and commercial laboratories, universities and other higher education institutions, the results of clustering were not so homogeneous (Fig. 2.13 (e, f, g)). This indicates certain features of the specialization of areas, as well as the level and structure of entrepreneurial activity in different regions. Thus, in particular in Fig. 2.13 (e and f) we see that 11 and 12 clusters were formed, respectively. Among the set of clustering objects, we observe quite a few singletons, that is, clusters, the sets of which contain only one object, and in Fig. 2.13 (e and f) formed 6 singletons.

Constructed clusters allow you to clearly see the distances between the studied objects, but do not allow you to track the relationships between them. A logical continuation of cluster analysis is the construction of dendrites by using the above chains and interchain distances.

The next stage of cluster analysis is the selection of those areas of Ukraine where the activities of enterprises with technological innovations have the most signs of similarity (Appendix B).

It should be noted that despite the different entrepreneurial activity in the regions of Ukraine and their specialization, which led to the formation of clusters among enterprises with technological innovations, it is necessary to establish linear links between different regions, formed on the basis of joint innovation processes between research partners.

In Appendix B, based on the original data matrix, the chains of the studied objects and the matrix of interchain distances within each of the 8 clusters are given (see Fig. 2.13).

For cluster 1, built on the basis of enterprises interaction with technological innovations with enterprises within its group of enterprises in the region, Figure 2.14 shows a graphical representation of the chain of objects and the matrix of interchain distances.

Built for cluster № 1

```
1 (3):   [ 1 ] —0,033488— [ 6 ] —0,010951— [ 17 ]

2 (5):   [ 2 ] —0,025388— [ 14 ] —0,064169— [ 12 ] —0,051744— [ 19 ] —0,123215—

3 (7):   [ 3 ] —0— [ 8 ] —0— [ 9 ] —0— [ 11 ] —0—

4 (2):   [ 4 ] —0,133531— [ 10 ]

5 (3):   [ 5 ] —0,02813— [ 22 ] —0,019068— [ 16 ]

6 (5):   [ 7 ] —0,029342— [ 20 ] —0,004125— [ 13 ] —0,009091— [ 15 ] —0,034661—
```

Matrix of interchain distances

Chains	1	2	3	4	5	6
1	0 (0; 0)	0,199741 (17; 23)	0,545722 (1; 3)	0,074921 (1; 10)	0,06292 (17; 5)	0,415942 (17; 25)
2	0,199741 (17; 23)	0 (0; 0)	0,789901 (23; 3)	0,3191 (23; 10)	0,089623 (23; 16)	0,092986 (19; 25)
3	0,545722 (1; 3)	0,789901 (23; 3)	0 (0; 0)	0,33727 (3; 4)	0,653081 (3; 5)	0,535301 (0; 0)
4	0,074921 (1; 10)	0,3191 (23; 10)	0,33727 (3; 4)	0 (0; 0)	0,18228 (10; 5)	0,535301 (10; 25)
5	0,06292 (17; 5)	0,089623 (23; 16)	0,653081 (3; 5)	0,18228 (10; 5)	0 (0; 0)	0,305824 (16; 25)
6	0,415942 (17; 25)	0,092986 (19; 25)	0,535301 (0; 0)	0,535301 (10; 25)	0,305824 (16; 25)	0 (0; 0)
Minimum distances between the chains	0,06292 (1; 5)	0,089623 (2; 5)	0,33727 (3; 4)	0,074921 (4; 1)	0,06292 (5; 1)	0,092986 (6; 2)

Fig. 2.14. Chains of researched objects and matrices of interchain distances within cluster 1, built on the basis of enterprises interaction with technological innovations with enterprises within their group of enterprises (formed by the author)

After the construction of dendrites determine the shape of the data trace - a spatial form that takes a set of experimental points. In the method of spheres, the critical radius is understood as the distance that determines the belonging of an object to a given cluster.

With the help of these data it is possible to build a dendrite - a tree-like structure of linear connections between the regions of Ukraine for the presence of common features in establishing a partnership of enterprises with technological innovations for the implementation of innovative projects.

To visualize such a partnership is shown in Fig. 2.15 is an example of such a dendrite that is constructed for cluster 1.
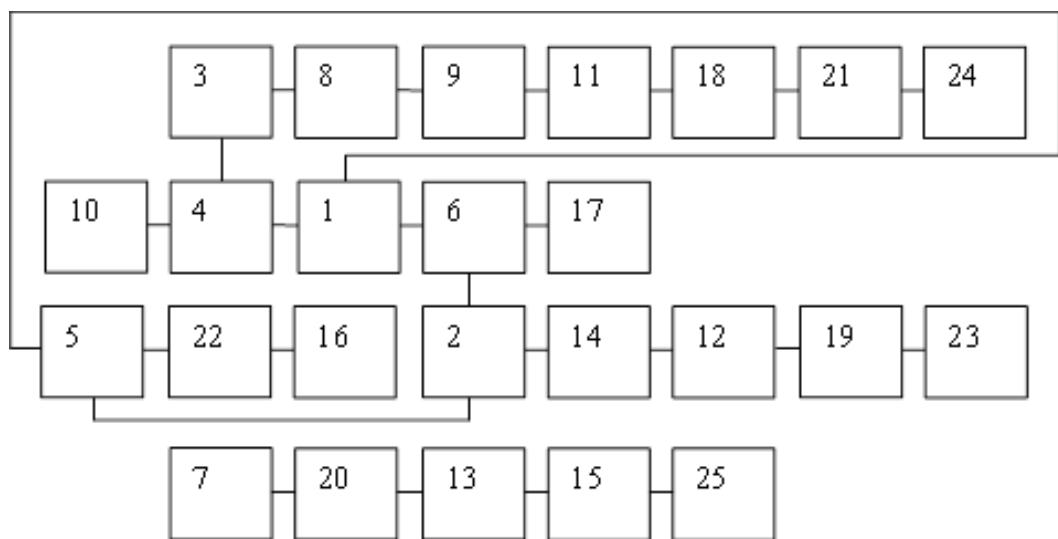
Fig. 2.15. Dendrite for a cluster built on the basis of enterprises interaction with technological innovations with enterprises within its group of enterprises (formed by the author)

As you can see in Figure 2.15, two autonomous dendrites were formed: the first of them includes objects: 7, 20, 13, 15 and 25, the second - all other objects. Linear relationships between the objects studied indicate that partnerships between enterprises that own technological innovations and other organizations have other objects of cooperation.

The similarity of these objects is typical for objects combined into common dendrites. The identified circumstance can be explained by the fact that enterprises with technological innovations, in addition to innovative

ones, also implement other projects, as well as produce and sell products that do not belong to high-tech.

In the table. 2.13 shows the distribution of enterprises with technological innovations in Ukraine by type of partner with which the innovative activity was carried out in terms of economic activities on average for the period 2008-2020.

Table 2.13. Distribution of enterprises with technological innovations in Ukraine by type of partner with which innovative activity was carried out in terms of economic activities during 2008-2020

Types of economic activity	Types of partners							
	within its group of enterprises	suppliers of equipment, materials, software	customers or buyers of the business sector	public sector customers or buyers	competitors, other enterprises in the same industry	consultants, commercial laboratories	universities and other higher education	research institutes
Industry	34,37	0,45	1,81	0,38	0,05	1,50	1,04	5,60
The mining industry	46,77	0,41	2,26	0,24	0,01	9,33	2,89	3,20
Processing industry	33,47	0,47	1,73	0,42	0,05	1,53	0,92	5,96
Supply of electricity, gas, steam and air conditioning	41,63	0,30	2,86	0,16	0,07	0,23	8,33	4,88
Water supply; sewerage, waste management	40,40	0,32	2,69	0,15	0,09	1,00	1,92	2,24
Services	19,83	0,31	2,58	0,44	0,11	1,65	0,89	2,41
Wholesale trade, except of motor vehicles and motorcycles	36,63	0,38	2,21	0,32	0,06	1,17	1,95	1,66
Transport and warehousing	44,33	0,34	2,63	0,23	0,06	2,67	0,53	5,81
Information and telecommunications	40,97	0,41	2,14	0,50	0,07	1,40	0,80	3,04
Professional, scientific and technical activities	8,07	0,11	7,11	0,40	0,25	2,74	0,37	2,26
Financial and insurance activities	42,93	0,44	2,19	0,33	0,01	1,00	1,00	36,33
Activities in the fields of architecture and engineering; technical tests and research	40,73	0,50	1,68	0,44	0,01	1,00	1,00	75,67
Research and development	44,17	0,64	1,17	0,53	0,01	1,00	1,00	148,67
Advertising and market research	36,53	0,56	1,31	0,57	0,01	1,00	1,00	21,00

Note: calculated by the author on the basis of [278].

[278] Derzhavna sluzhba staty`sty`ky` Ukrayiny`, 2020. Naukova ta innovacijna diyal`nist` Ukrayiny` [State Statistics Service of Ukraine, 2020. Scientific and innovative activity of Ukraine]. URL: https://ukrstat.org/uk/druk/publicat/ kat_u/publnauka_u.htm.

Listed in table. 2.13 data indicate that enterprises with technological innovations implement innovative projects together with partners in almost all types of economic activities.

The most intensive are partnerships in mining and processing, electricity, gas, steam and air conditioning, water supply, sewerage, waste management, services, transport and warehousing, information and telecommunications, professional, scientific and scientific-technical activities, financial and insurance activities.

In terms of these activities, there are more than 2 types of partners with values of more than 2% of the total participation in innovation projects implemented jointly with enterprises with technological innovations.

We will continue the cluster analysis by examining the connections of enterprises with technological innovations with foreign partners.

As the initial matrix we apply table. 2.14, where the first column contains the names of grouping objects (regions), and in other columns - indicators characterizing the number of enterprises with technological innovations in the regions (second column) and the number of foreign partners from Europe (third column), USA (fourth column), China and India (fifth column), as well as other countries (sixth column).

Using the same technique as during the previous clustering (3.1) - (3.3), we construct matrices of isomorphic distances and calculate the critical points on their basis (Table 2.14). As we can see (see Table 2.15 and Fig. 2.16), the studied populations, with few exceptions, are quite monolithic. Intermediate calculations of the matrix of isomorphic distances are given in Appendix C, and calculations of interchain distances are given in Appendix D.

Table 2.14. Regional distribution of enterprises with technological innovations in Ukraine by countries of origin of foreign partners with which innovation activities were carried out during 2008-2020

Oblast	Average values of regional distribution of enterprises with technological innovations in Ukraine to the total number of enterprises	European countries	USA	China and India	Other countries
Lviv	31,175	7,18	6,1	0,82	3,38
Ivano-Frankivsk	18,785	6,6	1,9	0,9	1,94
Transcarpathian	38,40333	13,66	0,9	0	1,26
Rivne	41,7	4,86	1,1	1,2	0,96
Ternopil	38,05	7,36	1,50	3,10	82,86
Volyn	37,65333	9,88	0	1,2	3,58
Chernivtsi	23,93333	9,24	1,24	0	48,4
Khmelnytsky	33,65667	5,64	1,0	0,72	3,8
Zhytomyr	58,705	10,5	0	1,5	5,56
Kyiv	39,25333	10,86	1,06	0,7	4,82
Chernihiv	32,45	8,32	10,5	2,4	4,32
Sumy	41,90833	10,54	1,9	1,6	9,92
Zaporozhye	22,66167	7,74	1,8	2,48	7,12
Dnepropetrovsk	40,43	8,02	1,32	0,74	8,22
Kherson	35,145	9,38	0,84	1,32	4,58
Odessa	33,285	6,76	1,36	1,26	6,62
Mykolayiv	36,47	7,96	1,62	2,0	4,44
Crimea	9,516667	3	2,3	1,3	2,88
Kharkiv	35,83333	7,62	0,98	1,14	5,26
Donetsk	46,86667	11,14	1,32	1,16	15,16
Luhansk	54,9	13,82	1,2	4,38	8,82
Vinnytsia	42,15667	6,24	0,5	0,66	3,22
Kirovograd	41,28667	6,44	0,98	1,64	5,26
Poltava	34,03667	7,24	1,1	2	7,42
Cherkasy	13,24333	4,46	1,9	1,2	2,98

Note: compiled by the author based on [279].

[279] Derzhavna sluzhba staty`sty`ky` Ukrayiny`, 2020. Naukova ta innovacijna diyal`nist` Ukrayiny` [State Statistics Service of Ukraine, 2020. Scientific and innovative activity of Ukraine]. URL: https://ukrstat.org/uk/druk/publicat/ kat_u/publnauka_u.htm.

Table 2.15. Critical points, shares of enterprises

Oblast	Partners			
	European countries	USA	China and India	Other countries
Lviv	**0,018995**	0,077987	0,009773	0,011515
Ivano-Frankivsk	0,004167	0,078664	0,047039	0,022318
Transcarpathian	0,004167	0,03701	**0,396524**	**0,152265**
Rivne	0,077964	0,007498	0,030662	0,040097
Ternopil	0,008849	0,012499	0,006582	0,011073
Volyn	0,005987	**0,42785**	0,000611	0,001022
Chernivtsi	0,027434	0,047153	**0,396524**	0,011073
Khmelnytsky	0,022556	0,017517	0,047735	0,011515
Zhytomyr	0,022556	0,269444	0,009773	0,001022
Kyiv	0,012632	0,004083	0,007878	0,002541
Chernihiv	0,006477	0,053431	0,024159	0,006509
Sumy	0,000321	0,0072	0,003008	0,017693
Zaporozhye	0,0048	0,078664	0,054663	0,010267
Dnepropetrovsk	0,008283	0,003434	0,007878	0,007542
Kherson	0,005987	0,002129	0,002775	0,006509
Odessa	0,008283	0,012499	0,002775	0,007542
Mykolayiv	0,009094	0,0072	0,023697	0,002541
Crimea	0,022701	0,045625	0,058365	0,013236
Kharkiv	0,000101	0,004083	0,000611	0,028987
Donetsk	0,011155	0,009524	0,010656	0,010267
Luhansk	0,000321	0,021077	0,006582	0,028987
Vinnytsia	0,017721	0,179484	0,038189	0,053658
Kirovograd	0,017721	0,002129	0,01401	0,006844
Poltava	0,000101	0,003434	0,023697	0,011019
Cherkasy	0,0048	0,077987	0,032642	0,011019

Note: critical points are highlighted in bold
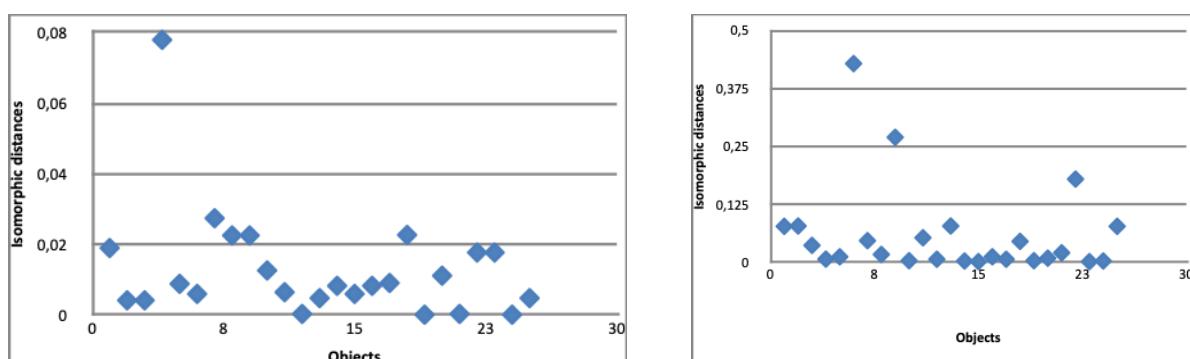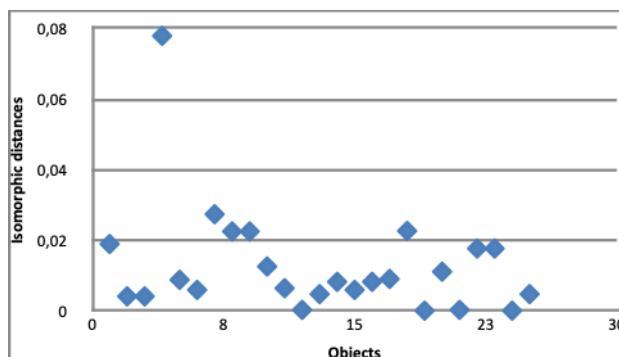
a) Clusters built on the basis of interaction of enterprises with technological innovations with partners from European countries

b) Clusters built on the basis of interaction of enterprises with technological innovations with partners from the USA
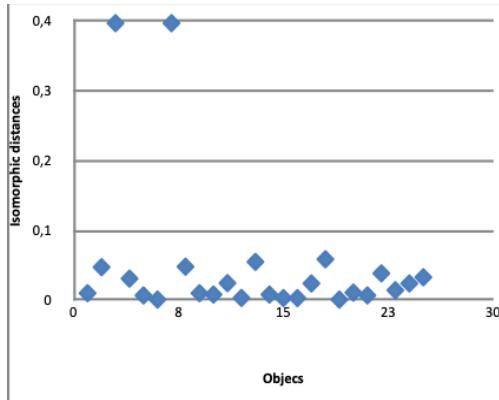
c) Clusters built on the basis of enterprises interaction with technological innovations with partners from China and India
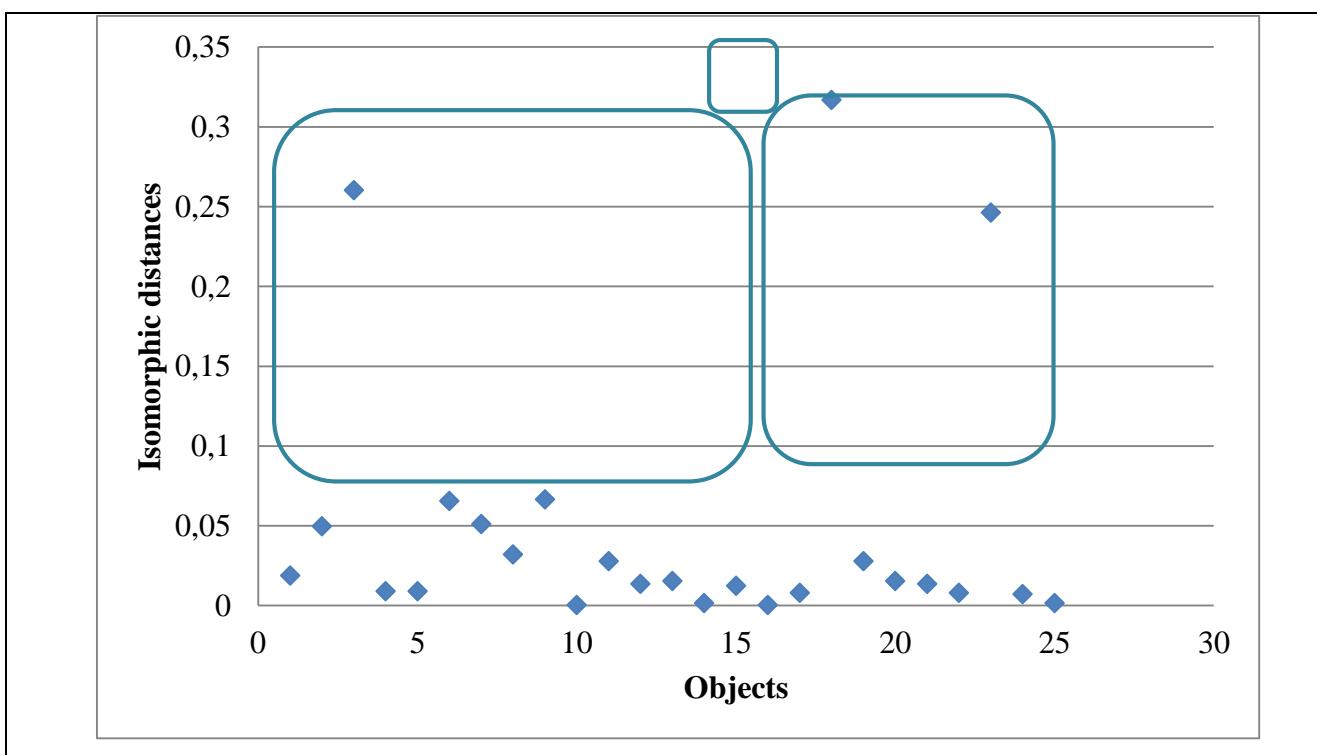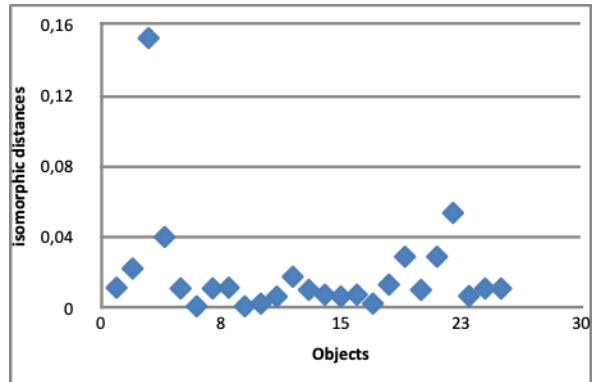

d) Clusters built on the basis of enterprises interaction with technological innovations with partners from other countries

Fig. 2.16. Clusters built on the basis of interaction of enterprises with technological innovations with foreign partners (formed by the author)

Based on the results of the cluster analysis of innovation cooperation with foreign partners, it can be concluded that in all regions of Ukraine enterprises with technological innovations implement innovative projects with the participation of partners from EU countries.

Against this background, only Lviv oblast differs, the importance of which turned out to be critical, which can be explained by the fact that in the Western region Lviv is the largest industrial and economic center, where the tourism and IT industry has been growing rapidly in recent years. Lviv IT cluster is one of the most successful in Ukraine. Its members are one of the most dynamic employers and exporters of high-tech services. Over the last year, 70 new companies have appeared in Lviv, their total number has increased from 247 to 317 companies. Thus, the growth dynamics is 28% per year. The structure of the market remains unchanged: 90% of the market consists of small and medium-sized companies, 10% – large (with more than 250 employees), while half of Lviv's IT specialists work in large companies. The number of IT professionals is also increasing with an average annual dynamics of 25%: the study shows that as of 2018 – in Lviv there are 20-21 thousand IT professionals, based on previous data in 2017, when the number

of IT professionals reached – 15- 17 thousand [280], we can predict that by the end of 2021 in Lviv there will be 28 thousand IT professionals.

Regarding the cooperation of enterprises with technological innovations with partners from the USA (Fig. 2.16 (b)), the regional specifics of the Western region are also well visible here, where five of the eight oblasts are united in one cluster, and all other oblasts of Ukraine, with the exception of Volyn oblast, they form one large cluster out of 19 regions. As we see, such a giant cluster was formed in Fig. 2.16 (d), which indicates the all-Ukrainian typical forms of interaction of enterprises with technological innovations with foreign partners for the implementation of innovative projects.

Against the background of the constructed clusters (Fig. 2.16 (a, b, d)) the most diversified is the cluster presented in Fig. 2.16 (c). The critical values revealed by the indicators of Transcarpathian and Chernivtsi oblasts developed the studied population into as many as four clusters. This is due to the fact that during the study period in Chernivtsi and Transcarpathian oblasts no partners of enterprises with technological innovations from China and India were identified.

In general, as we see from table. 2.15 and fig. 2.16, in all constructed clusters of the North, South, East and Central regions are a common set of objects, these are indicators which characterize the relationship of enterprises with technological innovations with foreign partners do not differ significantly. The peculiarity of the Western region is, first of all, the diversification of the specifics of economic activities by oblasts, as well as the fact that the Western region has the largest number of oblasts, in addition, most of them are border. In addition, unlike other regions of Ukraine, there are relatively few large enterprises in the Western regions. According to the regional departments of the State Statistics Service, in Western regions more than 80%, and in some regions more than 90% of all enterprises belong to the category of small. Thus, another reason for the identified clustering is that in the West the share of enterprises with technological innovations among small and medium enterprises is high. According to the matrices of minimum distances between objects, we can

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280 Ekonomichny`j efekt IT-galuzi L`vova syagnuv rekordnoyi sumy` – majzhe mil`yard dolariv [The economic effect of Lviv's IT industry has reached a record amount - almost a billion dollars]. URL: https://itcluster.lviv.ua/ekonomichnyj—efekt—galuzi—lvova—syagnuv—rekordnoyi—sumy—majzhe—milyard—dolariv/.

conclude that in the West, enterprises with technological innovations have the highest level of structural, isomorphic similarity.

The expected result of the study is to identify regions for which the number of enterprises with technological innovations and the types of foreign partners coincide, and those where such a coincidence is not found.

In all the built clusters of innovation cooperation, the regions of the North, South, East and Central regions are a common set of objects, these are indicators that characterize the links of enterprises with technological innovations with foreign partners do not differ significantly.

The peculiarity of the Western region is, first of all, the diversification of the specifics of economic activities by oblasts. The Western region has the largest number of oblasts, and most of them are border areas. In addition, unlike other regions of Ukraine, in the western oblasts there are relatively few large enterprises: according to the regional departments of the State Statistics Service in the western oblasts more than 80%, and in some oblasts more than 90% of small businesses.

Thus, we can say that the number of foreign partners determines the level of innovation activity in the region. Implementation of joint activities in innovation processes provides participants of interaction systems with greater diversification of project risks, more stable profits and a higher level of financial stability.

The results of the evaluation of innovation activity of the regions of Ukraine and generalization of world experience in implementing regional innovation policy allowed us to generalize that the decisive role in the formation of clusters interaction in regional innovation processes belongs to educational and research entities as generators of innovation process and centers of high innovation potential for ensuring the socio-economic development of the region. The use of statistical tools allowed to single out five clusters according to the level of partnership development of the subjects of the innovation process with such partners as the institutions of higher education (Table 2.16).

Table 2.16 presents the qualitative characteristics of the selected clusters and identifies development priorities. In particular, the first cluster, which includes Lviv, Ivano-Frankivsk, Transcarpathian, Rivne, Volyn oblasts, revealed a high level of innovation activity of enterprises and a high level of innovation cooperation with foreign partners. The development and implementation of the innovation process is ensured by a high level of small

innovative business development, which initiates the launch of innovative projects, so to increase the use of innovation potential and increase the innovative attractiveness of these areas should be important to optimize sources and cost of investment, development and subjects of the innovation process.

Table 2.16. Grouping of regions of Ukraine according to the level of development of innovative cooperation of innovative active enterprises with higher education institutions

Number of oblasts in the cluster	Oblasts of Ukraine	Priority characteristics	Substantiated strategic development priorities
5	Lviv, Ivano-Frankivsk, Transcarpathian, Rivne, Volyn	High level of innovation activity and high level of innovation cooperation with foreign partners, development of small innovative business	Development of financial instruments, public-private partnership to optimize the size and structure of funding
2	Ternopil, Chernivtsi	Above average level of innovation activity and high level of innovation cooperation	Promoting the allocation of material and management resources to support «growth points» and areas of innovative development
9	Khmelnytsky, Zhytomyr, Kyiv, Chernihiv, Sumy, Zaporizhia, Dnipropetrovsk, Kherson, Odessa	Average level of innovation activity and average level of innovation cooperation	Promoting the development of information and communication infrastructure
2	Mykolaiv, Crimea	Average level of innovation activity, high level of innovation cooperation	Development of research centers and an established mechanism of interaction between the subjects of the region
7	Kharkiv, Donetsk, Luhansk, Vinnytsia, Kirovohrad, Poltava, Cherkasy	High level of innovation activity and level of innovation cooperation with domestic partners, high level of industrial development, availability of scientific development centers	Development of innovation culture, support of small innovative business

Note: generated by the author.

The business environment prefers the acquisition of external knowledge from foreign partners. At the same time, the results of research generated in higher education institutions remain out of the attention of both enterprises and local governments.

Summarizing the cluster analysis of indicators of innovation cooperation in Ukraine during 2008-2020, in the context of developing recommendations for building systems of interaction in innovation processes in the region, it is necessary to identify priority features of building systems of interaction and group regions by selected features.

First, it should be noted that domestic entities in the implementation of innovation activities in the region do not actively cooperate with each other and with other stakeholders.

In addition, for the implementation of innovation cooperation and the formation of interaction systems in innovation often turned to domestic partners during the analyzed period. Domestic partners, according to the data, most often found a partner in Ukraine in 2012-2014 – 14.1%, in 2014-2016 – 30,3%, in 2016-2018 – 52,9%. This trend towards the development of domestic partnership may be observed in the future. In order to implement innovations in 2019, 177 companies purchased 885 new technologies in Ukraine, 55 companies purchased 112 technologies abroad [281].

The formation of innovative cooperation for enterprises with technological innovations with domestic partners is closer in terms of cost and information and communication parameters.

The largest share among the selected partners are suppliers of equipment, materials, components, software (13,9% in 2012/2014, 26,1% in 2014/2016, 52% in 2016/2018), but such partners cannot be considered the initiators of the formation of interaction systems. World experience shows that the most effective cooperation is in the triad «business - science – government», while industrial enterprises did not actively cooperate with research institutes (average 5,6%), universities (average 1,04%). Service enterprises mostly entered into partnerships with clients or buyers of the business sector (on average 2,58%), clients or buyers of the public sector (on average 0,44%).

Partnerships in various forms were more often chosen by large enterprises, and this share was constantly growing (from 34,1% in 2008/2010 to 65,4% in 2018/2020).

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281 Innovacijna diyal`nist` v Ukrayini u 2019 roci: naukovo—anality`chna dopovid` [Innovative activity in Ukraine in 2019: scientific-analytical report] / Py`sarenko T. V., Kvasha T. K., Rozhkova L. V., Kovalenko O. V. K. : UkrINTEI, 2020. 45 s. S. 38. URL: https://mon.gov.ua/storage/app/media/ innovatsii-transfer-tehnologiy/2020/08/za-2019-1-1.pdf.

Secondly, a typical partner is a large enterprise, although small and medium-sized enterprises are the carriers of new ideas and contribute to the innovative development of the country and the region.

The analyzed data of statistical forms prove insufficient activity of interaction in innovation processes in Ukraine. The problems of activation can be solved through the formation of a mechanism for establishing cooperation through the search and stimulation of potential partners.

The set of regions of Ukraine on individual indicators of development of interaction in innovations is homogeneous, and average values of these indicators in Ukraine are typical. Therefore, the operation of average values to characterize the typical regional development of innovation cooperation can be considered correct.

Analyzing the territorial disproportion of indicators of innovation cooperation, we note that this division of regions is due to two factors, and therefore when forming clusters on this basis of partnership with higher education institutions, the similarity of the relationship between these factors is taken into account.

Interest in the formation of interaction systems should be initiated by the direct subjects of the innovation process and realized through the revival of communications at all levels of the regional innovation system.

The results of clustering should be an information support for monitoring the effectiveness of innovation processes in the national innovation ecosystem, their study to identify patterns of change in their characteristics in different economic and social conditions, and sound conclusions and proposals should be the basis for regional innovation policy and innovation policy of economic entities.

CHAPTER 3

DIRECTIONS OF OPTIMIZATION OF INNOVATION AND INVESTMENT COMPONENT OF THE COUNTRY'S INTERNATIONAL COMPETITIVENESS

3.1. Economic and social instruments of the mechanism of development of interaction systems

For the development of systems of interaction in innovation processes as a factor of increasing international competitiveness, it is necessary to form a set of socio-economic tools, the use of which will allow to ensure balanced innovative development of the region. Priority tools for cooperation should include methods of smart specialization, public-private partnership, creation of regional networks of innovations, science and technology, regional agencies of innovation development, organization of transfer of results of innovation process in business environment, which provides a set of measures for forming «communication platforms» in real and online spaces to encourage cooperation between all actors in the innovative development of the state.

The mechanism of development of interaction systems in innovation processes involves the involvement of such a tool as transfer. Through effective technology transfer, the innovative development of countries and individual regions can really help the economy return to a higher growth trajectory.

Today, innovative development as a factor in increasing international competitiveness and intensification of innovation in particular depend on the level of interaction between the subjects of the innovation process, which produce knowledge, develop innovative products or ensure the production and sale of innovative products.

The intensification of transfer processes has taken place at different rates with foreign partners. In the domestic market in 2018 compared to

2017 there was an increase in the number of transferred technologies by 1.7%, in the foreign market – by 5.6% [282, p.181].

According to the statistics of the Ministry of Education and Science of Ukraine [283], during 2014 - 2018, 18,121 agreements on technology transfer were concluded for a total amount of UAH 494,24 million. The largest number of contracts was concluded in 2014, but the largest amount of funds under the concluded contracts was received in 2017 – UAH 144.52 million. However, with the tendency to increase the amount of funds received under technology transfer agreements, there is a simultaneous decrease in the number of concluded agreements, that is the average cost of one technology transfer agreement increases: the highest average cost of one such agreement was reached in 2017 – 45.18 thousand UAH, the lowest average cost was noted in 2014 – 12,20 thousand UAH. The imbalance between the generation of scientific and technical developments by Ukrainian business entities and the number of agreements on their transfer indicates a decrease in the level of competitiveness of the technological sector of the country's economy in both domestic and international arenas.

Insufficient development of interaction of innovatively active business entities on the basis of transfer of scientific and technical developments in Ukraine is evidenced by the data of the Innovation Index of the European Innovation Scoreboard. Thus, according to this index, low indicators of development of the innovation environment of Ukraine in 2017 are «communications and entrepreneurship» (9,5%), «innovation environment» (4,1%) [284, p.166]. Experts [108, p.166] note that Ukraine loses the competitiveness of its innovation potential in the final stages of the innovation cycle, where a commercial result from the transfer of scientific and technical developments should be provided.

The importance of paying attention to ensuring the effective transfer of scientific and technical development is confirmed by the provisions

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282 Lazarenko Yu. O. Peredumovy` zaprovadzhennya vidkry`ty`h innovacij u pidpry`yemny`cz`komu sektori Ukrayiny` [Prerequisites for the introduction of open innovations in the business sector of Ukraine]. *Molody`j vcheny`j.* 2014. # 12 (1). S. 179—183.

283 Ministerstvo osvity` i nauky` Ukrayiny`. Anality`chna dovidka shhodo napryamiv vy`kory`stannya koshtiv, oderzhany`h u rezul`tati transferu tehnologij, stvoreny`h za rahunok koshtiv derzhavnogo byudzhetu [Ministry of Education and Science of Ukraine. Analytical information on the use of funds received as a result of technology transfer created at the expense of the state budget]. 2019. URL: https://mon.gov.ua/storage/app/media/innovatsii-transfer-tehnologiy/2019/05/03/ dovidka052019.pdf.

284 European Innovation Scoreboard 2018. URL: https://ec.europa.eu/ docsroom/documents/30705/.

declared in the documents of the European Union. In particular, in «The Europe 2020 Competitiveness Report: Building a More Competitive Europe» [285, p. 3] states that reforms aimed at education, R&D and innovation, which are crucial for building a smarter economy and restoring growth, are important for increasing competitiveness in the medium and long term.

However, modern market demands for technology transfer, due to the above and other economic events and phenomena, are growing much faster than the development of methodological support for scientific and technical development. Not only the efficiency of their transfer, further market development, opportunities to finance further developments, convergence, diffusion, etc., but also opportunities to establish cooperation in innovation processes depend on the sound methodological support of scientific and technical development.

One of the problematic issues, the unresolved issue of which slows down the transfer, commercialization and effective market launch of scientific and technical development, and, accordingly, the innovative development of the subjects of their transfer, lies in the plane of pricing. Successful competition of innovatively active enterprises in modern markets is impossible without an effective methodological justification of competitive prices for scientific and technical research carried out by them. This problem necessitates a review of current requirements and approaches to the development of methodological support for competitive pricing for STR, which would meet modern market demands.

The methodological principles of pricing for innovative technologies are widely represented in world economics, while the methods of setting prices for scientific and technical development taking into account the changing market, in particular for the needs of transfer agreements, are much less developed than required by the modern market. The reason for this is the low rate of dissemination and perception by scientists and practitioners of modern views on the role of new scientific and technical development value in the generation of innovative technologies at the macro level, as well as a significant level of subjectivity and complexity of research on the impact of factors on scientific and technical research development - at the micro level.

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285 The Europe 2020 Competitiveness Report: Building a More Competitive Europe. 2020. URL: http://reports.weforum.org/the-europe-2020-competitiveness-report/#.

This indicates the need to provide businesses as participants in the innovation process with the necessary methodological tools based on the use of econometric tools. It is advisable to develop a pricing model for scientific and technical development, which will take into account their technical and economic features, the diverse interests of market stakeholders in innovation and the dynamism of today's changing market.

The growing role of business entities that generate scientific and technical development in terms of interaction with other participants in the innovation ecosystem, their decisive influence on scientific and technological progress led to the need to revise this issue and develop a pricing model for scientific and technical development on the basis of econometrics, which will maximize factors influencing the price.

There are different approaches to pricing that take into account current market characteristics. In particular, A. Zivkovic and M. Igelman propose to optimize product prices using business segmentation [286]. J. Tellefsen proposed to use the pricing tool as a multidimensional multi-level book that allows the user to select and edit selected parameters at any level or size [287].

Important for theory and practice is the non-stationary panel approach to price determination proposed by P. Ashworth and J. P. Byrne. In particular, wholesale price equations for 13 OECD countries have been identified and evaluated in an attempt to determine the relative importance of various cost and demand factors. These authors find that balanced prices are determined by a combination of domestic costs and prices of foreign competitors [358].

Scientific and technical development transfer, as a process of technology transfer, has its own features of pricing in terms of technology transfer agreements between countries, which in particular considered by A. M. Rugman, L. Eden (Eds.) [288], D. Mescall, K. J. Klassen [289, p. 835].

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286 Tellefsen J. E., Johnson J. D. Systems and methods for price optimization using business segmentation. 2008. URL: https://patents.google.com/ patent/US20080126264A1/en.

287 Tellefsen J. E. Systems and methods for price setting and triangulation. 2014. URL: https://patents.google.com/patent/US20070294192A1/en.

288 Rugman A. M., Eden L. (Eds.) Multinationals and Transfer Pricing. Routledge, 2018. 342 p.

289 Mescall D., Klassen, K. J. How Does Transfer Pricing Risk Affect Premiums in Cross-Border Mergers and Acquisitions? Contemporary Accounting Research. 2018. 35(2). Pp. 830—865.

A. Rocha, R. Lima, M. Amorim, F. Romero highlight the impact of such a factor on pricing as the form of payment and types of payments [290, p.101].

In our opinion, the issue of pricing in the scientific and technical development should be studied on the basis of the principle of relativism, that is from the standpoint of modern preconditions and features of the market environment. It is important to consider the pricing of scientific and technical development for the needs of transfer agreements, taking into account the variability of value relations in the economy. After all, insufficient consideration of the degree of influence of an array of factors on the pricing processes on scientific and technical development can distort the price of the product, and the transfer agreement will be biased and lead to inefficient transfer and market development of scientific and technical development, and therefore will not promote interaction between market stakeholders.

Using the basic provisions of theories of innovative development, theories of competitive advantage, industrial marketing, an empirical study was conducted in the perspective of substantiating the general concept of understanding the impact of various factors on the pricing of scientific and technical development. The general concept should determine the relationship between the costs incurred by such development, the expected revenue from the use of it, the level of quality characteristics of scientific and technical development in the perspective of pricing. Aspects of scientific and technical development implementation depending on the level of its readiness and peculiarities of industrial sector development become especially important in the developed concept. Such problems are related to the difficulty of obtaining the necessary information contained in conference agreements.

As part of the development of methodological support for the transfer of scientific and technical development, it is advisable to clarify such category. To form a factors system of the adjustment coefficient, the type of scientific and technical development acquires importance: process or product, which have different modes of market competition.

Process scientific and technical development is a new or improved business process for one or more business functions. New or improved

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290 Rocha A., Lima R., Amorim M., Romero F. Payment types included on technology licensing agreements and earnings distribution among Portuguese universities. 2017. Tékhne, 15 (2). Pp. 100—107.

business processes include the following functional categories: production of goods and services; distribution and logistics; marketing and sales; information and communication systems; administration and management; product development and business processes [291].

If the object of transfer is process innovation, then pricing should take into account the following three groups of factors, which are shown in   Fig. 3.1: factors of usefulness of development and cost development factors which form consumer value factors of development, correlated to development factors of the state. Factors of the region actualize and determine the influence consumer value factors of development through the current state development factors and dynamics development factors of a certain state.
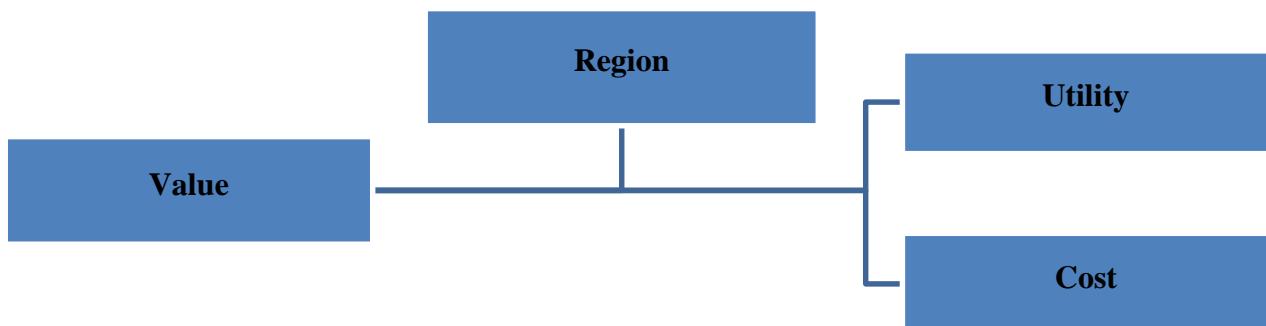
Fig. 3.1. Pricing factors for the technological form of scientific and technical development based on value (formed by the author)

Business representatives should become experts in forming a system of factors and assessing factors. Because they identify the significant factors that will determine the ability of new or improved features of the technology to increase the efficiency of business processes and assess the costs associated with the implementation and use of technology.

If the transfer agreement provides for the acquisition of the right to produce a product innovation, then consumers should also be involved in the process of forming pricing factors.

Therefore, the factors of consumer value of development should be supplemented by factors of the second order: the utility of the second order (products or services) and the cost of the second order (products or services).

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291 OECD. Oslo Manual (2018). Guidelines For Collecting, Reporting Aand Using Data on Innovation (4th edition). The Measurement of Scientific, Technological and Innovation Activities, OECD Publishing, Paris/Eurostat, Luxembourg. Retrieved from: https://doi.org/10.1787/9789264304604—en.

In the general case, the consumer value of scientific and technical development for product innovation may have different levels according to the five groups of factors, which are presented in Figure 3.2.
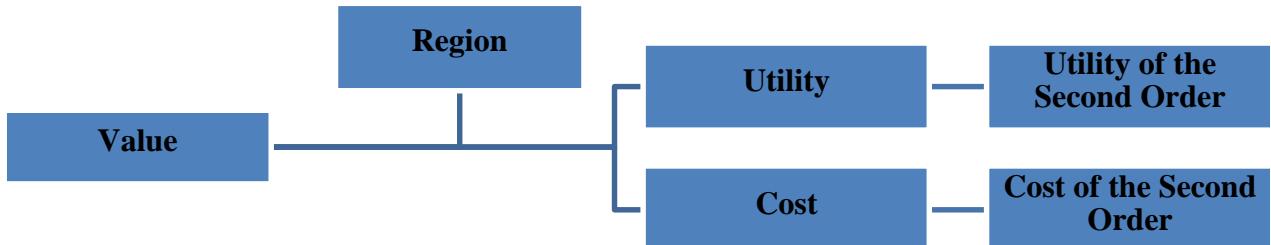
Fig. 3.2. Pricing factors for the product form of the region's scientific and technical development based on value (formed by the author)

In cases where it is necessary to take into account different types of indicators and their dependences of different levels of complexity, scientists propose to use approaches within the theory of fuzzy sets. In particular, the works of Arnold F. Shapiro [292], Yannis A. Phillis, Luc A. Andriantiatsaholiniaina [293], Andréde Siqueira Campos Boclin & Renatode Mello [294], Tomasz Korol [295] and others are devoted to this in economics. Obviously, fuzzy sets can be used in the case of assessing the factors influencing the scientific and technical development, because they are characterized by significant differences in quality.

Interaction systems development tools can be based on the use of econometric pricing models taking into account the conditions of market volatility.

The results of the study showed that the market is characterized by an array of different types of factors that in one way or another affect the prices of scientific and technical development. Assessors often neglect many factors, as most of them are quite difficult to identify and evaluate. It is even more difficult to identify interdisciplinary factors influencing scientific and

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[292] Shapiro A. F. Fuzzy logic in insurance. Insurance: Mathematics and Economics. 2004. 35(2). Pp. 399—424.

[293] Phillis Y. A., Andriantiatsaholiniaina L. A. Sustainability: an ill—defined concept and its assessment using fuzzy logic. Ecological Economics. 2001. 37 (3). Pp. 435—456. URL: https://www.sciencedirect.com/science/article/abs/pii/ S0921800900002901.

[294] De Siqueira Campos Boclin, A. De Mello R. A decision support method for environmental impact assessment using a fuzzy logic approach. Ecological Economics, 2006. 58 (1). Pp. 170—181. URL : https://www.sciencedirect.com /science/ article/abs/pii/S0921800905003034.

[295] Korol T. A fuzzy logic model for forecasting exchange rates. Knowledge-Based Systems, 2014. № 67. Pp. 49—60. URL: https://www.sciencedirect.com/ science/article/abs/pii/S0950705114002305.

technical development and their relationships, that complicates the justification of the price taking into account changing market conditions.

In our opinion, prices for scientific and technical development can be adjusted using a correction factor - an integrated indicator that will take into account the impact of market conditions on pricing and form a model for the application of such an indicator on the example of scientific and technical development.

The developed method is the basis for the model of pricing on scientific and technical development for their transfer between market regional stakeholders, taking into account the conditions of market volatility.

Forming the adjustment factor, there is a problem not so much economic as mathematical context: indicators that reflect the specific features of the scientific and technical development and its transfer processes, market uncertainty, etc., are quite heterogeneous. These indicators are characterized by a complex level of cross-correlation, and their impact on the integrated indicator (adjustment factor) is not always obvious.

It is proposed to develop a price correction factor for scientific and technical development, which, based on the algorithms of fuzzy set theory, will allow to respond effectively to changes in market conditions (in particular, by adding or subtracting appropriate scenarios in the knowledge base, adjusting features, etc.). One of the most promising approaches of this theory to modeling and forecasting economic processes is the fuzzylogic approach, which gained popularity in economic applications in the second half of the last century.

Unreasonable pricing decisions on scientific and technical development recorded in transfer agreements can have significant negative effects both in the long run and in the current activities of business entities, which in general can lead to a weakening of the effectiveness of interaction in the system of RIS interactions.

The application of the fuzzylogic approach for the development of a method of adjusting prices for scientific and technical development during their transfer from universities to the business environment is justified by the following arguments - table. 3.1.

Under the adjustment of scientific and technical development price on the basis of fuzzy set theory we understand the process by which on the basis of available data it is possible to establish significant parameters that are not

measured directly, but determine the nature of pricing on scientific and technical development and allow to analyze changes in its state.

The criterion for the effectiveness of price adjustment for scientific and technical development within the theory of fuzzy sets is expressed by maximizing the degree of suitability of the obtained estimates for a particular market situation.

In economics, the most common models used for tasks of this type are Mamdani, Sugeno, Tzukamoto, Larsen, etc.). To adjust the price of scientific and technical development on the basis of fuzzy sets, the Mamdani model was chosen, which differs from others in that its rules contain fuzzy values (membership functions).

Table 3.1. Rationale for using the fuzzylogic approach to adjust prices for scientific and technical development

Factor	Explanation
Ability to take into account the interaction of factors influencing the scientific and technical development, interdependent with different levels of complexity	Factors influencing the change in the price of scientific and technical development can be both the specific characteristics of the scientific and technical development itself, and the characteristics of the market to which this scientific and technical development is derived (in particular, market susceptibility to this scientific and technical development), as well as the processes of its transfer. These factors are not linearly related, but are closely related, so taking them into account in the system using fuzzy set theory algorithms will help to clarify the price of scientific and technical development.
Adaptability of expert assessments	Methods based on the theory of fuzzy sets have a high adaptability to expert estimates and are quite adequate in practical use.
Combination of qualitative and quantitative assessments	The development of the scientific and technical development price adjustment factor within the framework of fuzzy set theory operates with both qualitative and quantitative forms of its implementation, which allows to assess the features, external and internal features, properties of scientific and technical development and the market, etc. The method will also make it possible to take into account estimates that pass from one state to another.
Feedback	The method of adjusting prices for scientific and technical development is based on a number of indicators that can be changed in the process of calculating the adjustment factor. For example, in the case of irrelevance of some or the need to enter other indicators, they can be replaced, along with the appropriate modification of scenarios in the knowledge base. This is based on feedback from the market entity (consumer, enterprise, etc.) to the university.

Note: generated by the author

The methodology of estimation processes based on the theory of fuzzy sets is based on a number of theoretical preconditions, in particular those set out by Zade L. (1976).

To apply the econometric pricing model for scientific and technical development, it is proposed to comply with a number of conditions, namely:

- set the base price for the scientific and technical development using the methods of the cost approach, which will allow to approve the «lower limit» of the price adjustment of this scientific and technical development in the transfer agreement;

- assess the key competitive advantages of scientific and technical development in its implementation and use in a particular market;

- to determine the manifestation of the characteristics of the scientific and technical development in relation to consumer needs under different options of the transfer agreement;

- establish a time frame for the development of scientific and technical development depending on the level of readiness and pre-determine the time period of completion in specific conditions (in particular, for: refinement of the prototype; the period of the transfer agreement; for the implementation of scientific and technical development by the buyer, consumer, etc.).

Based on the study, the factors that determine the processes of transfer, commercialization and market launch of scientific and technical development, which affect its pricing and identified them by groups of features:

1. Group A (f (x1)) - features that characterize the basic usefulness of scientific and technical development;

2. Group B (f (x2)) - features that characterize the value of scientific and technical development;

3. Group C (f (x3)) - features that characterize the region.

The objectives of innovation are to increase or provide value to the user. In the case of process innovation, the value is formed at the level of the user - the business enterprise that plans to purchase and use a new or improved process. The value of such a process can be fully assessed after implementation in the business model of the enterprise, so at the stage of transfer is assessed by the user only in advance. It should be noted that the value of process innovation can develop in the process of use, acquire new forms for partners and for different market participants.

The value of process innovation is formed by comparing the growth of efficiency of business processes of the enterprise and the expected costs of implementation and use.

Signs of consumer value can be called user-independent parameters of the model, which are formed through comparison with market counterparts selected for comparison.

Signs of the basic usefulness of scientific and technical development include the assessment of those features that are directly related to the business needs of enterprises. Therefore, the level of basic and additional technical parameters of the scientific and technical development should be included in the assessment.

Features of the improved business function include greater efficiency, effectiveness, resource efficiency, reliability and sustainability, accessibility, convenience and ease of use for those involved in the business process, both external and internal to the firm.

The basic features that shape the usefulness of scientific and technical development should also include the level of novelty by comparing the number of new parameters, the level of improvement by comparing advanced parameters, as well as comparing the complexity of scientific and technical development, which determines the level of copying by other market participants (Fig. 3.3).

Mandatory modern indicators of the usefulness of scientific and technical development should include the level of environmental impact (environmental friendliness), as the level of the feature may be a priority for certain business sectors.

The importance of such a resource as time in innovation processes grows every year and often determines the success of innovations. Therefore, the usefulness indicators of scientific and technical development should include an assessment of the usefulness of time provided by this scientific and technical development. Accordingly, the higher the level of technological readiness, patent readiness on the date of the transfer, the higher the level of usefulness of time.

Also, the usefulness of time includes the level of completeness and quality of technological support that can be provided by the developer (seller) of scientific and technical development: increasing the completeness

Evaluation methodology based on fuzzy set theory

1. The object of study can acquire a state that belongs to a finite set of states S (the action of external and internal processes changes, but the inability to measure it leads to a limitation of the set S). On the set S there are two disjoint subsets S1∪ S2, where S1 is a subset of states, which according to the level of development of features are consistent with the characteristics of the desired state; S2 is a subset of states that do not agree with the characteristics of the desired (normative or reference) state in terms of the level of development of features. The subset $S\_1 = \{s\_i\}$, $i = (1, n)^-$ contains the types of states that allow it to function and develop. The subset $S\_2 = \{s\_j\}$, $i = (1, m)^-$ contains the types of states that correspond to such changes in parameters or structural relationships that contribute to the deviations of the desired result.

2. The solution of the problem of description and assessment of the real state of the object is based on the analysis of the set S or subsets S1 and S2.

3. Evaluation is based on the position of evaluators and methods of its implementation.

4. Detection of deviations from the characteristics of the desired state means that the object is in the process of transition from state Sk to state Sl, but the operating conditions may not be violated if Sk and Sl belong to a subset of states S_1.evaluation is based on evaluators' positions and methods.

Fig. 3.3. Methodology of estimation processes based on the theory of fuzzy sets (formed by the author)

of support will reduce the time spent for the buyer in the implementation of scientific and technical development. In some business sectors, the procedure of obtaining the necessary regulatory support for the implementation of scientific and technical development (obtaining permits, etc.) is important (barrier), so the buyer is forced to spend extra time.

Indicators of the usefulness of compatibility include a study of changes in business models of the enterprise after the introduction of scientific and technical development [296]. Indicators of the usefulness of compatibility / transition include assessing the level of access to the necessary resources and the level of necessary resources that the company needs when purchasing and using scientific and technical development: financial, labor, information and material, technical, as well as the level of knowledge and competencies. That is, the buyer compares the existing level of potential with the required. In assessing the usefulness of compatibility / transition, the company should

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[296] OECD. Oslo Manual (2018). Guidelines For Collecting, Reporting Aand Using Data on Innovation (4th edition). The Measurement of Scientific, Technological and Innovation Activities, OECD Publishing, Paris/Eurostat, Luxembourg. Retrieved from: https://doi.org/10.1787/9789264304604—en.

review its own business model for the independence of the use of scientific and technical development or determine the feasibility of partial or full partnership in the market.

If an enterprise will use scientific and technical development side by side to develop or expand an existing business portfolio, it is necessary to assess the level of probability of unexpected effects from the implementation and use of scientific and technical development, as such probability is associated with risk. The group of cost indicators includes three levels of features: time spent; implementation costs; usage costs. Signs of spending time are related to estimating the time that must be spent in the company to complete and debug scientific and technical development. Increasing the cost of time inevitably leads to an increase in the cost of the buyer. The level of complexity of scientific and technical development is determined by the potential of the enterprise, so it affects the cost of time.

Indications related to implementation costs include consideration of the level of initial investment costs that must be incurred in addition to the cost of acquiring scientific and technical development: the purchase of technical equipment, staff training costs, and the cost of marketing scientific and technical development that accompanies commercialization. The level of implementation costs is also affected by the level of attractiveness of the financial conditions of the transfer, that is obtaining various forms of loans, payment or deferred payment.

The cost of using the scientific and technical development involves estimating the current cost of servicing the scientific and technical development over the expected period of use. It is also necessary to take into account the projected value of indicators of the level of economic efficiency of investment costs (commercialization), indicators of return on investment costs. After correlating the indicators of usefulness and cost of scientific and technical development, which form its value, it is advisable to consider the indicators of the use of scientific and technical development. Some indicators in the region need to be seen as barriers and some as drivers for scientific and technical development pricing. The level of indicators of the region is determined by the internal features of the sector by external market features, and includes two levels of indicators: indicators of the current state; indicators of development dynamics.

Indicators of the current state are determined by the presence and intensity of competition among similar scientific and technical development and

substitutes (the higher the level, the less impact on the price of scientific and technical development), the current value of market capacity indicators.

Indicators of the dynamics of the region include foresight indicators of scientific and technical development market renewal, scientific and technical development market development (these two indicators act as limiting factors in pricing), as well as the level of the expected period of scientific and technical development use by the company.

The description of the process of adjusting the price of scientific and technical development based on the application of fuzzy set theory can be divided into stages: 1) phassification; 2) development of fuzzy rules (generalization of antecedents and consequences; conclusion with the help of logical connections); 3) dephasification.

The analysis made it possible to identify the most popular features of the factors within groups A, B, C and assign them the meaning of linguistic terms to adjust the price of scientific and technical development using the Mamdani model (Table 3.2).

Table 3.2. Signs and meanings of linguistic terms of factors influencing scientific and technical development

Factors	Subgroups of factors	Signs	Meaning and explanation of linguistic terms of the factor
1	2	3	4
Group A (f (x1)) Usefulness indicators	Basic utility	The level of novelty of scientific and technical development	L - low level of the sign - 0… 25%; T - permissible level of the sign - 26… 50%; A - sufficient level of the sign - 51… 75%; H - high level of the sign -76… 100%
		Level of improvement of scientific and technical development	
		The level of possible unauthorized reproduction of scientific and technical development	
		The level of environmental friendliness of scientific and technical development	
		The level of basic technical parameters	
		The level of additional technical parameters	
	Utility time	The level of technological readiness of scientific and technical development	
		The level of patent readiness of scientific and technical development	
		The level of completeness of technological support by technology developers	

1	2	3	4
	Utility compatibility	The level of required regulatory support for the implementation of scientific and technical development	
		The level of probability of unexpected effects from the introduction and use of scientific and technical development	
		The level of need for various forms of interaction for use (or the level of sufficient capacity for self-implementation) scientific and technical development	
		The level of necessary material resource support for the implementation of scientific and technical development	
		The level of access to the necessary resources for the use of scientific and technical development	
Group B (f (x2)) Cost indicators	Time consuming	The level of complexity of the implementation of scientific and technical development	L - low level of the sign - 0… 25%; T - permissible level of the sign - 26… 50%; A - sufficient level of the sign - 51… 75%; H - high level of the sign -76… 100%
		The level of time spent on implementation and refinement	
	Implementation / switching costs	The level of costs for marketing support of commercialization	
		The level of initial investment costs that need to be involved for the implementation of scientific and technical development	
		The level of attractiveness of the financial conditions of the transfer of scientific and technical development	
	Usage costs	The level of costs for the current maintenance of scientific and technical development	
		The level of indicators of economic efficiency of investment costs (commercialization)	
Group C (f (x3)) Indicators of the region	Current status	Level of direct competition	L - low level of the sign - 0… 25%; T - permissible level of the sign - 26… 50%; A - sufficient level of the sign - 51… 75%; H - high level of the sign -76… 100%
		The level of competition among substitutes	
		The size of the scientific and technical development market	
	Dynamics of development	The level of time of expected use of scientific and technical development to replace or improve	
		The growth rate of the scientific and technical development market	
		The level of renewal of the scientific and technical development market	

Note: generated by the author.

The model of adjusting prices for scientific and technical development in their transfer from universities to the business environment can be expressed as a function:

S = f (Utility Indicators; Cost Indicators; Region Indicators), which is a system of functions of the following order:

f (x1) = f (Basic utility (Level of novelty of scientific and technical development; Level of improvement of scientific and technical development; Level of possible unauthorized reproduction of scientific and technical development; Level of environmental friendliness of scientific and technical development; Level of basic technical parameters; Level of additional technical parameters); Usefulness of time (Level of technological readiness of scientific and technical development; Level of patent readiness of scientific and technical development; Level of completeness of technological support by technology developers; Level of necessary normative support of scientific and technical development implementation) (obtaining permits, etc.); Usefulness of compatibility (Level of probability of unexpected effects from the implementation and use of scientific and technical development; Level of the need to establish various forms of interaction for the use (or level of sufficient potential for self-implementation) scientific and technical development; Level of required material resource support for scientific and technical development implementation; Level of access to the necessary resources for the use of scientific and technical development))

f (x2) = f (Time costs (Level of complexity of scientific and technical development implementation; Level of time spent on implementation and refinement); Implementation / switching costs (Level of costs for marketing support of commercialization; Level of initial investment costs to be involved for scientific and technical development implementation; Level of attractiveness financial conditions of scientific and technical development transfer); Usage costs (Level of costs for current maintenance of scientific and technical development; Level of indicators of economic efficiency of investment costs (commercialization))

f (x3) = f (Current state (Level of direct competition; Level of competition among substitutes; Size of scientific and technical development market); Dynamics of development (Level of time of expected use of scientific and technical development before replacement or improvement; Growth rate of scientific and technical development market; Level of scientific and technical development market renewal) .

For practical use, the econometric model of scientific and technical development pricing is proposed to be implemented as follows:

1) expertly determine the assessment of each of the signs in the range from 0 to 10, where 0 - the smallest manifestation of the sign, 10 - the largest;

2) the obtained estimates by subgroups of factors add and, applying the range from the possible minimum to the possible maximum values of each of the subgroups of factors, determine the percentage of the relevant factor;

3) the levels of factors are compared with their linguistic meanings;

4) the obtained results by groups of factors are entered into the model previously developed for these purposes in the Fuzzy Logic Toolbox component of the MATLAB software package (based on the formed knowledge base) and compared with their average values;

5) determine the price adjustment factor for scientific and technical development.

Using the Mamdani model in the Fuzzy Logic Toolbox component of the MATLAB software package, a model was developed to adjust the prices of scientific and technical development when transferring them from developers to the business environment.

On the basis of the formed set of terms of factors (tab. 4.6) the knowledge base is developed - possible scenarios of a parity of factors of usefulness of scientific and technical development (Group A), factors of cost of scientific and technical development (Group B), factors of region (Group C).

A total of 27 rules have been established and substantiated. Note that in some scenarios the weight of the rule is used, which is measured in the range [0… 1] and indicates the level of significance of a particular scenario when adjusting the prices of scientific and technical development. A fragment of such a base of rules is shown in Fig. 3.4.

1. If (Utility_indicators is Low) or (Cost_indicator is Low) or (Business_enterprise_sector_indicator is Low) then (Correction_factor is Low) (0.5)
2. If (Utility_indicators is Low) or (Cost_indicator is Middle) or (Business_enterprise_sector_indicator is Middle) then (Correction_factor is Middle) (1)
3. If (Utility_indicators is Low) and (Cost_indicator is High) and (Business_enterprise_sector_indicator is High) then (Correction_factor is Middle) (1)
4. If (Utility_indicators is Low) and (Cost_indicator is Low) and (Business_enterprise_sector_indicator is Middle) then (Correction_factor is Low) (0.7)
5. If (Utility_indicators is Low) and (Cost_indicator is Low) and (Business_enterprise_sector_indicator is High) then (Correction_factor is Middle) (1)
6. If (Utility_indicators is Low) and (Cost_indicator is Middle) then (Correction_factor is Low) (1)
7. If (Utility_indicators is Low) or (Business_enterprise_sector_indicator is Low) then (Correction_factor is Low) (0.7)
8. If (Cost_indicator is High) and (Business_enterprise_sector_indicator is Middle) then (Correction_factor is Middle) (1)
9. If (Utility_indicators is Middle) or (Cost_indicator is Middle) or (Business_enterprise_sector_indicator is Middle) then (Correction_factor is Middle) (0.5)
10. If (Utility_indicators is Middle) and (Cost_indicator is Low) and (Business_enterprise_sector_indicator is Low) then (Correction_factor is Low) (1)
11. If (Utility_indicators is Middle) and (Cost_indicator is High) and (Business_enterprise_sector_indicator is High) then (Correction_factor is High) (0.8)
12. If (Utility_indicators is Middle) and (Cost_indicator is Middle) and (Business_enterprise_sector_indicator is Low) then (Correction_factor is Middle) (1)
13. If (Utility_indicators is Middle) and (Cost_indicator is Middle) and (Business_enterprise_sector_indicator is High) then (Correction_factor is Middle) (1)
14. If (Utility_indicators is Middle) and (Business_enterprise_sector_indicator is Low) then (Correction_factor is Middle) (1)
15. If (Utility_indicators is Middle) and (Cost_indicator is High) and (Business_enterprise_sector_indicator is Middle) then (Correction_factor is Middle) (1)
16. If (Utility_indicators is Middle) and (Business_enterprise_sector_indicator is High) then (Correction_factor is Middle) (1)
17. If (Cost_indicator is Low) and (Business_enterprise_sector_indicator is Middle) then (Correction_factor is Middle) (1)
18. If (Utility_indicators is High) or (Cost_indicator is High) or (Business_enterprise_sector_indicator is High) then (Correction_factor is High) (0.3)
19. If (Utility_indicators is High) and (Cost_indicator is Low) and (Business_enterprise_sector_indicator is Low) then (Correction_factor is Low) (1)
20. If (Utility_indicators is High) and (Cost_indicator is Middle) then (Correction_factor is Middle) (1)

Fig. 3.4. A fragment of the database of rules for adjusting prices for scientific and technical development in the Fuzzy Logic Toolbox component of the MATLAB software package (created by the author)

The full calculation for the adjustment of prices for scientific and technical development in the Fuzzy Logic Toolbox component of the MATLAB software package with intermediate results is given in Appendix I.

The developed model of adjustment of the price of scientific and technical development from developers in the business environment on the basis of the theory of fuzzy sets allows:

- enter estimates for groups of features A, B, C (previously obtained by experts) and obtain the coefficient of adjustment of the price of scientific and technical development;

- the obtained coefficient takes into account the conditions of market volatility at the moment, can serve as a basis for developing a strategy for market development of scientific and technical development.

The reference surfaces of the ratio of the influences of factors on the price of scientific and technical development in the agreements on its transfer are presented in Fig. 3.5.

The method enables economic forecasting in conditions of uncertainty, in particular, it is especially important at the stage of conceptual decision-making, planning the transfer and commercialization of scientific and technical development from the university to the business environment and so on.

a)

б)
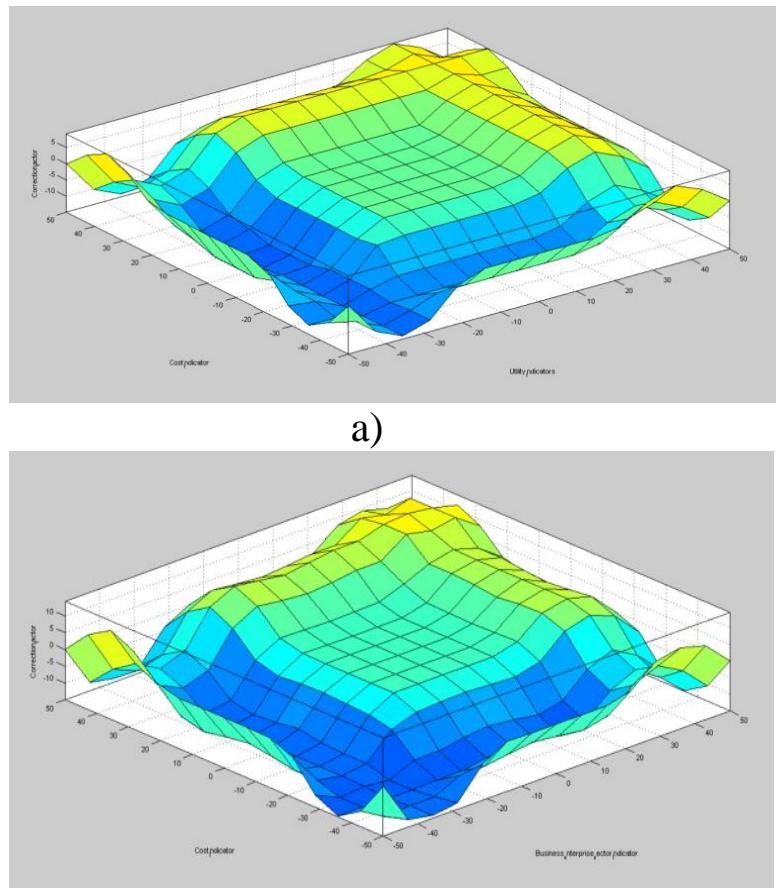
Fig. 3.5. Reference surfaces of the ratio of influences:
a) cost indicators and utility indicators for the scientific and technical
development price adjustment factor;
b) indicators of cost and indicators of the region on the corrective
coefficient of the price of scientific and technical development
(formed by the author)

The proposed method has been tested on a number of scientific and technical developments developed in the Free Economic Zone of the Western region and prepared for transfer to the business environment of the region. For example, a fragment of the price adjustment for the technology of optically stimulated fluorescent dosimetry is shown in Fig. 3.6. Other options for price adjustment are given in Annex J. The results are given in table. 3.3.

Given the peculiarities of the market situation, the groups of features can be supplemented and / or changed.

Fig. 3.6. Price adjustment of optically stimulated luminescent dosimetry technology based on the author's approach in the Fuzzy Logic Toolbox component of the MATLAB software package (fragment) (generated by the author)

Table 3.3. The results of using the econometric model of pricing on scientific and technical development for the conclusion of transfer agreements in the Western region of Ukraine

№	Scientific and technical development	Factor / Factor Estimation,%			Adjustment Ratio,%	Current Price, ths. USD	Adjusted price, ths. USD	Price change, +/-; ths. USD	Market price, analogue price, ths. USD
		Group A	Group B	Group C					
1	2	3	4	5	6	7	8	9	10
1	Technology of optically stimulated luminescent dosimetry	12.3 (M)	-0.83 (M)	26.8 (H)	5.62	25809.25	27259.72	+1450.48	29980
2	Ensuring the technological strength of welded joints with armored steel type ARMSTAL 500	11.9 (M)	36.01 (H)	49.0 (H)	15.06	120.89	139.096	+18.206	142.520

1	2	3	4	5	6	7	8	9	10
3	Device of smooth start, SSB series (SSB-21-170 model)	10.01 (M)	36.01 (H)	19.2 (M)	12.53	891.87	1003.62	+111.75	1129.05
4	Device of smooth start, SSB series (SSB-21-210 model)	-3.27 (M)	-21.34 (L)	13.46 (M)	-2.04	1284.39	1258.18	-26.21	1200.50
5	Vibrating table for vibrocompaction of concrete mix	-5.44 (M)	-22.9 (L)	-21.7 (L)	-11.89	10678.0	9408.38	-1269.61	8900.0
6	Technology of strengthening of friction of a surface of working surfaces of details of cars	-24.2 (L)	15.3 (M)	39.9 (H)	3.21	156.90	161.936	+5.036	165.89
7	Increasing the strength and reducing the material consumption of drilling equipment pipes	31.2 (H)	27.8 (H)	46.3 (H)	21.43	3400.0	4128.62	+728.62	12345.0
8	DM series magnetic plate control device	-31.6 (L)	-19.03 (M)	2.03 (M)	-3.089	277.29	268.72	-8.57	301.25
9	Information technology for processing personalized medical information	33.7 (H)	19.8 (M)	36.4 (H)	17.89	23135.0	27273.85	+4138.85	87900.0

Note: generated by the author

The obtained results show, for example, that items 1, 2, 3, 6 and 7 (according to Table 3.3) can set an even higher price (in particular, at the level of the adjusted price).

It is projected that sales of such products will not decrease, but will remain at the same level. Finally, the adjusted price is based on a number of indicators that reflect the perception in the market of the product, the level of which in these cases significantly exceeds the level of the value of scientific and technical development.

In cases 4, 5 and 8, the price of scientific and technical development should be slightly reduced, which will increase its price competitiveness in the market and, accordingly, increase its sales.

The values obtained as a result of applying the model are characterized by a fuzzy number with a certain range of values, which allows us to operate with project data, rather than probabilistic estimates. This helps to increase the level of accuracy of the scientific and technical development price when it is transferred between businesses.

Summarizing the developed methodological provisions of pricing and calculations, we note that the pricing of scientific and technical developments during their transfer between businesses is an effective tool for developing interaction between the innovation process in the region. The conducted analytical researches give the bases for development of strategic bases of management of interaction in innovative processes of the region.

The developed methodological approaches are based on taking into account changes in market conditions and on assessing the expected costs and usefulness of the transfer of scientific and technical development in the business environment of a particular region.

Methodological approaches involve the use of pricing in the mechanism of interaction based on the adjustment of prices for scientific and technical development. The mechanism of interaction between developers and consumers is based on the involvement of consumers in the stages of creating scientific and technical development through the identification of a heterogeneous set of factors influencing the process of scientific and technical development transfer.

The Mamdani model used for this purpose in the FuzzyLogicToolbox component of the MATLAB software package allows not only to aggregate different types of factors influencing the price of scientific and technical development from the correction factor, but also to take into account their interdependence, its specificity and strength. This approach is universal for use in the implementation of scientific and technical development transfer transactions, as it allows you to adjust both the value of the factors and the list of factors and the weight of their estimates. Also, this approach can be applied regardless of the stage of readiness of the scientific and technical development and depending on the possibility of its transfer (in particular, in situations where the buyer is ready to purchase the scientific and technical development at the initial stage of readiness).

The advantages of the proposed pricing models for scientific and technical development transfer agreements and the development of cooperation in innovation processes in the region are as follows:

- justification of the price on the basis of the author's method allows to present an adequate result of regional cooperation (taking into account the changing market conditions, the conditions of implementation of a particular buyer, characterized by flexibility, etc., the level of novelty);

- the developer gets the opportunity to more effectively manage the commercialization of scientific and technical development and involve consumers in the distribution of projected profits from the use of scientific and technical development in the business environment of the region (in particular, in most cases increases the amount of marginal profit);

- the author's approach can be applied not only to the price, but also to other parameters of pricing on scientific and technical development (management of usefulness and cost of interaction);

- the indicators used in the method may change depending on the situation on the regional market.

To intensify cooperation in innovation processes as prerequisites for the development of the region can be involved participants of different levels of government and forms of ownership, activities that will increase the efficiency of economic and social tools to intensify innovation processes.

3.2. Modelling the impact of innovation activity of economic entities on macroeconomic indicators of Ukraine

In the conditions of globalization processes and rapid diffusion of innovations, the tendencies of development of national innovation systems largely determine the priorities and organizational and technological mechanisms for solving the problems of economic development of the regions of the state. Indicators of the efficiency of the innovation system form the level of development of the national economy as a whole, because investing in innovation processes on the one hand is possible with stable sustainable development of the country's economy, and on the other serves as a tool to increase innovation growth in the regions.

In Ukraine, the monitoring of innovation processes can be assessed mainly through a certain system of indicators in the forms of statistical reporting. The conclusions of the evaluation become tools for making management decisions at different levels of regulation of innovation processes. However, the indicators used in such reporting are based only on the cost or expert characteristics of the innovation activity of economic entities. Therefore, they lead to ambiguous, often contradictory conclusions, unsuitable for justifying management decisions at the national level.

An important task of monitoring innovation development at the national level is to assess the impact of indicators of innovation activity of economic entities on the macroeconomic indicators of the country. This impact should be considered from the standpoint of increasing the gross domestic product (GDP) of the country and the resulting factor in the implementation of innovations - the volume of sold innovative products. This approach requires the study of models of the impact of innovation activity of economic entities on the macroeconomic indicators of Ukraine.

To monitor innovation, you can also use the approach of A.R. Stoyanovsky, which conditionally divides it into three components, namely:

- monitoring the course of innovation processes in the country (at the macro and micro levels);

- monitoring the practical consequences of state measures to stimulate and regulate innovation in the country;

- monitoring the implementation of priority areas of innovation [297, p.288].

Monitoring the flow of innovation processes in the country allows you to assess innovation processes, mainly through a certain system of indicators in the forms of statistical reporting. We consider it expedient to use the other two areas of monitoring when assessing the effectiveness of the formation of measures of state and regional innovation policy, which should be considered as a separate area of research.

The study of the data of monitoring the course of innovation processes in the country should allow to compare them with the data of international practice to identify problems and trends. Indicators of the development of innovation processes in Ukraine are regularly assessed in international

297 Stoyanovs`ky`j A. R. Osobly`vosti pobudovy` ta perspekty`vy` rozvy`tku zagal`noderzhavnoyi sy`stemy` monitory`ngu innovacijnoyi diyal`nosti v Ukrayini [Features of construction and prospects of development of the national system of monitoring of innovative activity in Ukraine]. *Visny`k Hmel`ny`cz`kogo nacional`nogo universy`tetu.* 2010. # 4. T. 1. S. 283—289. URL: http://www.nbuv.gov.ua/portal/Soc_Gum/Vchnu_ekon/2010_4_1/282—289.pdf.

rankings of competitiveness and innovation. Analyzing the results of such an assessment allows us to draw a conclusion about the weakening of Ukraine's position on the basis of some contradiction of their conclusions.

In particular, according to the Global Innovation Index 2018 rating, Ukraine lost its position due to a decrease in education expenditures as a percentage of GDP (22nd place in 2017, 26th place in 2018) and research and development expenditures as a percentage of GDP (54th place - 2017, 62nd place - 2018) [298, p.6].

According to the Bloomberg Innovation Development Index, Ukraine fell by six marks in 2019 compared to 2018 due to all estimated indicators, including R&D expenditures in relation to GDP, productivity, the percentage of innovative companies in the total number of enterprises, the number of scientists per million inhabitants , the value added of production in relation to GDP, the percentage of graduates of free economic education in the total number of graduates of educational institutions and patent activity. In 2019, Ukraine took 53rd place in the ranking with a total score of 48.09. A year earlier, our country ranked 46th. Especially the overall result was affected by a decrease in productivity (a decrease of 10 points), a decrease in value added production (a decrease of 10 points) (Table 3.4).

Table 3.4.Ukraine's place in the Bloomberg Innovation Index

In 2018-2019.	General index	Intensity of research and development (R&D expenditures in relation to GDP)	Productivity	High technology penetration (share of innovative companies in the total number of enterprises)	Concentration of researchers (number of scientists per 1 million inhabitants)	Value added production (value added of production in relation to GDP)	Efficiency of higher education (share of freelance graduates in the total number of graduates of educational institutions)	Patent activity
Ukraine-2018	46	47	50	32	46	48	21	27
Ukraine-2019	53	54	60	37	46	58	28	35

Note: compiled by the author on the basis of [299].

298 Stan innovacijnoyi diyal`nosti ta diyal`nosti u sferi transferu texnologij v Ukrayini u 2018 roci: anality`chna dovidka [The state of innovation and technology transfer activities in Ukraine in 2018: analytical reference]. Py`sarenko T. V., Kvasha T.K. ta in. K.: UkrINTEI, 2019. 80 s.

299 The Global Innovation Index. URL: https://www.wipo.int/publications/en/details.jsp?id=247.

According to this rating, the problems for Ukraine to increase the efficiency of innovation are the state of development of clusters and public procurement of new technological products and «Companies that accept breakthrough ideas». The relationship between the developer-manufacturer chain is obvious.

In the Global Competitiveness Index (2018) in the sub-index «Innovation Capacity» the highest is the position of the indicator «Quality of research institutions» (44th place) and the indicator «Scientific publications H index» (50th place), the lowest is the position of the indicator «Cluster development» - 106th place.

The European Innovation Scoreboard reflects the main indicators for assessing the effectiveness of the national innovation system of the EU. According to the methodology, Ukraine belongs to the group of countries «slow innovators».

According to the Innovation Index of the European Innovation Scoreboard (2018), Ukraine fell to lower positions, mainly due to the indicators «communications and entrepreneurship», «innovation environment».

Ukraine lags behind in all indicators, except for human resources (110,3%) and the impact of employment (77,5%).

In the report «Assessment of readiness for future production 2018» on the index «Drivers of production» in the Driver «Technology and Innovation», the indicator «The level of technology use by enterprises» ranks 71st, and in the driver «Ability to innovate» the indicator «Cluster development» «(87th place) and the indicator» Companies that perceive breakthrough ideas (72nd place) [300, p.6, 9].

After analyzing the data of international ratings, we can conclude that the deterioration of Ukraine's position in world rankings is associated with the following problems:

- reduction of quantitative indicators of expenditures on research and innovation;

- reduction of indicators of efficiency of use of innovations by the enterprises;

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300 Stan innovacijnoyi diyal`nosti ta diyal`nosti u sferi transferu texnologij v Ukrayini u 2018 roci: analitу`chna dovidka [The state of innovation and technology transfer activities in Ukraine in 2018: analytical reference]. Py`sarenko T. V., Kvasha T.K. ta in. K.: UkrINTEI, 2019. 80 s.

- deterioration of the complex indicator of the state of development of clusters and innovation infrastructure in general.

Thus, the analysis of international ratings, which directly or as part of integrated indicators assess the level of innovation of national economies, also confirms the decline in innovation in Ukraine in 2017-2018. However, this decline is somewhat diverse.

These assessments of international ratings allow us to determine the general economic trends of the country: it is obvious that each of the studied indicators has a different impact on the overall level of Ukraine's ability to innovate and the state of macroeconomic stability in general.

The world practice of monitoring innovation within the country differs in its approaches - each country, in its internal diagnostics, takes into account different indicators:

- Republic of Poland - costs of innovation in industry by type of activity and territory, costs in the field of services, human resources in the field of science and technology [301];

- Russian Federation - the share of innovative enterprises in the economy, by type of economic activity, by number of employees, its costs, the volume of its results, the innovative activity of small businesses [302];

- Germany - costs of innovation, the number of patents issued, international trade in innovation [303];

- France - the cost of innovation, the involvement of specialists, the number of patents issued, the volume of exports of high-tech goods [304];

- Great Britain - the cost of financing innovation, the percentage of innovative enterprises in the economy, the volume of production of innovative goods and services [305].

[301] Oficijny`j sajt Central`nogo staty`sty`chnogo ofisu Respubliky` Pol`shha [Official site of the Central Statistical Office of the Republic of Poland]. URL: http://www.stat.gov.pl/gus/index.htm.

[302] Oficijny`j sajt Federal`noyi sluzhby` derzhavnoyi staty`sty`ky` Rosijs`koyi Federaciyi [Official site of the Federal State Statistics Service of the Russian Federation]. URL: http://www.gks.ru/wps/wcm/connect/rosstat/ rosstatsite /main/.

[303] Oficijny`j sajt Federal`nogo staty`sty`chnogo ofisu Nimechchy`ny` [Official site of the Federal Statistical Office of Germany]. URL: https://www.destatis.de/DE/Startseite.html.

[304] Oficijny`j sajt Nacional`nogo insty`tutu staty`sty`ky` i ekonomiky` Franciyi [Official site of the National Institute of Statistics and Economics of France]. URL: http://www.insee.fr/fr/.

[305] Oficijny`j sajt Nacional`nogo staty`sty`chnogo ofisu Vely`kobry`taniyi [Official site of the National Statistics Office of Great Britain]. URL: http://www.statistics.gov.uk/hub/index.html.

Monitoring the flow of innovation processes in the country allows you to assess innovation processes, mainly through a certain system of indicators in the forms of statistical reporting. Statistical forms of information collection and monitoring in Ukraine allow to analyze a certain list of indicators [306, p.21-22], and the conclusions of the evaluation become tools for management decisions at different levels of regulation of innovation processes.

The Ukrainian analogue of monitoring the innovation activity of enterprises of different types of activity is the observation of the form №1-HH - Survey of innovation activity of the organization (enterprise) for the corresponding period (for 2014-2016, 2016-2018), which provides quantitative and qualitative data on innovation activity of enterprises in 11 main sections and is similar to the corresponding European monitoring [307].

However, we must agree with domestic scientists who note that most indicators of macroeconomic evaluation of innovation of industrial enterprises are mostly quantitative in nature and almost do not correlate with cost indicators and reflect only one of the manifestations of innovation and development - innovation [308, p.271].This leads to limited opportunities to use analytical indicators obtained on the basis of such an assessment, and, accordingly, unsubstantiated conclusions and decisions.

As noted by Ligonenko L.O. main type of calculation indicators - the number of relevant objects of accounting and reporting: technologies, samples, innovators, etc. in statistical collections and reports (in statics and dynamics) and without the use of any special analytical indicators that can be built on its basis [309] significantly limits the capabilities of researchers.

306 Metodologichni polozhennya zi staty`sty`ky` innovacijnoyi diyal`nosti (u redakciyi nakazu Derzhavnoyi sluzhby` staty`sty`ky` Ukrayiny` vid 28.12.2015, # 369) [Methodological provisions on innovation statistics (as amended by the order of the State Statistics Service of Ukraine dated 28.12.2015, № 369).]. Oficijny`j sajt Derzhavnoyi sluzhby` staty`sty`ky`. Ukrayina u cy`frah. URL: http://ukrstat.org.

307 Kerivny`cztvo Oslo. Rekomendaciyi zi zboru ta analizu dany`h stosovno innovacij [Oslo Guide. Recommendations for collecting and analyzing data on innovation]/ pereklad z anglijs`koyi G.O. Androshhuk. UkrINTEI, 2009. 164 s.

308 Voloshhuk L. O. Innovacijna diyal`nist` ta rozvy`tok promy`slovy`h pidpry`yemstv Ukrayiny`: problemy` staty`sty`chnogo ta ekonomichnogo analizu [Innovative activity and development of industrial enterprises of Ukraine: problems of statistical and economic analysis]. *Problemy` ekonomiky`*. # 4. 2014. S. 269—274.

309 Ligonenko L. O. Metodologiya ta instrumentarij ocinyuvannya innovacijnosti pidpry`yemstva [Innovative activity and development of industrial enterprises of Ukraine: problems of statistical and economic analysis]. *Markety`ng i menedzhment innovacij*. 2015. # 3. URL: http://mmi.fem.sumdu.edu.ua/http://mmi.fem.sumdu.edu.ua/ sites/default/files/mmi2015_3_105_117.pdf.

This opinion is confirmed by N.V. Ezhakova: «Statistics has only the following data: how much money was spent on various types of innovative activities, what was the volume of produced and sold products» [310].

Many foreign authors point out that innovations cannot always be objectively quantified [311; 312]. Foreign experts also advise to pay attention to the feasibility of innovation for consumers, the number of consumer groups for which it is designed, consumer attitudes to the brand that presents innovative development, environmental impact, the total number of innovative ideas, the number of prototypes of new products and patents, time , spent at all stages of the innovation process and many others [313]. Many innovations developed and implemented by startups cannot be related to official R&D or R&D cannot be recorded as such, as startups often do not have revenue on which to record costs [314]. Therefore, in order to perform research based on the analysis of statistical reporting data, it is not enough to evaluate only a set of indicators based only on quantitative or cost aspects of innovation processes, as they give ambiguous conclusions.

An important task of monitoring innovation processes at the national level is to determine the impact of innovation on macroeconomic indicators of the country, which can be considered from the standpoint of GDP growth and the direct resultant of innovation, which is considered in the form of sold innovative products.

To perform the study, we will use analytical data taken from statistical reporting forms of domestic enterprises through their generalization in the statistical data of the State Statistics Service of Ukraine. Such a study should allow them to be compared with the conclusions of international experts to generalize the identification of problems and trends in the national innovation ecosystem and the formation of measures at different levels of government.

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310 Yezhakova N. V. Metody`chni pidhody` do upravlins`kogo obliku ta analizu efekty`vnosti innovacijnoyi diyal`nosti j innovacijnoyi akty`vnosti pidpry`yemstv [Methodical approaches to management accounting and analysis of the effectiveness of innovation and innovation activity of enterprises]. *Ekonomika promy`slovosti: nauk.-prakt. zhurnal*, 2011. URL: http://econindustry.org/arhiv/html/2011/st_53_20. pdf.

311 Mark Malinoski, Gail S. Perry. How Do I Measure «Innovation»? URL : http://www.balancedscorecard.org/portals/0/pdf/Howtomeasureinnovation.pdf.

312 Langdon Morris. The innovation master plan. The CEO's guide to innovation. Chapter 6: innovation metrics. URL: http://www.innovationmanagement.se/wp—content/uploads/2011/09/Innovation—Master—Plan_Chapter—6.pdf.

313 Langdon Morris. Innovation Metrics. The Innovation Process and How to Measure It. InnovationLabs LLC, Nov 2008. URL: http://www.innovationtools.com/PDF/measuring_innovation.pdf.

314 Capturing Change in Science, Technology and Innovation Improving indicators to inform policy The national academies press Washington, D.C. 2014. URL: https://www.nap.edu/read/18606/chapter/1.

Many scientists have come to the conclusion that it is necessary to improve the tools of analysis of innovation and innovative development of industrial enterprises in two directions: analysis of the actual development and signs of its innovation - innovation activity and innovation potential, which requires improving the tools of statistical analysis innovation activity and innovation potential with indicators as the least financial, reflecting their development [315, p.271].

To perform this task, it is advisable to use methods of economic and mathematical modeling. Scientists have developed a number of economic and mathematical models to solve the problem of assessing the impact of indicators of innovation activity of economic entities in the context of their impact on the macroeconomic situation of the country [316, 317].

In Ukraine, the issue of economic evaluation of the interaction of innovation indicators of economic entities was studied by scientists [318, 363], modern econometric models for estimating macroeconomic indicators of the world were developed by the authors [319, 320], some approaches to macroeconomic evaluation and forecasting are given in [321, 322].

Despite numerous developments of Ukrainian and foreign scientists and practitioners, the issue of modelling the impact of innovation activity of economic entities on the macroeconomic indicators of Ukraine still remains insufficiently resolved, therefore, the existing developments can not serve as an effective basis for assessing the macroeconomic status of Ukraine and the formation of a modern strategic vision of its innovative development.

In addition, taking into account the relevant parameters of innovation activity and determining their impact will make it possible to assess the

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[315] Voloshchuk L. O. Innovatsiina diialnist ta rozvytok promyslovykh pidpryiemstv Ukrainy: problemy statystychnoho ta ekonomichnoho analizu [Innovative activity and development of industrial enterprises of Ukraine: problems of statistical and economic analysis]. *Problemy ekonomiky*. № 4. 2014. S. 269—274.

[316] Kiseľáková D., Šofranková B., Čabinová V. Onuferová E. Competitiveness and sustainable growth analysis of the EU countries with the use of Global Indexes' methodology. Entrepreneurship and Sustainability Issues, Entrepreneurship and Sustainability Center. 5(3). Pp. 581—599.

[317] Ulengin F., Ulengin B., Onsel S. A power—based measurement approach to specify macroeconomic competitiveness of countries. *Socio—economic Planning Sciences*. 2002. №36. Pp. 203—226.

[318] Lyeonov S. V., Vasylieva T. A., Lyulyov O. V. Macroeconomic stability evaluation in countries of lower—middle income economies. *Naukovyi Visnyk Natsionalnoho Hirnychoho Universytetu*. 2018. 1. Pp. 138—146.

[319] Săvoiu G., Dinu V., Ciuca S. Foreign direct investment based on country risk and other macroeconomic factors. Econometric models for Romanian economy Romanian Journal of Economic Forecasting. 2013. 16(1). Pp. 39—61.

[320] Chapcakova A., Heckova J., Gira D., Valentiny T. Zbihlejova L. Quantification of the selected macroeconomic impacts on the EEA countries competitiveness assessment Montenegrin. *Journal of Economics*. 2019. 15 (1).

[321] Joy L. Aid and Macroeconomic Performance: Theory, Empirical Evidence and Four ed White H (Palgrave Macmillan UK). 1998. P. 298.

[322] Abaas M. S. M, Chygryn O, Kubatko O, Pimonenko T. Social and economic drivers of national economic development: the case of OPEC countries. *Problems and Perspectives in Management*. 2018. 16(4). P. 155—168.

overall economic development of the country and the propensity of economic entities to innovate. This will serve as a positive impetus to strengthen effective interaction between participants in the innovation process, justification and selection of priority areas for the development of the national innovation system and more.

Indicators of innovation performance reflect the quantitative result of innovation. The criterion for the effectiveness of scientific research is the amount of costs for scientific and technical work and the amount of scientific and technical work performed [323].

This approach is used in statistical surveys of innovation and scientific and technical activities in Ukraine.

The general principles of the organization of an estimation of efficiency of financing of scientific researches and developments should be: accurate definition of branch of consumption of final results of each type of R&D; multiple forms of financing / investment according to the type of research work; availability of a system of criteria for evaluating the effectiveness of financing fundamental research and the effectiveness of financing / investing applied research; application of cross-sectoral evaluation of the effectiveness of research work funding [324, p.15].

To substantiate the criteria for the effectiveness of research results, different approaches are used both in statistics and in scientific organizations directly. In particular, the criteria for the effectiveness of research is the amount of scientific output, which is measured by the total number or average number of publications per researcher during the study period, completed and defended dissertations, completed topics or submitted reports [325, p.112.]. This approach does not link the result of scientific research with its implementation and use in the subsequent stages of the innovation process. Instead, the "single criterion of economic efficiency" is widely used. The only criterion of economic efficiency is characterized by cost-effective indicators of savings of living and tangible

323 Metodolohichni polozhennia zi statystyky naukovoi ta naukovo-tekhnichnoi diialnosti [Methodological provisions on statistics of scientific and scientific-technical activity]. URL: http://ukrstat.gov.ua/metod_polog/metod_doc/2011-/312/312.pdf.

324 Rezultatyvnist biudzhetnoho finansuvannia naukovykh doslidzhen v Ukraini [Effectiveness of budget funding for research in Ukraine]. URL: http://www.niss.gov.ua/content/articles/files/biudzhet_fin—58b32.pdf.

325 Rud N. Ekonomichne obgruntuvannia naukovykh rozrobok [Economic substantiation of scientific developments]: navchalnyi posibnyk. Lutsk : RVV LDTU, 2008. 196 s.

labor in social production, services, which are obtained from the use of research results and compare them with the cost of research [326].

One of the most important indicators of the effectiveness of the use of budget funds aimed at financing scientific and technical work is the number of implemented scientific and technical products. An important indicator is the time of introduction of scientific development into production.

It is also advisable to assess the effectiveness of applied research differentiated by areas of use and stages of implementation of the innovation process, the main indicators include:

- indicator of the level of diffusion of results in the spheres of the country's economy;

- indicator of the ratio of the useful effect (scientific and technical, economic, economic, environmental) and the cost of achieving them;

- indicator of relevance and significance of results, which is correlated in time of receipt and use.

Substantiated indicators should provide for the formation of a system based on quantitative and qualitative performance indicators.

In order to carry out complex modelling and obtain reliable conclusions, two groups of these indicators need to be involved in the analysis.

Given the quantitative parameters of determining the favorable development of the level of innovation activity of enterprises, it is important to take into account such parameters of the system as:

1) costs of innovation for the purchase of machinery, equipment and software;
2) the cost of innovation for the rest;
3) the number of organizations that carried out research;
4) the number of employees involved in the implementation of research;
5) the number of innovatively active industrial enterprises;
6) costs of innovation;
7) the number of industrial enterprises that have implemented innovations.

The author's approach to modelling involves determining the strength and closeness of the relationship between indicators of innovation activity

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326 Hnatiuk N. O., Danylchenko O. Ye. Efektyvnist naukovykh doslidzhen [The effectiveness of scientific research]. URL: http://dspace.udpu.org.ua:8080/jspui/bitstream/6789/1769/1.pdf.

in Ukraine and such macroeconomic indicators that determine the level of development of the national economy as a whole (GDP and sales).

The initial data for the construction of economic and mathematical model for determining the impact on the level of macroeconomic indicators of GDP and indicators of the volume of sold innovative products indicators of the effectiveness of innovative activity are given in table 3.5.

Table 3.5. Initial data for construction of multifactor regression of GDP indicators and indicator of volume of sold products (goods, services) and indicators of efficiency of innovative activity in Ukraine, UAH million

Year	GDP	Volume of sold innovative products (goods, services)	The cost of innovation for the purchase of machinery, equipment and software	The cost of innovation is different	Number of organizations that carried out research, units	Number of employees involved in the implementation of R & D, persons	Number of innovatively active industrial enterprises, units	The cost of innovation	Number of industrial enterprises that implemented innovations, units
	Y_1	Y_2	X1	X2	X3	X4	X5	X6	X7
2007	751100	40188	7441,3	2064,9	1404	155549	1472	10821	1186
2008	990800	31432	7664,8	2664	1378	147275	1397	11994,2	1160
2009	947000	31432	4974,7	2012,6	1340	139760	1411	7949,9	1180
2010	1120600	33697,6	5051,7	1855,8	1303	182484	1462	8045,5	1217
2011	1349200	42386,7	10489,1	2440,2	1255	175330	1679	14333,9	1327
2012	1459100	36157,7	8051,8	2185,5	1208	164340	1758	11480,6	1371
2013	1522700	35891,6	5546,3	2290,9	1143	155386	1715	9562,6	1312
2014	1586900	25669	5115,3	778,8	999	136123	1609	7695,9	1208
2015	1988500	23050,1	11141,3	548	978	122504	824	13813,7	723
2016	2383200	22443,11	19829	878,4	972	97912	834	23229,5	735
2017	2983882	17714,2	5898,8	1027,1	963	94274	759	9117,5	672
2018	3558706	24861,1	8291,3	633,9	950	88128	777	12180,1	739

Note: calculated by the author

Taking into account the relevant parameters of innovation activity and determining their impact, will assess the overall economic development of the country and the propensity of domestic entities and households to innovate, which will serve as a positive impetus for growth of technology transfer, use and sale in both foreign and domestic markets.

Accordingly, the use of software products (Microsoft Excel Data Analysis Batch Extension) allowed to determine the following equations of the multifactor model of dependence of GDP (Y1) and the volume of sold innovative products (Y2) on indicators of innovation processes in the country, practical measures to stimulate and regulate innovation activities, implementation of priority areas of innovation.

Equation of multifactor dependence of GDP in UAH million looks like:

$$Y1 = -432{,}3237 * X1 + 5{,}474 * X2 - 4815{,}1648 * X3 - 4{,}0409 * X4 - 5807{,}817 * X5 - + 400{,}3506 * X6 + 8249{,}7868 * X7 + 5527726{,}46$$

The equation of multifactor dependence of the volume of sold innovative products has the form:

$$Y_2 = -5{,}3276 * X_1 - 5{,}2912 * X_2 + 21{,}235 * X_3 + 0{,}1197 * X_4 + 5{,}149 * X_5 + 5{,}5856 * X_6 + 6{,}2576 * X_7 - 36702{,}6$$

Checking the validity of the model based on multiple correlation coefficients (R1 = 0.9773, R2 = 0.9427) and determination (R12 = 0.9551, R22 = 0.8887) we see that they are close to 1, which indicates the adequacy model and its compliance for use in further analysis.

Commenting on the weights in both equations, we can state a significant positive impact of such performance indicators as:

• costs of innovation;

• number of industrial enterprises that implemented innovations.

For the volume of sold products, a positive trend is also formed by the number of organizations that carried out research, the number of employees involved in research, the number of innovative industrial enterprises.

Indicators of efficiency of innovations allow to characterize a qualitative degree of achievement of effect in innovative processes. Such indicators include:

1) the share of the volume of sold innovative products (% of the total volume of sold products);

2) the number of new technological processes introduced into production;

3) the number of new or significantly improved low-waste, resource-saving technological processes introduced into production;

4) the number of introduced types of innovative products;

5) the number of introduced types of innovative products (new types of machines, equipment, devices, apparatus);

6) the share of R&D expenditures in GDP;

7) fixed capital investments, UAH million;

8) the number of innovative types of products introduced into production, the volume of sold innovative products (goods, services);

9) the share of the volume of performed scientific and scientific and technical work in GDP (Table 3.6).

Table 3.6. Initial data for the construction of multivariate regression of the impact of innovation performance on GDP

Year	GDP, UAH million	Share of the volume of sold innovative products (goods, services),% to the total volume of sold products (goods, services),%	Number of new technological processes introduced into production, units	Number of new or significantly improved low-waste, resource-saving technological processes introduced into production, units	Number of introduced types of innovative products (goods, services), units	Number of introduced types of innovative products (new types of machines, equipment, devices, devices), total, units	The share of R&D expenditures in GDP,%	Fixed capital investments, UAH million	The production of innovative types of products and names has been introduced	Volume of sold innovative products (goods, services), UAH million	The share of the volume of performed scientific and technical works in GDP,%
	y	X1	X2	X3	X4	X5	X6	X7	X8	X9	X10
2000	176100	9,4	1403	430	15323	631	1,16	1403	15323	12,1	1,16
2001	211200	6,8	1421	469	19484	610	1,11	1421	19484	12,2	1,11
2002	234100	7	1142	430	22847	520	1,11	1142	22847	12,4	1,11
2003	277400	5,6	1482	606	7416	710	1,24	1482	7416	12,9	1,24
2004	357500	5,8	1727	645	3978	769	1,19	1727	3978	18,8	1,19
2005	457300	6,5	1808	690	3152	657	1,09	1808	3152	17,4	1,09
2006	565000	6,7	1145	424	2408	786	0,98	1145	2408	30892	0,98
2007	751100	6,7	1419	634	2526	881	0,93	1419	2526	40188	0,93
2008	990800	5,9	1647	680	2446	758	0,9	1647	2446	31432	0,9
2009	947000	4,8	1893	753	2685	641	0,95	1893	2685	31432	0,95
2010	1120600	3,8	2043	479	2408	663	0,75	2043	2408	33697,6	0,9
2011	1349200	3,8	2510	517	3238	897	0,65	2510	3238	42386,7	0,79
2012	1459100	3,3	2188	554	3403	942	0,67	2188	3403	36157,7	0,8
2013	1522700	3,3	1576	502	3138	809	0,7	1576	3138	35891,6	0,8
2014	1586900	2,5	1743	447	3661	1314	0,6	1743	3661	25669	0,69
2015	1988500	1,4	1217	458	3136	966	0,55	1217	3136	23050,1	0,64
2016	2383200	1	3489	748	4139	1305	0,48	3489	4139	17805,75	0,61
2017	2983882	0,7	1831	611	2387	751	0,45	1831	2387	17714,2	0,56
2018	3558706	0,8	2002	926	3843	920	0,423	2002	3843	24861,1	0,508

Note: calculated by the author.

To build a multifactor regression of the impact of innovation efficiency indicators on GDP, Table 3.7 is constructed.

Table 3.7. The results of the multivariate regression equation for significant indicators

The name of the factor	Identification of the factor in the equation	Coefficients for the equation of GDP
	Free member	3937233
Share of the volume of sold innovative products (goods, services),% to the total volume of sold products (goods, services),%	Variable X 1	392,954
Number of new technological processes introduced into production, units	Variable X 2	0
Number of new or significantly improved low-waste, resource-saving technological processes introduced into production, units	Variable X 3	2385,9
Number of introduced types of innovative products (goods, services), units	Variable X 4	-1,37981
Number of introduced types of innovative products (new types of machines, equipment, devices, devices), total, units	Variable X 5	-219,538
The share of R&D expenditures in GDP,%	Variable X 6	-5047097
Fixed capital investments, UAH million	Variable X 7	-358,15
The production of innovative types of products and names has been introduced	Variable X 8	0
Volume of sold innovative products (goods, services), UAH million	Variable X 9	-12,8606
The share of the volume of performed scientific and scientific-technical works in GDP,%	Variable X 10	1350710

Note: calculated by the author

A summary analysis of all indicators for certain functions, describing the interdependence of indicators of innovation activity and GDP, is given in Table 3.8. Most of the equations that most accurately describe the relationship between the resulting indicator and the factors that affect it reflect the hyperbolic nature of the relationship. This trend is due to the decline of both macroeconomic indicators of dependent variables and the results in 2013-2017 compared to the upward trend of 2001-2012. The wave-like development of the world economy in general and the economy of Ukraine in particular, under the influence of various factors, is reflected by the mathematical function of the quadratic equation.

Table 3.8. Types of equations describing the dependences of the influence of factors on GDP and the coefficient of determination

Factors	Linear	Logarithmic	Polynomial	Degree	Exponential
1	2	3	4	5	6
Share of the volume of sold innovative products (goods, services),% to the total volume of sold products (goods, services),%	$y = -312389{,}10496x + 2550814{,}21789$ $R^2 = 0{,}85991$	**$y = -1073516{,}50071\ln(x) + 2540259{,}15634$** **$R^2 = 0{,}92551$**	$y = 33384{,}48847x^2 - 619530{,}66206x + 3076009{,}44707$ $R^2 = 0{,}92490$	$y = 3158462{,}44717x^{-1{,}02358}$ $R^2 = 0{,}70324$	$y = 3766764{,}77566e^{-0{,}33303x}$ $R^2 = 0{,}81679$
Number of new technological processes introduced into production, units	$y = 735{,}98698x - 219857{,}19806$ $R^2 = 0{,}26347$	$y = 1446154{,}84809\ln(x) - 9673776{,}47848$ $R^2 = 0{,}25357$	$y = -0{,}00483x^2 + 757{,}38751x - 241126{,}65197$ $R^2 = 0{,}26348$	$y = 3{,}19377x^{1{,}66928}$ $R^2 = 0{,}28237$	$y = 186429{,}64859e^{0{,}00081x}$ $R^2 = 0{,}26954$
Number of new or significantly improved low-waste, resource-saving technological processes introduced into production, units	$y = 1318{,}31905x + 337604{,}49422$ $R^2 = 0{,}03408$	$y = 783438{,}28569\ln(x) - 3866823{,}72389$ $R^2 = 0{,}03762$	$y = -7{,}56706x^2 + 10075{,}03237x - 2101907{,}37002$ $R^2 = 0{,}04247$	$y = 791{,}63729x^{1{,}09294}$ $R^2 = 0{,}06118$	$y = 278337{,}73496e^{0{,}00184x}$ $R^2 = 0{,}05575$
Number of introduced types of innovative products (goods, services), units	$y = -65{,}75255x + 1469336{,}82567$ $R^2 = 0{,}26623$	$y = -575062{,}88971\ln(x) + 5885103{,}94882$ $R^2 = 0{,}27780$	$y = 0{,}00520x^2 - 186{,}52038x + 1809558{,}65298$ $R^2 = 0{,}29219$	**$y = 1251633001{,}57349x^{-0{,}88225}$** **$R^2 = 0{,}54648$**	$y = 1420641{,}01728e^{-0{,}00010x}$ $R^2 = 0{,}51254$
Number of introduced types of innovative products (new types of machines, equipment, devices, devices), total, units	$y = 2244{,}83379x - 746413{,}31508$ $R^2 = 0{,}36522$	$y = 2045475{,}37236\ln(x) - 12565785{,}78118$ $R^2 = 0{,}38881$	$y = -2{,}67480x^2 + 7258{,}62779x - 2934668{,}11514$ $R^2 = 0{,}39731$	$y = 0{,}05902x^{2{,}45895}$ $R^2 = 0{,}46962$	$y = 92484{,}99424e^{0{,}00263x}$ $R^2 = 0{,}41883$
The share of R&D expenditures in GDP,%	$y = -2953729{,}45015x + 3620773{,}65399$ $R^2 = 0{,}90268$	$y = -2409176{,}39474\ln(x) + 602668{,}34181$ $R^2 = 0{,}94679$	**$y = 3450890{,}80678x^2 - 8797205{,}21121x + 5874349{,}74320$** **$R^2 = 0{,}95128$**	$y = 476437{,}95994x^{-2{,}52142}$ $R^2 = 0{,}86676$	$y = 12598844{,}82770e^{-3{,}22632x}$ $R^2 = 0{,}90013$

1	2	3	4	5	6
New technological processes have been introduced	$y = 735{,}98698x - 219857{,}19806$ $R^2 = 0{,}26347$	$y = 1446154{,}84809\ln(x) - 9673776{,}47848$ $R^2 = 0{,}25357$	$y = -0{,}00483x^2 + 757{,}38751x - 241126{,}65197$ $R^2 = 0{,}26348$	$y = 3{,}19377x^{1{,}66928}$ $R^2 = 0{,}28237$	$y = 186429{,}64859e^{0{,}00081x}$ $R^2 = 0{,}26954$
The production of innovative types of products and names has been introduced	$y = 144488{,}22910x - 296994{,}73203$ $R^2 = 0{,}91460$	$y = 827187{,}78107\ln(x) - 596904{,}75349$ $R^2 = 0{,}67625$	$y = 7895{,}10939x^2 - 5518{,}84933x + 203028{,}86275$ $R^2 = 0{,}97286$	$y = 93456{,}08140x^{1{,}05039}$ $R^2 = 0{,}91137$	$\mathbf{y = 165849{,}34724e^{0{,}16319x}}$ $\mathbf{R^2 = 0{,}97505}$
Volume of sold innovative products (goods, services), UAH million	$y = 22{,}24565x + 622817{,}76518$ $R^2 = 0{,}19849$	$y = 147017{,}88160\ln(x) - 62456{,}04346$ $R^2 = 0{,}45933$	$y = -0{,}00310x^2 + 135{,}78126x + 357449{,}52816$ $R^2 = 0{,}58652$	$\mathbf{y = 161503{,}07611x^{0{,}20369}}$ $\mathbf{R^2 = 0{,}73693}$	$y = 363466{,}70874e^{0{,}00004x}$ $R^2 = 0{,}47428$
The share of the volume of performed scientific and scientific-technical works in GDP,%	$y = -3674314{,}16534x + 4431662{,}85491$ $R^2 = 0{,}91247$	$y = -3241222{,}07886\ln(x) + 695395{,}84735$ $R^2 = 0{,}94986$	$\mathbf{y = 4495414{,}61848x^2 - 11770222{,}87901x + 7889269{,}68666}$ $\mathbf{R^2 = 0{,}96251}$	$y = 524795{,}30684x^{-3{,}39544}$ $R^2 = 0{,}87122$	$y = 29979358{,}87863e^{-3{,}99280x}$ $R^2 = 0{,}90057$

Note: calculated by the author

The most significant coefficient in the models of interdependence on macroeconomic indicators belongs to the factor «Introduced production of innovative products, names» ($R^2 = 0,97505$), but in the multivariate equation the coefficient of influence for this indicator is 0, so for in-depth correlation-regression analysis «The share of the volume of scientific and technical work performed in GDP,%» for which $R^2 = 0,96251$.

In the pair wise regression, the identified indicators will be the following indicators: «Share of scientific and technical work performed in GDP,%» - independent variable or factor (X) and «GDP, UAH million» - dependent variable or indicator (U). A detailed analysis and description of the use of economic and mathematical modelling in 2000–2018 is given in Table 3.9. Define the type of equation that describes the statistics using the graphical capabilities of Microsoft Excel.

Consider exponential, linear, logarithmic, polynomial of the 2nd degree, power and linear filtering of the trend line (Fig. 3.7-3.11).

The criterion for choosing the type of function, that is the form of dependence, is the value of the coefficient of determination (R^2) - the closer the value of this indicator to 1, the better the given function describes the statistics.

The analysis showed that the most optimal form of dependence is given in Fig. 3.9 polynomial trend line of the 2nd degree, because the value of the reliability of the approximation acquires the greatest value from the considered variants of dependences ($R^2 = 0, 96251$).

Thus, the model of the dependence of GDP on the indicator «the share of the volume of performed scientific and scientific-technical work», on the basis of the statistical data collected by us, takes the form of a polynomial trend line of the 2nd degree:

$$y = 4495414{,}61848x2 - 11770222{,}87901x + 7889269{,}68666 \quad (3.1)$$

Table 3.9. Empirical data for constructing a correlation model

	The share of scientific and technical works in GDP,%	GDP, UAH million	Y calculated	Coefficient elast
2000	1,16	176100,00	284841,06	-5,46
2001	1,11	211200,00	363122,64	-5,47
2002	1,11	234100,00	363122,64	-5,47
2003	1,24	277400,00	206342,83	-3,74
2004	1,19	357500,00	248661,10	-5,13
2005	1,09	457300,00	400728,86	-5,36
2006	0,98	565000,00	671847,46	-4,32
2007	0,93	751100,00	831046,51	-3,81
2008	0,9	990800,00	937354,94	-3,53
2009	0,95	947000,00	764669,64	-4,01
2010	0,9	1120600,00	937354,94	-3,53
2011	0,79	1349200,00	1396381,88	-2,64
2012	0,8	1459100,00	1350156,74	-2,71
2013	0,8	1522700,00	1350156,74	-2,71
2014	0,69	1586900,00	1908082,80	-2,01
2015	0,64	1988500,00	2197648,87	-1,75
2016	0,60	2383200,00	2418243,25	-1,58
2017	0,56	2983882,00	2731819,09	-1,38
2018	0,51	3558706,0	3065986,68	-1,19
Total		22920288,00	22427568,68	-65,82

Note: calculated by the author.

Substituting the value of the independent variable in equation, determine the calculated value of the indicator. As the data of table. 3.9, the sums of statistical and calculated values of the indicator are almost the same (22920288 and 22427568,68 million UAH) and their dynamics coincide, which confirms the reliability and correctness of the selected equation describing the dependence.

Fig. 3.7. Linear trend line

$$y = -3674314{,}16534x + 4431662{,}85491$$
$$R^2 = 0{,}91247$$
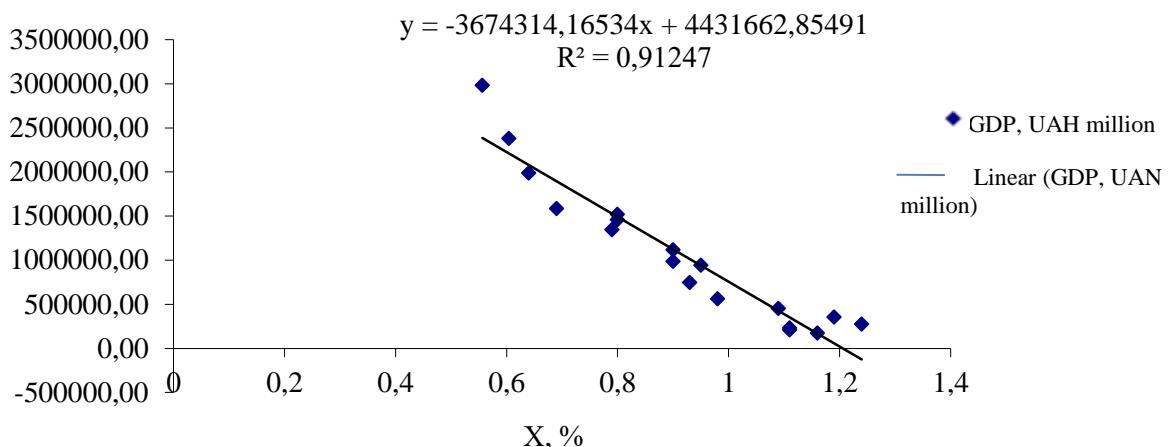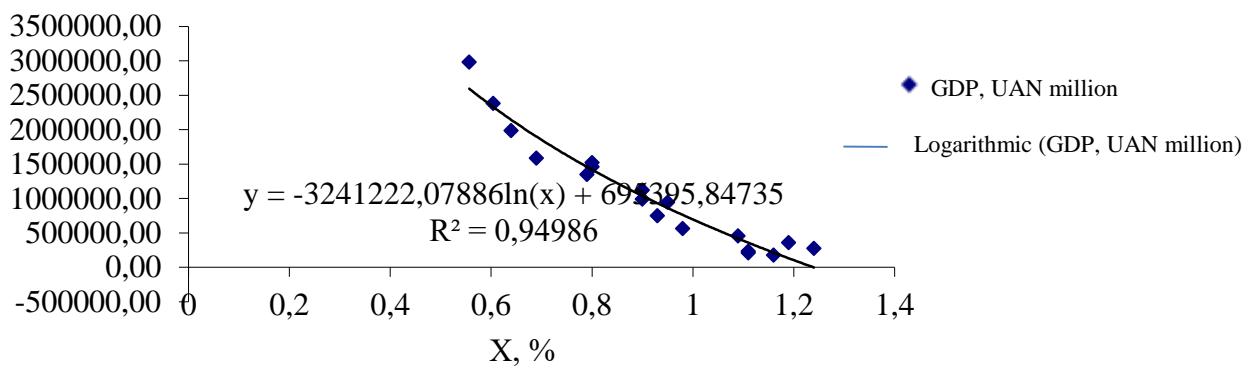
Fig. 3.8. Logarithmic trend line

$$y = -3241222{,}07886\ln(x) + 69\ 395{,}84735$$
$$R^2 = 0{,}94986$$

Fig. 3.9. Polynomial trend line of the 2nd degree

$$y = 4495414{,}61848x^2 - 11770222{,}87901x + 7889269{,}68666$$
$$R^2 = 0{,}96251$$
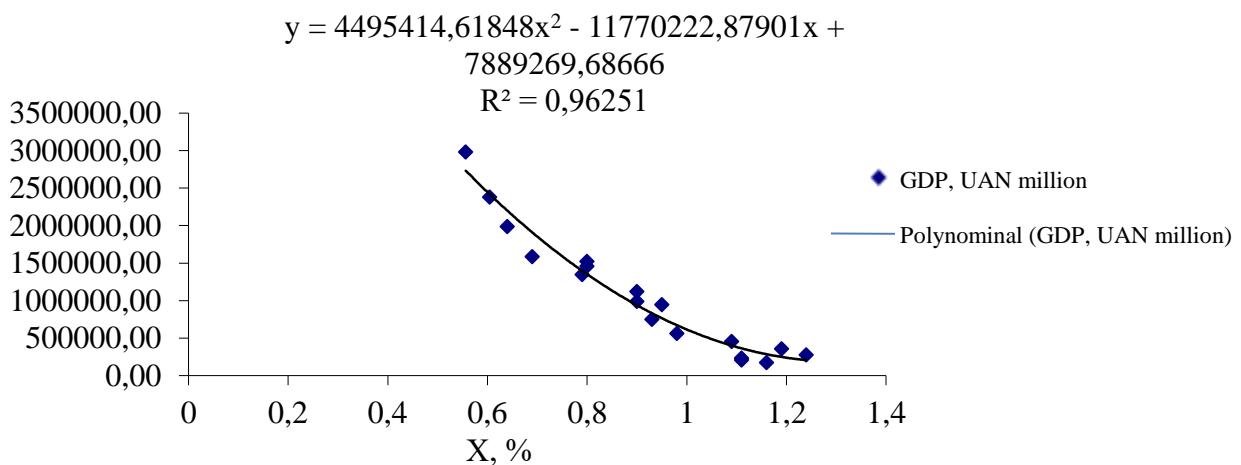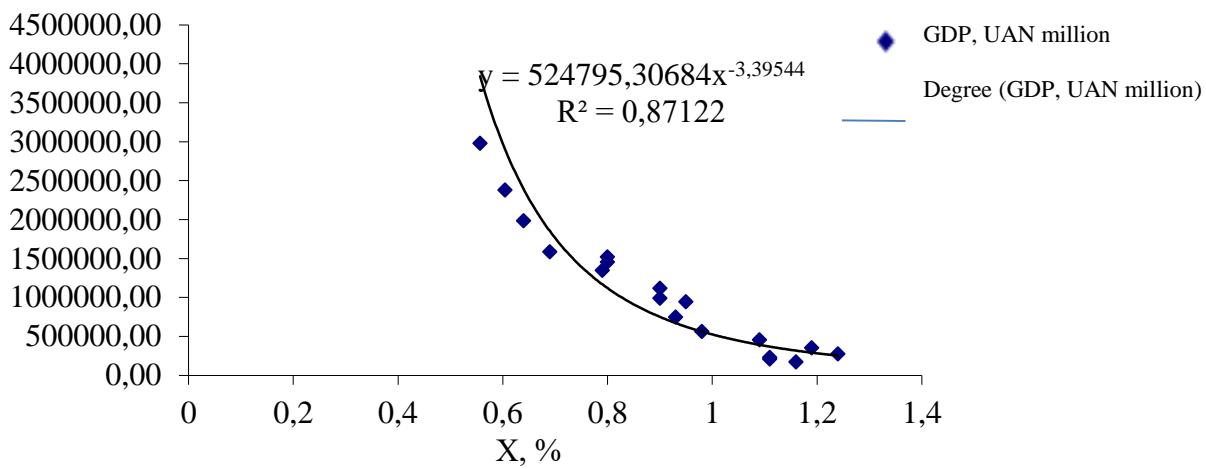
Fig. 3.10. Degree of the trend
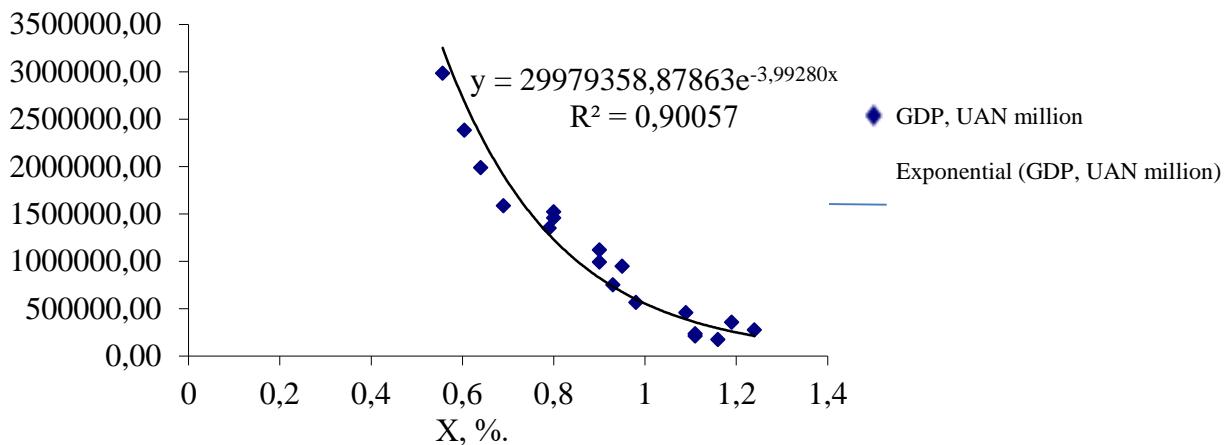
Fig. 3.11. Exponential trend line

We will analyze the compliance of the constructed model, in particular, check its adequacy to statistical data, using Fisher's criterion. To do this, calculate the calculated value of the criterion by the formula:

(3.2)

$$F_{\text{розр}} = \frac{R^2}{1 - R^2} * \frac{n - m - 1}{m}.$$

$$F_{\text{розр}} = \frac{(0{,}96251)}{1 - (0{,}96251)} * \frac{18 - 1 - 1}{1} = 359{,}432915$$

.

The tabular value of Fisher's criterion is calculated with a given probability p (p = 0.95) and the number of degrees of equality: k1 = m and

k2 = n-m-1. For the statistics we collected, the number of observations is n = 18, so the number of degrees of freedom k1 = 1 and k2 = 16. Tabular value of Fisher's criterion: F table = 4.49.

Since the inequality F calc. > F table. (359.43 > 4.49), then with probability p = 0.95 we state that the constructed model is adequate to statistical data and is suitable for further analysis and forecasting.

Let's estimate the closeness and direction of the connection between X and Y, using the correlation coefficient, the formula of which has the form:

$$Kкорел[X,Y] = \frac{\sum_{uu=1}^{n}(Xi - \overline{X})*(Yi - \overline{Y})}{\sqrt{\sum_{1=1}^{n}(Xi - \overline{X})^2 * \sum_{i=n}^{n}(Yi - \overline{Y})^2}}.$$ (3.3)

The correlation coefficient is calculated using the built-in function of Microsoft Excel. To do this, use the function of the category CORREL.

We obtained the following value of the coefficient and correlation r [x; y] = - 0.94695.

From the obtained value we conclude: because r [x; y] <0, the relationship between X and Y is inverse; since 0.7 <| r [x; y] | <1, the relationship between X and Y is strong.

Let's estimate the influence of the variation of the factor X on the variation of the indicator B, using the coefficient of determination, which is: R^2 = 0.96251, that is the variation of the indicator by 96.25% is due to the variation of the factor.

Thus, the indicator of efficiency of innovative activity «The share of the volume of performed scientific and scientific-technical works in GDP,%» has the greatest impact on the volume of GDP. In the field of innovative development in Ukraine there are negative trends, in particular, problems associated with low funding for scientific and scientific-technical work. These problems are increasing in an economic recession, as opportunities to invest in innovative development are narrowing.

Among the performance indicators, the costs of innovation and the number of industrial enterprises that implemented innovations have the greatest impact on GDP. The results of construction and obtained indicators allow to draw the following conclusions and generalizations for

the development of innovation activity and innovation cooperation in the regions of Ukraine.

The results of the study suggest that the development of models of the impact of innovation activity of economic entities on the development indicators of the region should be based on a combination of indicators of effectiveness and efficiency of innovation processes. This will ensure the complexity and systematization of evaluation, will allow to determine the input and output indicators of the formation of innovation policy in the region.

It is substantiated that in the conditions of the conducted evaluation, among the performance indicators, the costs of innovations and the number of industrial enterprises that implemented innovations have the most significant impact. The results of econometric studies indicate a positive and significant impact of the level of knowledge intensity of GDP on the overall economic dynamics. Thus, the innovation policy of the region, aimed at increasing the share of scientific and technical work in the regional GDP, is one of the most important factors in ensuring economic growth.

The generalization of research results allows to substantiate the position that the innovation policy of the region, aimed at maintaining a high level of science-intensive regional GDP and stimulating the retention of a large number of researchers, has a direct economic effect (in case of favorable conditions for capitalization and implementation of economic results), which is reflected in the level of GDP per capita. This connection is reproduced, first of all, through the activation and efficiency of innovation processes. Mathematical modelling should be a tool for evaluation, which provides a stable and flexible basis for changing the factors of monitoring innovation processes.

In contrast to the current models, the proposed provides a higher level of accuracy in assessing the macroeconomic status of Ukraine as a basis for the formation of an effective state policy of innovation development. Within the limits of the specified actual directions of development of regional innovation system are allocated:

- expansion of institutions to stimulate the creation, use and protection of intellectual property rights in the real sector of the economy;

- determination of the legal mechanism for changing the structure of priority areas of innovation and the system of their formation;

- strengthening the institutional capacity of the main managers of budget funds to make decisions on investing projects based on the results of the analysis of revenues and expenditures.

This approach will provide a favorable innovation climate, which will allow businesses to successfully commercialize their scientific and technical products, and, in turn, will contribute to the growth of socio-economic level of the regions. The obtained results are comparable with the assessments of international methodologies for assessing innovation in Ukraine.

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APPENDIXS

Appendix A
Matrix of isomorphic distances for cluster construction № 1

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
1	0	0,115557	0,619585	0,111753	0,011569	0,128901	0,054789	0,106689	0,244376	0,09654	0,136642	0,099976	0,053083	0,043153	0,126034	0,150453	0,143429	0,661811	0,073428	0,131074	0,089213	0,21504	0,128125	0,2658	0,161248
2	0,115557	0	0,735142	0,003804	0,127126	0,013343	0,060768	0,222246	0,359933	0,019018	0,021085	0,015581	0,062474	0,15871	0,010476	0,034896	0,027872	0,777368	0,188985	0,015517	0,026345	0,099483	0,012568	0,381357	0,045691
3	0,619585	0,735142	0	0,731338	0,608016	0,748485	0,674374	0,512896	0,375209	0,716124	0,756227	0,719561	0,672668	0,576432	0,745618	0,770038	0,763014	0,042226	0,546157	0,750659	0,708797	0,834625	0,74771	0,353785	0,780833
4	0,111753	0,003804	0,731338	0	0,123322	0,017147	0,056964	0,218442	0,356129	0,015213	0,024889	0,011777	0,05867	0,154906	0,014281	0,0387	0,031676	0,773564	0,185181	0,019321	0,02254	0,103287	0,016372	0,377553	0,049495
5	0,011569	0,127126	0,608016	0,123322	0	0,140469	0,066358	0,09512	0,232807	0,108108	0,148211	0,111545	0,064652	0,031584	0,137602	0,162022	0,154998	0,650242	0,06186	0,142643	0,100781	0,226609	0,139694	0,254231	0,172817
6	0,128901	0,013343	0,748485	0,017147	0,140469	0	0,074111	0,23559	0,373276	0,032361	0,007741	0,028924	0,075817	0,172054	0,002867	0,021553	0,014528	0,790712	0,202329	0,002173	0,039688	0,08614	0,000775	0,3947	0,032347
7	0,054789	0,060768	0,674374	0,056964	0,066358	0,074111	0	0,161479	0,299165	0,04175	0,081853	0,045187	0,001706	0,097942	0,071244	0,095664	0,088639	0,716601	0,128218	0,076284	0,034423	0,160251	0,073336	0,320589	0,106458
8	0,106689	0,222246	0,512896	0,218442	0,09512	0,23559	0,161479	0	0,137687	0,203229	0,243331	0,206665	0,159772	0,063536	0,232723	0,257142	0,250118	0,555122	0,033261	0,237763	0,195902	0,321729	0,234814	0,159111	0,267937
9	0,244376	0,359933	0,375209	0,356129	0,232807	0,373276	0,299165	0,137687	0	0,340915	0,381018	0,344352	0,297459	0,201223	0,370409	0,394829	0,387805	0,417435	0,170948	0,37545	0,333588	0,459416	0,372501	0,021424	0,405624
10	0,09654	0,019018	0,716124	0,015213	0,108108	0,032361	0,04175	0,203229	0,340915	0	0,040102	0,003437	0,043456	0,139693	0,029494	0,053914	0,046889	0,758351	0,169968	0,034534	0,007327	0,118501	0,031586	0,36234	0,064708
11	0,136642	0,021085	0,756227	0,024889	0,148211	0,007741	0,081853	0,243331	0,381018	0,040102	0	0,036666	0,083559	0,179795	0,010608	0,013811	0,006787	0,798453	0,21007	0,005568	0,047429	0,078398	0,008517	0,402442	0,024606
12	0,099976	0,015581	0,719561	0,011777	0,111545	0,028924	0,045187	0,206665	0,344352	0,003437	0,036666	0	0,046893	0,143129	0,026057	0,050477	0,043453	0,761787	0,173405	0,031098	0,010764	0,115064	0,028149	0,365776	0,061272
13	0,053083	0,062474	0,672668	0,05867	0,064652	0,075817	0,001706	0,159772	0,297459	0,043456	0,083559	0,046893	0	0,096236	0,07295	0,09737	0,090345	0,714894	0,126512	0,07799	0,036129	0,161957	0,075042	0,318883	0,108164
14	0,043153	0,15871	0,576432	0,154906	0,031584	0,172054	0,097942	0,063536	0,201223	0,139693	0,179795	0,143129	0,096236	0	0,169187	0,193606	0,186582	0,618658	0,030275	0,174227	0,132366	0,258193	0,171278	0,222647	0,204401
15	0,126034	0,010476	0,745618	0,014281	0,137602	0,002867	0,071244	0,232723	0,370409	0,029494	0,010608	0,026057	0,07295	0,169187	0	0,02442	0,017395	0,787845	0,199462	0,00504	0,036821	0,089007	0,002092	0,391834	0,035214
16	0,150453	0,034896	0,770038	0,0387	0,162022	0,021553	0,095664	0,257142	0,394829	0,053914	0,013811	0,050477	0,09737	0,193606	0,02442	0	0,007024	0,812264	0,223881	0,019379	0,061241	0,064587	0,022328	0,416253	0,010795
17	0,143429	0,027872	0,763014	0,031676	0,154998	0,014528	0,088639	0,250118	0,387805	0,046889	0,006787	0,043453	0,090345	0,186582	0,017395	0,007024	0	0,80524	0,216857	0,012355	0,054216	0,071612	0,015303	0,409229	0,017819
18	0,661811	0,777368	0,042226	0,773564	0,650242	0,790712	0,716601	0,555122	0,417435	0,758351	0,798453	0,761787	0,714894	0,618658	0,787845	0,812264	0,80524	0	0,588383	0,792885	0,751024	0,876852	0,789937	0,396011	0,823059
19	0,073428	0,188985	0,546157	0,185181	0,06186	0,202329	0,128218	0,033261	0,170948	0,169968	0,21007	0,173405	0,126512	0,030275	0,199462	0,223881	0,216857	0,588383	0	0,204502	0,162641	0,288469	0,201554	0,192372	0,234676
20	0,131074	0,015517	0,750659	0,019321	0,142643	0,002173	0,076284	0,237763	0,37545	0,034534	0,005568	0,031098	0,07799	0,174227	0,00504	0,019379	0,012355	0,792885	0,204502	0	0,041861	0,083967	0,002948	0,396874	0,030174
21	0,089213	0,026345	0,708797	0,02254	0,100781	0,039688	0,034423	0,195902	0,333588	0,007327	0,047429	0,010764	0,036129	0,132366	0,036821	0,061241	0,054216	0,751024	0,162641	0,041861	0	0,125828	0,038913	0,355013	0,072035
22	0,21504	0,099483	0,834625	0,103287	0,226609	0,08614	0,160251	0,321729	0,459416	0,118501	0,078398	0,115064	0,161957	0,258193	0,089007	0,064587	0,071612	0,876852	0,288469	0,083967	0,125828	0	0,086915	0,48084	0,053793
23	0,128125	0,012568	0,74771	0,016372	0,139694	0,000775	0,073336	0,234814	0,372501	0,031586	0,008517	0,028149	0,075042	0,171278	0,002092	0,022328	0,015303	0,789937	0,201554	0,002948	0,038913	0,086915	0	0,393925	0,033122
24	0,2658	0,381357	0,353785	0,377553	0,254231	0,3947	0,320589	0,159111	0,021424	0,36234	0,402442	0,365776	0,318883	0,222647	0,391834	0,416253	0,409229	0,396011	0,192372	0,396874	0,355013	0,48084	0,393925	0	0,427048
25	0,161248	0,045691	0,780833	0,049495	0,172817	0,032347	0,106458	0,267937	0,405624	0,064708	0,024606	0,061272	0,108164	0,204401	0,035214	0,010795	0,017819	0,823059	0,234676	0,030174	0,072035	0,053793	0,033122	0,427048	0

Matrix of isomorphic distances for cluster construction № 2

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
1	0	0,135494	0,090897	0,114721	0,072226	0,011749	0,141789	0,062047	0,072999	0,129503	0,03463	0,015977	0,03546	0,05078	0,096849	0,123788	0,116311	0,653921	0,052796	0,062443	0,112992	0,028008	0,047857	0,026491	0,034819
2	0,135494	0	0,226391	0,020773	0,063268	0,123745	0,006295	0,073447	0,208493	0,005991	0,100864	0,119517	0,100034	0,084713	0,038645	0,011706	0,019183	0,789415	0,082697	0,073051	0,022502	0,107485	0,087637	0,109003	0,100675
3	0,090897	0,226391	0	0,205618	0,163123	0,102646	0,232686	0,152944	0,017897	0,220399	0,125527	0,106874	0,126357	0,141677	0,187746	0,214685	0,207207	0,563024	0,143693	0,15334	0,203889	0,118905	0,138754	0,117387	0,125716
4	0,114721	0,020773	0,205618	0	0,042495	0,102972	0,027068	0,052674	0,18772	0,014782	0,080091	0,098744	0,079261	0,063941	0,017872	0,009067	0,00159	0,768642	0,061924	0,052278	0,001729	0,086712	0,066864	0,08823	0,079902
5	0,072226	0,063268	0,163123	0,042495	0	0,060477	0,069563	0,010179	0,145226	0,057276	0,037596	0,056249	0,036766	0,021446	0,024623	0,051562	0,044085	0,726147	0,01943	0,009783	0,040766	0,044218	0,024369	0,045736	0,037407
6	0,011749	0,123745	0,102646	0,102972	0,060477	0	0,13004	0,050298	0,084748	0,117754	0,022881	0,004228	0,023711	0,039031	0,0851	0,112039	0,104562	0,66567	0,041048	0,050694	0,101243	0,01626	0,036108	0,014742	0,02307
7	0,141789	0,006295	0,232686	0,027068	0,069563	0,13004	0	0,079742	0,214789	0,012287	0,107159	0,125812	0,106329	0,091009	0,04494	0,018001	0,025478	0,79571	0,088993	0,079346	0,028797	0,113781	0,093932	0,115299	0,10697
8	0,062047	0,073447	0,152944	0,052674	0,010179	0,050298	0,079742	0	0,135047	0,067455	0,027417	0,04607	0,026587	0,011267	0,034802	0,061741	0,054263	0,715968	0,009251	0,000396	0,050945	0,034039	0,01419	0,035557	0,027228
9	0,072999	0,208493	0,017897	0,18772	0,145226	0,084748	0,214789	0,135047	0	0,202502	0,107629	0,088977	0,10846	0,12378	0,169848	0,196787	0,18931	0,580922	0,125796	0,135442	0,185992	0,101008	0,120856	0,09949	0,107818
10	0,129503	0,005991	0,220399	0,014782	0,057276	0,117754	0,012287	0,067455	0,202502	0	0,094873	0,113525	0,094042	0,078722	0,032654	0,005715	0,013192	0,783424	0,076706	0,06706	0,01651	0,101494	0,081646	0,103012	0,094684
11	0,03463	0,100864	0,125527	0,080091	0,037596	0,022881	0,107159	0,027417	0,107629	0,094873	0	0,018653	0,00083	0,016151	0,062219	0,089158	0,081681	0,688551	0,018167	0,027813	0,078362	0,006621	0,013227	0,008139	0,000189
12	0,015977	0,119517	0,106874	0,098744	0,056249	0,004228	0,125812	0,04607	0,088977	0,113525	0,018653	0	0,019483	0,034803	0,080872	0,107811	0,100334	0,669898	0,036819	0,046466	0,097015	0,012031	0,03188	0,010513	0,018842
13	0,03546	0,100034	0,126357	0,079261	0,036766	0,023711	0,106329	0,026587	0,10846	0,094042	0,00083	0,019483	0	0,01532	0,061389	0,088327	0,08085	0,689381	0,017336	0,026983	0,077532	0,007452	0,012397	0,00897	0,000641
14	0,05078	0,084713	0,141677	0,063941	0,021446	0,039031	0,091009	0,011267	0,12378	0,078722	0,016151	0,034803	0,01532	0	0,046069	0,073007	0,06553	0,704702	0,002016	0,011663	0,062212	0,022772	0,002923	0,02429	0,015962
15	0,096849	0,038645	0,187746	0,017872	0,024623	0,0851	0,04494	0,034802	0,169848	0,032654	0,062219	0,080872	0,061389	0,046069	0	0,026939	0,019462	0,75077	0,044053	0,034406	0,016143	0,06884	0,048992	0,070358	0,06203
16	0,123788	0,011706	0,214685	0,009067	0,051562	0,112039	0,018001	0,061741	0,196787	0,005715	0,089158	0,107811	0,088327	0,073007	0,026939	0	0,007477	0,777709	0,070991	0,061345	0,010796	0,095779	0,075931	0,097297	0,088969
17	0,116311	0,019183	0,207207	0,00159	0,044085	0,104562	0,025478	0,054263	0,18931	0,013192	0,081681	0,100334	0,08085	0,06553	0,019462	0,007477	0	0,770232	0,063514	0,053868	0,003319	0,088302	0,068454	0,08982	0,081492
18	0,653921	0,789415	0,563024	0,768642	0,726147	0,66567	0,79571	0,715968	0,580922	0,783424	0,688551	0,669898	0,689381	0,704702	0,75077	0,777709	0,770232	0	0,706718	0,716364	0,766913	0,68193	0,701778	0,680412	0,68874
19	0,052796	0,082697	0,143693	0,061924	0,01943	0,041048	0,088993	0,009251	0,125796	0,076706	0,018167	0,036819	0,017336	0,002016	0,044053	0,070991	0,063514	0,706718	0	0,009647	0,060196	0,024788	0,004939	0,026306	0,017978
20	0,062443	0,073051	0,15334	0,052278	0,009783	0,050694	0,079346	0,000396	0,135442	0,06706	0,027813	0,046466	0,026983	0,011663	0,034406	0,061345	0,053868	0,716364	0,009647	0	0,050549	0,034434	0,014586	0,035952	0,027624
21	0,112992	0,022502	0,203889	0,001729	0,040766	0,101243	0,028797	0,050945	0,185992	0,01651	0,078362	0,097015	0,077532	0,062212	0,016143	0,010796	0,003319	0,766913	0,060196	0,050549	0	0,084984	0,065135	0,086502	0,078173
22	0,028008	0,107485	0,118905	0,086712	0,044218	0,01626	0,113781	0,034039	0,101008	0,101494	0,006621	0,012031	0,007452	0,022772	0,06884	0,095779	0,088302	0,68193	0,024788	0,034434	0,084984	0	0,019849	0,001518	0,00681
23	0,047857	0,087637	0,138754	0,066864	0,024369	0,036108	0,093932	0,01419	0,120856	0,081646	0,013227	0,03188	0,012397	0,002923	0,048992	0,075931	0,068454	0,701778	0,004939	0,014586	0,065135	0,019849	0	0,021366	0,013038
24	0,026491	0,109003	0,117387	0,08823	0,045736	0,014742	0,115299	0,035557	0,09949	0,103012	0,008139	0,010513	0,00897	0,02429	0,070358	0,097297	0,08982	0,680412	0,026306	0,035952	0,086502	0,001518	0,021366	0	0,008328
25	0,034819	0,100675	0,125716	0,079902	0,037407	0,02307	0,10697	0,027228	0,107818	0,094684	0,000189	0,018842	0,000641	0,015962	0,06203	0,088969	0,081492	0,68874	0,017978	0,027624	0,078173	0,00681	0,013038	0,008328	0

Matrix of isomorphic distances for cluster construction № 3

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
1	0	0,135494	0,090897	0,114721	0,072226	0,011749	0,141789	0,062047	0,072999	0,129503	0,03463	0,015977	0,03546	0,05078	0,096849	0,123788	0,116311	0,653921	0,052796	0,062443	0,112992	0,028008	0,047857	0,026491	0,034819
2	0,135494	0	0,226391	0,020773	0,063268	0,123745	0,006295	0,073447	0,208493	0,005991	0,100864	0,119517	0,100034	0,084713	0,038645	0,011706	0,019183	0,789415	0,082697	0,073051	0,022502	0,107485	0,087637	0,109003	0,100675
3	0,090897	0,226391	0	0,205618	0,163123	0,102646	0,232686	0,152944	0,017897	0,220399	0,125527	0,106874	0,126357	0,141677	0,187746	0,214685	0,207207	0,563024	0,143693	0,15334	0,203889	0,118905	0,138754	0,117387	0,125716
4	0,114721	0,020773	0,205618	0	0,042495	0,102972	0,027068	0,052674	0,18772	0,014782	0,080091	0,098744	0,079261	0,063941	0,017872	0,009067	0,00159	0,768642	0,061924	0,052278	0,001729	0,086712	0,066864	0,08823	0,079902
5	0,072226	0,063268	0,163123	0,042495	0	0,060477	0,069563	0,010179	0,145226	0,057276	0,037596	0,056249	0,036766	0,021446	0,024623	0,051562	0,044085	0,726147	0,01943	0,009783	0,040766	0,044218	0,024369	0,045736	0,037407
6	0,011749	0,123745	0,102646	0,102972	0,060477	0	0,13004	0,050298	0,084748	0,117754	0,022881	0,004228	0,023711	0,039031	0,0851	0,112039	0,104562	0,66567	0,041048	0,050694	0,101243	0,01626	0,036108	0,014742	0,02307
7	0,141789	0,006295	0,232686	0,027068	0,069563	0,13004	0	0,079742	0,214789	0,012287	0,107159	0,125812	0,106329	0,091009	0,04494	0,018001	0,025478	0,79571	0,088993	0,079346	0,028797	0,113781	0,093932	0,115299	0,10697
8	0,062047	0,073447	0,152944	0,052674	0,010179	0,050298	0,079742	0	0,135047	0,067455	0,027417	0,04607	0,026587	0,011267	0,034802	0,061741	0,054263	0,715968	0,009251	0,000396	0,050945	0,034039	0,01419	0,035557	0,027228
9	0,072999	0,208493	0,017897	0,18772	0,145226	0,084748	0,214789	0,135047	0	0,202502	0,107629	0,088977	0,10846	0,12378	0,169848	0,196787	0,18931	0,580922	0,125796	0,135442	0,185992	0,101008	0,120856	0,09949	0,107818
10	0,129503	0,005991	0,220399	0,014782	0,057276	0,117754	0,012287	0,067455	0,202502	0	0,094873	0,113525	0,094042	0,078722	0,032654	0,005715	0,013192	0,783424	0,076706	0,06706	0,01651	0,101494	0,081646	0,103012	0,094684
11	0,03463	0,100864	0,125527	0,080091	0,037596	0,022881	0,107159	0,027417	0,107629	0,094873	0	0,018653	0,00083	0,016151	0,062219	0,089158	0,081681	0,688551	0,018167	0,027813	0,078362	0,006621	0,013227	0,008139	0,000189
12	0,015977	0,119517	0,106874	0,098744	0,056249	0,004228	0,125812	0,04607	0,088977	0,113525	0,018653	0	0,019483	0,034803	0,080872	0,107811	0,100334	0,669898	0,036819	0,046466	0,097015	0,012031	0,03188	0,010513	0,018842
13	0,03546	0,100034	0,126357	0,079261	0,036766	0,023711	0,106329	0,026587	0,10846	0,094042	0,00083	0,019483	0	0,01532	0,061389	0,088327	0,08085	0,689381	0,017336	0,026983	0,077532	0,007452	0,012397	0,00897	0,000641
14	0,05078	0,084713	0,141677	0,063941	0,021446	0,039031	0,091009	0,011267	0,12378	0,078722	0,016151	0,034803	0,01532	0	0,046069	0,073007	0,06553	0,704702	0,002016	0,011663	0,062212	0,022772	0,002923	0,02429	0,015962
15	0,096849	0,038645	0,187746	0,017872	0,024623	0,0851	0,04494	0,034802	0,169848	0,032654	0,062219	0,080872	0,061389	0,046069	0	0,026939	0,019462	0,75077	0,044053	0,034406	0,016143	0,06884	0,048992	0,070358	0,06203
16	0,123788	0,011706	0,214685	0,009067	0,051562	0,112039	0,018001	0,061741	0,196787	0,005715	0,089158	0,107811	0,088327	0,073007	0,026939	0	0,007477	0,777709	0,070991	0,061345	0,010796	0,095779	0,075931	0,097297	0,088969
17	0,116311	0,019183	0,207207	0,00159	0,044085	0,104562	0,025478	0,054263	0,18931	0,013192	0,081681	0,100334	0,08085	0,06553	0,019462	0,007477	0	0,770232	0,063514	0,053868	0,003319	0,088302	0,068454	0,08982	0,081492
18	0,653921	0,789415	0,563024	0,768642	0,726147	0,66567	0,79571	0,715968	0,580922	0,783424	0,688551	0,669898	0,689381	0,704702	0,75077	0,777709	0,770232	0	0,706718	0,716364	0,766913	0,68193	0,701778	0,680412	0,68874
19	0,052796	0,082697	0,143693	0,061924	0,01943	0,041048	0,088993	0,009251	0,125796	0,076706	0,018167	0,036819	0,017336	0,002016	0,044053	0,070991	0,063514	0,706718	0	0,009647	0,060196	0,024788	0,004939	0,026306	0,017978
20	0,062443	0,073051	0,15334	0,052278	0,009783	0,050694	0,079346	0,000396	0,135442	0,06706	0,027813	0,046466	0,026983	0,011663	0,034406	0,061345	0,053868	0,716364	0,009647	0	0,050549	0,034434	0,014586	0,035952	0,027624
21	0,112992	0,022502	0,203889	0,001729	0,040766	0,101243	0,028797	0,050945	0,185992	0,01651	0,078362	0,097015	0,077532	0,062212	0,016143	0,010796	0,003319	0,766913	0,060196	0,050549	0	0,084984	0,065135	0,086502	0,078173
22	0,028008	0,107485	0,118905	0,086712	0,044218	0,01626	0,113781	0,034039	0,101008	0,101494	0,006621	0,012031	0,007452	0,022772	0,06884	0,095779	0,088302	0,68193	0,024788	0,034434	0,084984	0	0,019849	0,001518	0,00681
23	0,047857	0,087637	0,138754	0,066864	0,024369	0,036108	0,093932	0,01419	0,120856	0,081646	0,013227	0,03188	0,012397	0,002923	0,048992	0,075931	0,068454	0,701778	0,004939	0,014586	0,065135	0,019849	0	0,021366	0,013038
24	0,026491	0,109003	0,117387	0,08823	0,045736	0,014742	0,115299	0,035557	0,09949	0,103012	0,008139	0,010513	0,00897	0,02429	0,070358	0,097297	0,08982	0,680412	0,026306	0,035952	0,086502	0,001518	0,021366	0	0,008328
25	0,034819	0,100675	0,125716	0,079902	0,037407	0,02307	0,10697	0,027228	0,107818	0,094684	0,000189	0,018842	0,000641	0,015962	0,06203	0,088969	0,081492	0,68874	0,017978	0,027624	0,078173	0,00681	0,013038	0,008328	0

Matrix of isomorphic distances for cluster construction № 4

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
1	0	0,889477	0,079738	1,217318	0,833526	0,444637	0,38721	1,217318	1,217318	1,122077	1,217318	0,505118	0,831453	1,217318	1,217318	0,689151	1,217318	1,217318	0,816513	1,217318	1,217318	0,722688	0,912631	0,574737	0,486255
2	0,889477	0	0,969215	0,32784	0,055951	0,44484	0,502267	0,32784	0,32784	0,232599	0,32784	0,384359	0,058024	0,32784	0,32784	0,200326	0,32784	0,32784	0,072964	0,32784	0,32784	0,166789	0,023154	0,314741	0,403222
3	0,079738	0,969215	0	1,297056	0,913264	0,524375	0,466948	1,297056	1,297056	1,201815	1,297056	0,584857	0,911191	1,297056	1,297056	0,768889	1,297056	1,297056	0,896251	1,297056	1,297056	0,802426	0,99237	0,654475	0,565994
4	1,217318	0,32784	1,297056	0	0,383791	0,772681	0,830107	0	0	0,095241	0	0,712199	0,385864	0	0	0,528166	0	0	0,400804	0	0	0,494629	0,304686	0,642581	0,731062
5	0,833526	0,055951	0,913264	0,383791	0	0,388889	0,446316	0,383791	0,383791	0,28855	0,383791	0,328408	0,002073	0,383791	0,383791	0,144375	0,383791	0,383791	0,017013	0,383791	0,383791	0,110838	0,079105	0,25879	0,347271
6	0,444637	0,44484	0,524375	0,772681	0,388889	0	0,057427	0,772681	0,772681	0,67744	0,772681	0,060482	0,386816	0,772681	0,772681	0,244514	0,772681	0,772681	0,371876	0,772681	0,772681	0,278051	0,467994	0,1301	0,041619
7	0,38721	0,502267	0,466948	0,830107	0,446316	0,057427	0	0,830107	0,830107	0,734866	0,830107	0,117908	0,444243	0,830107	0,830107	0,301941	0,830107	0,830107	0,429303	0,830107	0,830107	0,335478	0,525421	0,187526	0,099045
8	1,217318	0,32784	1,297056	0	0,383791	0,772681	0,830107	0	0	0,095241	0	0,712199	0,385864	0	0	0,528166	0	0	0,400804	0	0	0,494629	0,304686	0,642581	0,731062
9	1,217318	0,32784	1,297056	0	0,383791	0,772681	0,830107	0	0	0,095241	0	0,712199	0,385864	0	0	0,528166	0	0	0,400804	0	0	0,494629	0,304686	0,642581	0,731062
10	1,122077	0,232599	1,201815	0,095241	0,28855	0,67744	0,734866	0,095241	0,095241	0	0,095241	0,616958	0,290623	0,095241	0,095241	0,432925	0,095241	0,095241	0,305563	0,095241	0,095241	0,399388	0,209445	0,54734	0,635821
11	1,217318	0,32784	1,297056	0	0,383791	0,772681	0,830107	0	0	0,095241	0	0,712199	0,385864	0	0	0,528166	0	0	0,400804	0	0	0,494629	0,304686	0,642581	0,731062
12	0,505118	0,384359	0,584857	0,712199	0,328408	0,060482	0,117908	0,712199	0,712199	0,616958	0,712199	0	0,326335	0,712199	0,712199	0,184033	0,712199	0,712199	0,311395	0,712199	0,712199	0,21757	0,407513	0,069618	0,018863
13	0,831453	0,058024	0,911191	0,385864	0,002073	0,386816	0,444243	0,385864	0,385864	0,290623	0,385864	0,326335	0	0,385864	0,385864	0,142302	0,385864	0,385864	0,01494	0,385864	0,385864	0,108765	0,081178	0,256717	0,345198
14	1,217318	0,32784	1,297056	0	0,383791	0,772681	0,830107	0	0	0,095241	0	0,712199	0,385864	0	0	0,528166	0	0	0,400804	0	0	0,494629	0,304686	0,642581	0,731062
15	1,217318	0,32784	1,297056	0	0,383791	0,772681	0,830107	0	0	0,095241	0	0,712199	0,385864	0	0	0,528166	0	0	0,400804	0	0	0,494629	0,304686	0,642581	0,731062
16	0,689151	0,200326	0,768889	0,528166	0,144375	0,244514	0,301941	0,528166	0,528166	0,432925	0,528166	0,184033	0,142302	0,528166	0,528166	0	0,528166	0,528166	0,127362	0,528166	0,528166	0,033537	0,22348	0,114415	0,202896
17	1,217318	0,32784	1,297056	0	0,383791	0,772681	0,830107	0	0	0,095241	0	0,712199	0,385864	0	0	0,528166	0	0	0,400804	0	0	0,494629	0,304686	0,642581	0,731062
18	1,217318	0,32784	1,297056	0	0,383791	0,772681	0,830107	0	0	0,095241	0	0,712199	0,385864	0	0	0,528166	0	0	0,400804	0	0	0,494629	0,304686	0,642581	0,731062
19	0,816513	0,072964	0,896251	0,400804	0,017013	0,371876	0,429303	0,400804	0,400804	0,305563	0,400804	0,311395	0,01494	0,400804	0,400804	0,127362	0,400804	0,400804	0	0,400804	0,400804	0,093825	0,096118	0,241777	0,330258
20	1,217318	0,32784	1,297056	0	0,383791	0,772681	0,830107	0	0	0,095241	0	0,712199	0,385864	0	0	0,528166	0	0	0,400804	0	0	0,494629	0,304686	0,642581	0,731062
21	1,217318	0,32784	1,297056	0	0,383791	0,772681	0,830107	0	0	0,095241	0	0,712199	0,385864	0	0	0,528166	0	0	0,400804	0	0	0,494629	0,304686	0,642581	0,731062
22	0,722688	0,166789	0,802426	0,494629	0,110838	0,278051	0,335478	0,494629	0,494629	0,399388	0,494629	0,21757	0,108765	0,494629	0,494629	0,033537	0,494629	0,494629	0,093825	0,494629	0,494629	0	0,189943	0,147952	0,236433
23	0,912631	0,023154	0,99237	0,304686	0,079105	0,467994	0,525421	0,304686	0,304686	0,209445	0,304686	0,407513	0,081178	0,304686	0,304686	0,22348	0,304686	0,304686	0,096118	0,304686	0,304686	0,189943	0	0,337895	0,426376
24	0,574737	0,314741	0,654475	0,642581	0,25879	0,1301	0,187526	0,642581	0,642581	0,54734	0,642581	0,069618	0,256717	0,642581	0,642581	0,114415	0,642581	0,642581	0,241777	0,642581	0,642581	0,147952	0,337895	0	0,088481
25	0,486255	0,403222	0,565994	0,731062	0,347271	0,041619	0,099045	0,731062	0,731062	0,635821	0,731062	0,018863	0,345198	0,731062	0,731062	0,202896	0,731062	0,731062	0,330258	0,731062	0,731062	0,236433	0,426376	0,088481	0

Matrix of isomorphic distances for cluster construction № 5

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
1	0	0,276869	0,545722	0,208452	0,107359	0,033488	0,537598	0,545722	0,545722	0,074921	0,545722	0,315651	0,504132	0,251482	0,495041	0,154557	0,044439	0,545722	0,367394	0,508257	0,545722	0,135489	0,244179	0,545722	0,460381
2	0,276869	0	0,822591	0,485321	0,169511	0,243382	0,260729	0,822591	0,822591	0,35179	0,822591	0,038781	0,227263	0,025388	0,218172	0,122313	0,232431	0,822591	0,090525	0,231387	0,822591	0,141381	0,03269	0,822591	0,183511
3	0,545722	0,822591	0	0,33727	0,653081	0,57921	1,08332	0	0	0,470801	0	0,861372	1,049854	0,797204	1,040763	0,700279	0,590161	0	0,913116	1,053979	0	0,681211	0,789901	0	1,006102
4	0,208452	0,485321	0,33727	0	0,315811	0,24194	0,74605	0,33727	0,33727	0,133531	0,33727	0,524102	0,712584	0,459934	0,703493	0,363009	0,252891	0,33727	0,575846	0,716709	0,33727	0,343941	0,452631	0,33727	0,668832
5	0,107359	0,169511	0,653081	0,315811	0	0,073871	0,43024	0,653081	0,653081	0,18228	0,653081	0,208292	0,396774	0,144123	0,387682	0,047198	0,06292	0,653081	0,260035	0,400898	0,653081	0,02813	0,136821	0,653081	0,353022
6	0,033488	0,243382	0,57921	0,24194	0,073871	0	0,50411	0,57921	0,57921	0,108409	0,57921	0,282163	0,470644	0,217994	0,461553	0,121069	0,010951	0,57921	0,333906	0,474769	0,57921	0,102001	0,210692	0,57921	0,426893
7	0,537598	0,260729	1,08332	0,74605	0,43024	0,50411	0	1,08332	1,08332	0,612519	1,08332	0,221948	0,033466	0,286117	0,042557	0,383042	0,49316	1,08332	0,170204	0,029342	1,08332	0,40211	0,293419	1,08332	0,077218
8	0,545722	0,822591	0	0,33727	0,653081	0,57921	1,08332	0	0	0,470801	0	0,861372	1,049854	0,797204	1,040763	0,700279	0,590161	0	0,913116	1,053979	0	0,681211	0,789901	0	1,006102
9	0,545722	0,822591	0	0,33727	0,653081	0,57921	1,08332	0	0	0,470801	0	0,861372	1,049854	0,797204	1,040763	0,700279	0,590161	0	0,913116	1,053979	0	0,681211	0,789901	0	1,006102
10	0,074921	0,35179	0,470801	0,133531	0,18228	0,108409	0,612519	0,470801	0,470801	0	0,470801	0,390571	0,579053	0,326403	0,569962	0,229478	0,11936	0,470801	0,442315	0,583178	0,470801	0,21041	0,3191	0,470801	0,535301
11	0,545722	0,822591	0	0,33727	0,653081	0,57921	1,08332	0	0	0,470801	0	0,861372	1,049854	0,797204	1,040763	0,700279	0,590161	0	0,913116	1,053979	0	0,681211	0,789901	0	1,006102
12	0,315651	0,038781	0,861372	0,524102	0,208292	0,282163	0,221948	0,861372	0,861372	0,390571	0,861372	0	0,188482	0,064169	0,179391	0,161094	0,271212	0,861372	0,051744	0,192606	0,861372	0,180162	0,071471	0,861372	0,14473
13	0,504132	0,227263	1,049854	0,712584	0,396774	0,470644	0,033466	1,049854	1,049854	0,579053	1,049854	0,188482	0	0,25265	0,009091	0,349575	0,459694	1,049854	0,136738	0,004125	1,049854	0,368643	0,259953	1,049854	0,043752
14	0,251482	0,025388	0,797204	0,459934	0,144123	0,217994	0,286117	0,797204	0,797204	0,326403	0,797204	0,064169	0,25265	0	0,243559	0,096925	0,207043	0,797204	0,115912	0,256775	0,797204	0,115993	0,007302	0,797204	0,208899
15	0,495041	0,218172	1,040763	0,703493	0,387682	0,461553	0,042557	1,040763	1,040763	0,569962	1,040763	0,179391	0,009091	0,243559	0	0,340484	0,450602	1,040763	0,127647	0,013216	1,040763	0,359552	0,250862	1,040763	0,034661
16	0,154557	0,122313	0,700279	0,363009	0,047198	0,121069	0,383042	0,700279	0,700279	0,229478	0,700279	0,161094	0,349575	0,096925	0,340484	0	0,110118	0,700279	0,212837	0,3537	0,700279	0,019068	0,089623	0,700279	0,305824
17	0,044439	0,232431	0,590161	0,252891	0,06292	0,010951	0,49316	0,590161	0,590161	0,11936	0,590161	0,271212	0,459694	0,207043	0,450602	0,110118	0	0,590161	0,322955	0,463818	0,590161	0,09105	0,199741	0,590161	0,415942
18	0,545722	0,822591	0	0,33727	0,653081	0,57921	1,08332	0	0	0,470801	0	0,861372	1,049854	0,797204	1,040763	0,700279	0,590161	0	0,913116	1,053979	0	0,681211	0,789901	0	1,006102
19	0,367394	0,090525	0,913116	0,575846	0,260035	0,333906	0,170204	0,913116	0,913116	0,442315	0,913116	0,051744	0,136738	0,115912	0,127647	0,212837	0,322955	0,913116	0	0,140863	0,913116	0,231905	0,123215	0,913116	0,092986
20	0,508257	0,231387	1,053979	0,716709	0,400898	0,474769	0,029342	1,053979	1,053979	0,583178	1,053979	0,192606	0,004125	0,256775	0,013216	0,3537	0,463818	1,053979	0,140863	0	1,053979	0,372768	0,264077	1,053979	0,047876
21	0,545722	0,822591	0	0,33727	0,653081	0,57921	1,08332	0	0	0,470801	0	0,861372	1,049854	0,797204	1,040763	0,700279	0,590161	0	0,913116	1,053979	0	0,681211	0,789901	0	1,006102
22	0,135489	0,141381	0,681211	0,343941	0,02813	0,102001	0,40211	0,681211	0,681211	0,21041	0,681211	0,180162	0,368643	0,115993	0,359552	0,019068	0,09105	0,681211	0,231905	0,372768	0,681211	0	0,108691	0,681211	0,324892
23	0,244179	0,03269	0,789901	0,452631	0,136821	0,210692	0,293419	0,789901	0,789901	0,3191	0,789901	0,071471	0,259953	0,007302	0,250862	0,089623	0,199741	0,789901	0,123215	0,264077	0,789901	0,108691	0	0,789901	0,216201
24	0,545722	0,822591	0	0,33727	0,653081	0,57921	1,08332	0	0	0,470801	0	0,861372	1,049854	0,797204	1,040763	0,700279	0,590161	0	0,913116	1,053979	0	0,681211	0,789901	0	1,006102
25	0,460381	0,183511	1,006102	0,668832	0,353022	0,426893	0,077218	1,006102	1,006102	0,535301	1,006102	0,14473	0,043752	0,208899	0,034661	0,305824	0,415942	1,006102	0,092986	0,047876	1,006102	0,324892	0,216201	1,006102	0

Matrix of isomorphic distances for cluster construction № 6

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
1	0	0,03297	0,101006	0,278562	0,104194	0,494033	0,547759	0,419296	0,287559	0,494033	0,494033	0,313554	0,562543	0,437832	0,250327	0,269466	0,284246	0,494033	0,04871	0,516108	0,494033	0,131905	0,002175	0,142961	0,494033
2	0,03297	0	0,068036	0,245591	0,071224	0,527003	0,514789	0,386326	0,254589	0,527003	0,527003	0,280583	0,529573	0,404862	0,217356	0,236495	0,251275	0,527003	0,015739	0,483138	0,527003	0,098934	0,030796	0,10999	0,527003
3	0,101006	0,068036	0	0,177555	0,003188	0,595039	0,446753	0,31829	0,186553	0,595039	0,595039	0,212548	0,461537	0,336826	0,14932	0,16846	0,183239	0,595039	0,052297	0,415102	0,595039	0,030899	0,098831	0,041954	0,595039
4	0,278562	0,245591	0,177555	0	0,174367	0,772594	0,269197	0,140734	0,008998	0,772594	0,772594	0,034992	0,283981	0,159271	0,028235	0,009096	0,005684	0,772594	0,229852	0,237547	0,772594	0,146657	0,276387	0,135601	0,772594
5	0,104194	0,071224	0,003188	0,174367	0	0,598227	0,443565	0,315102	0,183365	0,598227	0,598227	0,20936	0,458349	0,333638	0,146132	0,165271	0,180051	0,598227	0,055485	0,411914	0,598227	0,02771	0,102019	0,038766	0,598227
6	0,494033	0,527003	0,595039	0,772594	0,598227	0	1,041792	0,913329	0,781592	0	0	0,807587	1,056576	0,931865	0,744359	0,763498	0,778278	0	0,542742	1,010141	0	0,625938	0,496208	0,636993	0
7	0,547759	0,514789	0,446753	0,269197	0,443565	1,041792	0	0,128463	0,2602	1,041792	1,041792	0,234205	0,014784	0,109927	0,297433	0,278293	0,263514	1,041792	0,49905	0,031651	1,041792	0,415854	0,545584	0,404799	1,041792
8	0,419296	0,386326	0,31829	0,140734	0,315102	0,913329	0,128463	0	0,131737	0,913329	0,913329	0,105742	0,143247	0,018536	0,16897	0,14983	0,135051	0,913329	0,370586	0,096812	0,913329	0,287391	0,417121	0,276336	0,913329
9	0,287559	0,254589	0,186553	0,008998	0,183365	0,781592	0,2602	0,131737	0	0,781592	0,781592	0,025995	0,274984	0,150273	0,037233	0,018093	0,003314	0,781592	0,23885	0,228549	0,781592	0,155654	0,285384	0,144599	0,781592
10	0,494033	0,527003	0,595039	0,772594	0,598227	0	1,041792	0,913329	0,781592	0	0	0,807587	1,056576	0,931865	0,744359	0,763498	0,778278	0	0,542742	1,010141	0	0,625938	0,496208	0,636993	0
11	0,494033	0,527003	0,595039	0,772594	0,598227	0	1,041792	0,913329	0,781592	0	0	0,807587	1,056576	0,931865	0,744359	0,763498	0,778278	0	0,542742	1,010141	0	0,625938	0,496208	0,636993	0
12	0,313554	0,280583	0,212548	0,034992	0,20936	0,807587	0,234205	0,105742	0,025995	0,807587	0,807587	0	0,248989	0,124278	0,063227	0,044088	0,029308	0,807587	0,264844	0,202555	0,807587	0,181649	0,311379	0,170593	0,807587
13	0,562543	0,529573	0,461537	0,283981	0,458349	1,056576	0,014784	0,143247	0,274984	1,056576	1,056576	0,248989	0	0,124711	0,312216	0,293077	0,278297	1,056576	0,513833	0,046434	1,056576	0,430638	0,560368	0,419582	1,056576
14	0,437832	0,404862	0,336826	0,159271	0,333638	0,931865	0,109927	0,018536	0,150273	0,931865	0,931865	0,124278	0,124711	0	0,187506	0,168367	0,153587	0,931865	0,389123	0,078276	0,931865	0,305927	0,435657	0,294872	0,931865
15	0,250327	0,217356	0,14932	0,028235	0,146132	0,744359	0,297433	0,16897	0,037233	0,744359	0,744359	0,063227	0,312216	0,187506	0	0,019139	0,033919	0,744359	0,201617	0,265782	0,744359	0,118422	0,248152	0,107366	0,744359
16	0,269466	0,236495	0,16846	0,009096	0,165271	0,763498	0,278293	0,14983	0,018093	0,763498	0,763498	0,044088	0,293077	0,168367	0,019139	0	0,01478	0,763498	0,220756	0,246643	0,763498	0,137561	0,267291	0,126505	0,763498
17	0,284246	0,251275	0,183239	0,005684	0,180051	0,778278	0,263514	0,135051	0,003314	0,778278	0,778278	0,029308	0,278297	0,153587	0,033919	0,01478	0	0,778278	0,235536	0,231863	0,778278	0,152341	0,282071	0,141285	0,778278
18	0,494033	0,527003	0,595039	0,772594	0,598227	0	1,041792	0,913329	0,781592	0	0	0,807587	1,056576	0,931865	0,744359	0,763498	0,778278	0	0,542742	1,010141	0	0,625938	0,496208	0,636993	0
19	0,04871	0,015739	0,052297	0,229852	0,055485	0,542742	0,49905	0,370586	0,23885	0,542742	0,542742	0,264844	0,513833	0,389123	0,201617	0,220756	0,235536	0,542742	0	0,467399	0,542742	0,083195	0,046535	0,094251	0,542742
20	0,516108	0,483138	0,415102	0,237547	0,411914	1,010141	0,031651	0,096812	0,228549	1,010141	1,010141	0,202555	0,046434	0,078276	0,265782	0,246643	0,231863	1,010141	0,467399	0	1,010141	0,384204	0,513934	0,373148	1,010141
21	0,494033	0,527003	0,595039	0,772594	0,598227	0	1,041792	0,913329	0,781592	0	0	0,807587	1,056576	0,931865	0,744359	0,763498	0,778278	0	0,542742	1,010141	0	0,625938	0,496208	0,636993	0
22	0,131905	0,098934	0,030899	0,146657	0,02771	0,625938	0,415854	0,287391	0,155654	0,625938	0,625938	0,181649	0,430638	0,305927	0,118422	0,137561	0,152341	0,625938	0,083195	0,384204	0,625938	0	0,12973	0,011056	0,625938
23	0,002175	0,030796	0,098831	0,276387	0,102019	0,496208	0,545584	0,417121	0,285384	0,496208	0,496208	0,311379	0,560368	0,435657	0,248152	0,267291	0,282071	0,496208	0,046535	0,513934	0,496208	0,12973	0	0,140786	0,496208
24	0,142961	0,10999	0,041954	0,135601	0,038766	0,636993	0,404799	0,276336	0,144599	0,636993	0,636993	0,170593	0,419582	0,294872	0,107366	0,126505	0,141285	0,636993	0,094251	0,373148	0,636993	0,011056	0,140786	0	0,636993
25	0,494033	0,527003	0,595039	0,772594	0,598227	0	1,041792	0,913329	0,781592	0	0	0,807587	1,056576	0,931865	0,744359	0,763498	0,778278	0	0,542742	1,010141	0	0,625938	0,496208	0,636993	0

Matrix of isomorphic distances for cluster construction № 7

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
1	0	0,378947	0,479909	0,675601	0,30431	0,736041	0,855388	0,287885	0,321781	0,039666	0,124538	0,028523	0,162149	0,089809	0,152737	0,033939	0,101429	0,855388	0,080906	0,090212	0,007382	0,199711	0,483146	0,150359	0,26308
2	0,378947	0	0,100962	0,296655	0,074637	0,357094	0,476442	0,091061	0,057165	0,418613	0,254408	0,350424	0,541096	0,289137	0,22621	0,412885	0,277517	0,476442	0,298041	0,469159	0,386328	0,179236	0,104199	0,228588	0,115867
3	0,479909	0,100962	0	0,195693	0,175599	0,256132	0,37548	0,192023	0,158127	0,519575	0,35537	0,451386	0,642057	0,390099	0,327172	0,513847	0,378479	0,37548	0,399003	0,570121	0,48729	0,280198	0,003237	0,32955	0,216829
4	0,675601	0,296655	0,195693	0	0,371291	0,06044	0,179787	0,387716	0,35382	0,715268	0,551063	0,647079	0,83775	0,585792	0,522865	0,70954	0,574172	0,179787	0,594695	0,765814	0,682983	0,475891	0,192455	0,525243	0,412522
5	0,30431	0,074637	0,175599	0,371291	0	0,431731	0,551078	0,016425	0,017471	0,343976	0,179772	0,275787	0,466459	0,214501	0,151573	0,338249	0,202881	0,551078	0,223404	0,394522	0,311692	0,104599	0,178836	0,153951	0,04123
6	0,736041	0,357094	0,256132	0,06044	0,431731	0	0,119347	0,448156	0,41426	0,775707	0,611503	0,707518	0,89819	0,646232	0,583304	0,76998	0,634612	0,119347	0,655135	0,826253	0,743423	0,53633	0,252895	0,585682	0,472961
7	0,855388	0,476442	0,37548	0,179787	0,551078	0,119347	0	0,567503	0,533607	0,895055	0,73085	0,826866	1,017537	0,765579	0,702652	0,889327	0,753959	0	0,774482	0,945601	0,86277	0,655678	0,372242	0,70503	0,592309
8	0,287885	0,091061	0,192023	0,387716	0,016425	0,448156	0,567503	0	0,033896	0,327552	0,163347	0,259363	0,450034	0,198076	0,135149	0,321824	0,186456	0,567503	0,206979	0,378098	0,295267	0,088174	0,195261	0,137527	0,024806
9	0,321781	0,057165	0,158127	0,35382	0,017471	0,41426	0,533607	0,033896	0	0,361447	0,197243	0,293259	0,48393	0,231972	0,169045	0,35572	0,220352	0,533607	0,240875	0,411993	0,329163	0,12207	0,161365	0,171423	0,058702
10	0,039666	0,418613	0,519575	0,715268	0,343976	0,775707	0,895055	0,327552	0,361447	0	0,164205	0,068189	0,122483	0,129476	0,192403	0,005728	0,141095	0,895055	0,120572	0,050546	0,032285	0,239377	0,522812	0,190025	0,302746
11	0,124538	0,254408	0,35537	0,551063	0,179772	0,611503	0,73085	0,163347	0,197243	0,164205	0	0,096016	0,286687	0,034729	0,028198	0,158477	0,023109	0,73085	0,043632	0,214751	0,13192	0,075172	0,358608	0,02582	0,138541
12	0,028523	0,350424	0,451386	0,647079	0,275787	0,707518	0,826866	0,259363	0,293259	0,068189	0,096016	0	0,190671	0,061287	0,124214	0,062461	0,072907	0,826866	0,052383	0,118735	0,035904	0,171188	0,454623	0,121836	0,234557
13	0,162149	0,541096	0,642057	0,83775	0,466459	0,89819	1,017537	0,450034	0,48393	0,122483	0,286687	0,190671	0	0,251958	0,314885	0,12821	0,263578	1,017537	0,243055	0,071937	0,154767	0,36186	0,645295	0,312507	0,425228
14	0,089809	0,289137	0,390099	0,585792	0,214501	0,646232	0,765579	0,198076	0,231972	0,129476	0,034729	0,061287	0,251958	0	0,062927	0,123748	0,01162	0,765579	0,008903	0,180022	0,097191	0,109902	0,393337	0,060549	0,17327
15	0,152737	0,22621	0,327172	0,522865	0,151573	0,583304	0,702652	0,135149	0,169045	0,192403	0,028198	0,124214	0,314885	0,062927	0	0,186675	0,051307	0,702652	0,071831	0,242949	0,160118	0,046974	0,330409	0,002378	0,110343
16	0,033939	0,412885	0,513847	0,70954	0,338249	0,76998	0,889327	0,321824	0,35572	0,005728	0,158477	0,062461	0,12821	0,123748	0,186675	0	0,135368	0,889327	0,114845	0,056274	0,026557	0,233649	0,517084	0,184297	0,297018
17	0,101429	0,277517	0,378479	0,574172	0,202881	0,634612	0,753959	0,186456	0,220352	0,141095	0,023109	0,072907	0,263578	0,01162	0,051307	0,135368	0	0,753959	0,020523	0,191641	0,108811	0,098282	0,381717	0,048929	0,16165
18	0,855388	0,476442	0,37548	0,179787	0,551078	0,119347	0	0,567503	0,533607	0,895055	0,73085	0,826866	1,017537	0,765579	0,702652	0,889327	0,753959	0	0,774482	0,945601	0,86277	0,655678	0,372242	0,70503	0,592309
19	0,080906	0,298041	0,399003	0,594695	0,223404	0,655135	0,774482	0,206979	0,240875	0,120572	0,043632	0,052383	0,243055	0,008903	0,071831	0,114845	0,020523	0,774482	0	0,171118	0,088288	0,118805	0,40224	0,069453	0,182174
20	0,090212	0,469159	0,570121	0,765814	0,394522	0,826253	0,945601	0,378098	0,411993	0,050546	0,214751	0,118735	0,071937	0,180022	0,242949	0,056274	0,191641	0,945601	0,171118	0	0,082831	0,289923	0,573358	0,240571	0,353292
21	0,007382	0,386328	0,48729	0,682983	0,311692	0,743423	0,86277	0,295267	0,329163	0,032285	0,13192	0,035904	0,154767	0,097191	0,160118	0,026557	0,108811	0,86277	0,088288	0,082831	0	0,207092	0,490528	0,15774	0,270461
22	0,199711	0,179236	0,280198	0,475891	0,104599	0,53633	0,655678	0,088174	0,12207	0,239377	0,075172	0,171188	0,36186	0,109902	0,046974	0,233649	0,098282	0,655678	0,118805	0,289923	0,207092	0	0,283435	0,049352	0,063369
23	0,483146	0,104199	0,003237	0,192455	0,178836	0,252895	0,372242	0,195261	0,161365	0,522812	0,358608	0,454623	0,645295	0,393337	0,330409	0,517084	0,381717	0,372242	0,40224	0,573358	0,490528	0,283435	0	0,332787	0,220066
24	0,150359	0,228588	0,32955	0,525243	0,153951	0,585682	0,70503	0,137527	0,171423	0,190025	0,02582	0,121836	0,312507	0,060549	0,002378	0,184297	0,048929	0,70503	0,069453	0,240571	0,15774	0,049352	0,332787	0	0,112721
25	0,26308	0,115867	0,216829	0,412522	0,04123	0,472961	0,592309	0,024806	0,058702	0,302746	0,138541	0,234557	0,425228	0,17327	0,110343	0,297018	0,16165	0,592309	0,182174	0,353292	0,270461	0,063369	0,220066	0,112721	0

Matrix of isomorphic distances for cluster construction № 8

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
1	0	0,108112	0,699169	0,373154	0,382155	0,438835	0,309206	0,263361	0,143647	0,085834	0,077062	0,157874	0,258091	0,053309	0,120643	0,085416	0,026886	0,699169	0,049113	0,242679	0,171537	0,018828	0,295527	0,007358	0,05172
2	0,108112	0	0,807282	0,481266	0,490267	0,546947	0,201094	0,371474	0,251759	0,022278	0,185174	0,049762	0,149978	0,054803	0,01253	0,022696	0,081226	0,807282	0,157225	0,134567	0,063425	0,089284	0,403639	0,100754	0,056392
3	0,699169	0,807282	0	0,326015	0,317015	0,260335	1,008376	0,435808	0,555522	0,785003	0,622107	0,857044	0,95726	0,752479	0,819812	0,784585	0,726055	0	0,650057	0,941849	0,870706	0,717998	0,403643	0,706527	0,750889
4	0,373154	0,481266	0,326015	0	0,009001	0,065681	0,68236	0,109793	0,229507	0,458988	0,296092	0,531028	0,631245	0,426463	0,493797	0,45857	0,40004	0,326015	0,324041	0,615833	0,544691	0,391982	0,077627	0,380512	0,424874
5	0,382155	0,490267	0,317015	0,009001	0	0,05668	0,691361	0,118793	0,238508	0,467989	0,305092	0,540029	0,640245	0,435464	0,502797	0,46757	0,40904	0,317015	0,333042	0,624834	0,553692	0,400983	0,086628	0,389512	0,433875
6	0,438835	0,546947	0,260335	0,065681	0,05668	0	0,748041	0,175473	0,295188	0,524669	0,361773	0,596709	0,696925	0,492144	0,559477	0,52425	0,46572	0,260335	0,389722	0,681514	0,610372	0,457663	0,143308	0,446193	0,490555
7	0,309206	0,201094	1,008376	0,68236	0,691361	0,748041	0	0,572568	0,452853	0,223372	0,386269	0,151332	0,051116	0,255897	0,188564	0,223791	0,282321	1,008376	0,358319	0,066527	0,137669	0,290378	0,604733	0,301849	0,257486
8	0,263361	0,371474	0,435808	0,109793	0,118793	0,175473	0,572568	0	0,119714	0,349195	0,186299	0,421236	0,521452	0,316671	0,384004	0,348777	0,290247	0,435808	0,214249	0,506041	0,434898	0,28219	0,032165	0,270719	0,315081
9	0,143647	0,251759	0,555522	0,229507	0,238508	0,295188	0,452853	0,119714	0	0,229481	0,066585	0,301521	0,401738	0,196956	0,26429	0,229063	0,170533	0,555522	0,094534	0,386326	0,315184	0,162475	0,15188	0,151005	0,195367
10	0,085834	0,022278	0,785003	0,458988	0,467989	0,524669	0,223372	0,349195	0,229481	0	0,162896	0,07204	0,172257	0,032525	0,034809	0,000418	0,058948	0,785003	0,134947	0,156845	0,085703	0,067006	0,381361	0,078476	0,034114
11	0,077062	0,185174	0,622107	0,296092	0,305092	0,361773	0,386269	0,186299	0,066585	0,162896	0	0,234937	0,335153	0,130372	0,197705	0,162478	0,103948	0,622107	0,02795	0,319742	0,248599	0,095891	0,218464	0,08442	0,128782
12	0,157874	0,049762	0,857044	0,531028	0,540029	0,596709	0,151332	0,421236	0,301521	0,07204	0,234937	0	0,100216	0,104565	0,037232	0,072459	0,130989	0,857044	0,206987	0,084805	0,013663	0,139046	0,453401	0,150517	0,106154
13	0,258091	0,149978	0,95726	0,631245	0,640245	0,696925	0,051116	0,521452	0,401738	0,172257	0,335153	0,100216	0	0,204781	0,137448	0,172675	0,231205	0,95726	0,307203	0,015411	0,086554	0,239262	0,553617	0,250733	0,206371
14	0,053309	0,054803	0,752479	0,426463	0,435464	0,492144	0,255897	0,316671	0,196956	0,032525	0,130372	0,104565	0,204781	0	0,067333	0,032106	0,026424	0,752479	0,102422	0,18937	0,118228	0,034481	0,348836	0,045952	0,001589
15	0,120643	0,01253	0,819812	0,493797	0,502797	0,559477	0,188564	0,384004	0,26429	0,034809	0,197705	0,037232	0,137448	0,067333	0	0,035227	0,093757	0,819812	0,169755	0,122037	0,050894	0,101814	0,416169	0,113285	0,068923
16	0,085416	0,022696	0,784585	0,45857	0,46757	0,52425	0,223791	0,348777	0,229063	0,000418	0,162478	0,072459	0,172675	0,032106	0,035227	0	0,05853	0,784585	0,134528	0,157264	0,086121	0,066587	0,380942	0,078058	0,033696
17	0,026886	0,081226	0,726055	0,40004	0,40904	0,46572	0,282321	0,290247	0,170533	0,058948	0,103948	0,130989	0,231205	0,026424	0,093757	0,05853	0	0,726055	0,075998	0,215794	0,144651	0,008057	0,322412	0,019528	0,024834
18	0,699169	0,807282	0	0,326015	0,317015	0,260335	1,008376	0,435808	0,555522	0,785003	0,622107	0,857044	0,95726	0,752479	0,819812	0,784585	0,726055	0	0,650057	0,941849	0,870706	0,717998	0,403643	0,706527	0,750889
19	0,049113	0,157225	0,650057	0,324041	0,333042	0,389722	0,358319	0,214249	0,094534	0,134947	0,02795	0,206987	0,307203	0,102422	0,169755	0,134528	0,075998	0,650057	0	0,291792	0,22065	0,067941	0,246414	0,05647	0,100833
20	0,242679	0,134567	0,941849	0,615833	0,624834	0,681514	0,066527	0,506041	0,386326	0,156845	0,319742	0,084805	0,015411	0,18937	0,122037	0,157264	0,215794	0,941849	0,291792	0	0,071142	0,223851	0,538206	0,235322	0,190959
21	0,171537	0,063425	0,870706	0,544691	0,553692	0,610372	0,137669	0,434898	0,315184	0,085703	0,248599	0,013663	0,086554	0,118228	0,050894	0,086121	0,144651	0,870706	0,22065	0,071142	0	0,152709	0,467064	0,164179	0,119817
22	0,018828	0,089284	0,717998	0,391982	0,400983	0,457663	0,290378	0,28219	0,162475	0,067006	0,095891	0,139046	0,239262	0,034481	0,101814	0,066587	0,008057	0,717998	0,067941	0,223851	0,152709	0	0,314355	0,011471	0,032892
23	0,295527	0,403639	0,403643	0,077627	0,086628	0,143308	0,604733	0,032165	0,15188	0,381361	0,218464	0,453401	0,553617	0,348836	0,416169	0,380942	0,322412	0,403643	0,246414	0,538206	0,467064	0,314355	0	0,302885	0,347247
24	0,007358	0,100754	0,706527	0,380512	0,389512	0,446193	0,301849	0,270719	0,151005	0,078476	0,08442	0,150517	0,250733	0,045952	0,113285	0,078058	0,019528	0,706527	0,05647	0,235322	0,164179	0,011471	0,302885	0	0,044362
25	0,05172	0,056392	0,750889	0,424874	0,433875	0,490555	0,257486	0,315081	0,195367	0,034114	0,128782	0,106154	0,206371	0,001589	0,068923	0,033696	0,024834	0,750889	0,100833	0,190959	0,119817	0,032892	0,347247	0,044362	0

Built for a cluster № 1

1 (3):	1	0,033488	6	0,010951	17							
2 (5):	2	0,025388	14	0,064169	12	0,051744	19	0,123215	23			
3 (7):	3	0	8	0	9	0	11	0	18	0	21	0	24
4 (2):	4	0,133531	10									
5 (3):	5	0,02813	22	0,019068	16							
6 (5):	7	0,029342	20	0,004125	13	0,009091	15	0,034661	25			

Matrix of interchain distances

Chains	1	2	3	4	5	6
1	0	0,199741	0,545722	0,074921	0,06292	0,415942
	(0; 0)	(17; 23)	(1; 3)	(1; 10)	(17; 5)	(17; 25)
2	0,199741	0	0,789901	0,3191	0,089623	0,092986
	(17; 23)	(0; 0)	(23; 3)	(23; 10)	(23; 16)	(19; 25)
3	0,545722	0,789901	0	0,33727	0,653081	1
	(1; 3)	(23; 3)	(0; 0)	(3; 4)	(3; 5)	(0; 0)
4	0,074921	0,3191	0,33727	0	0,18228	0,535301
	(1; 10)	(23; 10)	(3; 4)	(0; 0)	(10; 5)	(10; 25)
5	0,06292	0,089623	0,653081	0,18228	0	0,305824
	(17; 5)	(23; 16)	(3; 5)	(10; 5)	(0; 0)	(16; 25)
6	0,415942	0,092986	1	0,535301	0,305824	0
	(17; 25)	(19; 25)	(0; 0)	(10; 25)	(16; 25)	(0; 0)
Minimum distances between chains	0,06292	0,089623	0,33727	0,074921	0,06292	0,092986
	(1; 5)	(2; 5)	(3; 4)	(4; 1)	(5; 1)	(6; 2)

Built for a cluster № 2

1 (2): | 1 | 0,002175 | 23 |

2 (2): | 2 | 0,015739 | 19 |

3 (2): | 3 | 0,003188 | 5 |

4 (4): | 4 | 0,005684 | 17 | 0,003314 | 9 | 0,025995 | 12 |

5 (6): | 6 | 0 | 10 | 0 | 11 | 0 | 18 | 0 | 21 | 0 | 25 |

6 (3): | 7 | 0,014784 | 13 | 0,046434 | 20 |

7 (2): | 8 | 0,018536 | 14 |

8 (2): | 15 | 0,019139 | 16 |

9 (2): | 22 | 0,011056 | 24 |

Matrix of interchain distances

Chains	1	2	3	4	5	6	7	8	9
1	0	0,030796	0,098831	0,276387	0,494033	0,513934	0,417121	0,248152	0,12973
	(0; 0)	(23; 2)	(23; 3)	(23; 4)	(1; 6)	(23; 20)	(23; 8)	(23; 15)	(23; 22)
2	0,030796	0	0,052297	0,229852	0,527003	0,467399	0,370586	0,201617	0,083195
	(23; 2)	**(0; 0)**	(19; 3)	(19; 4)	(2; 6)	(19; 20)	(19; 8)	(19; 15)	(19; 22)
3	0,098831	0,052297	0	0,174367	0,595039	0,411914	0,315102	0,146132	0,02771
	(23; 3)	(19; 3)	**(0; 0)**	(5; 4)	(3; 6)	(5; 20)	(5; 8)	(5; 15)	(5; 22)
4	0,276387	0,229852	0,174367	0	0,772594	0,202555	0,105742	0,009096	0,135601
	(23; 4)	(19; 4)	(5; 4)	**(0; 0)**	(4; 6)	(12; 20)	(12; 8)	(4; 16)	(4; 24)
5	0,494033	0,527003	0,595039	0,772594	0	1	0,913329	0,744359	0,625938
	(1; 6)	(2; 6)	(3; 6)	(4; 6)	**(0; 0)**	(0; 0)	(6; 8)	(6; 15)	(6; 22)
6	0,513934	0,467399	0,411914	0,202555	1	0	0,078276	0,246643	0,373148
	(23; 20)	(19; 20)	(5; 20)	(12; 20)	(0; 0)	**(0; 0)**	(20; 14)	(20; 16)	(20; 24)
7	0,417121	0,370586	0,315102	0,105742	0,913329	0,078276	0	0,14983	0,276336
	(23; 8)	(19; 8)	(5; 8)	(12; 8)	(6; 8)	(20; 14)	**(0; 0)**	(8; 16)	(8; 24)
8	0,248152	0,201617	0,146132	0,009096	0,744359	0,246643	0,14983	0	0,107366
	(23; 15)	(19; 15)	(5; 15)	(4; 16)	(6; 15)	(20; 16)	(8; 16)	**(0; 0)**	(15; 24)
9	0,12973	0,083195	0,02771	0,135601	0,625938	0,373148	0,276336	0,107366	0
	(23; 22)	(19; 22)	(5; 22)	(4; 24)	(6; 22)	(20; 24)	(8; 24)	(15; 24)	**(0; 0)**
Minimum distances between chains	0,030796	0,030796	0,02771	0,009096	0,494033	0,078276	0,078276	0,009096	0,02771
	(1; 2)	(2; 1)	(3; 9)	(4; 8)	(5; 1)	(6; 7)	(7; 6)	(8; 4)	(9; 3)

Built for a cluster № 3

1 (3):	1	0,007382	21	0,035904	12

2 (2):	2	0,057165	9

3 (2):	3	0,003237	23

4 (2):	4	0,06044	6

5 (3):	5	0,016425	8	0,024806	25

6 (2):	7	0	18

7 (2):	10	0,005728	16

8 (2):	11	0,023109	17

9 (2):	13	0,071937	20

10 (2):	14	0,008903	19

11 (3):	15	0,002378	24	0,049352	22

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Matrix of interchain distances

Chains	1	2	3	4	5	6	7	8	9	10	11
1	0	0,293259	0,451386	0,647079	0,234557	0,826866	0,026557	0,072907	0,082831	0,052383	0,121836
	(0; 0)	(12; 9)	(12; 3)	(12; 4)	(12; 25)	(12; 7)	(21; 16)	(12; 17)	(21; 20)	(12; 19)	(12; 24)
2	0,293259	0	0,100962	0,296655	0,017471	0,476442	0,35572	0,197243	0,411993	0,231972	0,12207
	(12; 9)	(0; 0)	(2; 3)	(2; 4)	(9; 5)	(2; 7)	(9; 16)	(9; 11)	(9; 20)	(9; 14)	(9; 22)
3	0,451386	0,100962	0	0,192455	0,175599	0,372242	0,513847	0,35537	0,570121	0,390099	0,280198
	(12; 3)	(2; 3)	(0; 0)	(23; 4)	(3; 5)	(23; 7)	(3; 16)	(3; 11)	(3; 20)	(3; 14)	(3; 22)
4	0,647079	0,296655	0,192455	0	0,371291	0,119347	0,70954	0,551063	0,765814	0,585792	0,475891
	(12; 4)	(2; 4)	(23; 4)	(0; 0)	(4; 5)	(6; 7)	(4; 16)	(4; 11)	(4; 20)	(4; 14)	(4; 22)
5	0,234557	0,017471	0,175599	0,371291	0	0,551078	0,297018	0,138541	0,353292	0,17327	0,063369
	(12; 25)	(9; 5)	(3; 5)	(4; 5)	(0; 0)	(5; 7)	(25; 16)	(25; 11)	(25; 20)	(25; 14)	(25; 22)
6	0,826866	0,476442	0,372242	0,119347	0,551078	0	0,889327	0,73085	0,945601	0,765579	0,655678
	(12; 7)	(2; 7)	(23; 7)	(6; 7)	(5; 7)	(0; 0)	(7; 16)	(7; 11)	(7; 20)	(7; 14)	(7; 22)
7	0,026557	0,35572	0,513847	0,70954	0,297018	0,889327	0	0,135368	0,050546	0,114845	0,184297
	(21; 16)	(9; 16)	(3; 16)	(4; 16)	(25; 16)	(7; 16)	(0; 0)	(16; 17)	(10; 20)	(16; 19)	(16; 24)
8	0,072907	0,197243	0,35537	0,551063	0,138541	0,73085	0,135368	0	0,191641	0,01162	0,02582
	(12; 17)	(9; 11)	(3; 11)	(4; 11)	(25; 11)	(7; 11)	(16; 17)	(0; 0)	(17; 20)	(17; 14)	(11; 24)
9	0,082831	0,411993	0,570121	0,765814	0,353292	0,945601	0,050546	0,191641	0	0,171118	0,240571
	(21; 20)	(9; 20)	(3; 20)	(4; 20)	(25; 20)	(7; 20)	(10; 20)	(17; 20)	(0; 0)	(20; 19)	(20; 24)
10	0,052383	0,231972	0,390099	0,585792	0,17327	0,765579	0,114845	0,01162	0,171118	0	0,060549
	(12; 19)	(9; 14)	(3; 14)	(4; 14)	(25; 14)	(7; 14)	(16; 19)	(17; 14)	(20; 19)	(0; 0)	(14; 24)
11	0,121836	0,12207	0,280198	0,475891	0,063369	0,655678	0,184297	0,02582	0,240571	0,060549	0
	(12; 24)	(9; 22)	(3; 22)	(4; 22)	(25; 22)	(7; 22)	(16; 24)	(11; 24)	(20; 24)	(14; 24)	(0; 0)
Minimum distances between chains	0,026557	0,017471	0,100962	0,119347	0,017471	0,119347	0,026557	0,01162	0,050546	0,01162	0,02582
	(1; 7)	(2; 5)	(3; 2)	(4; 6)	(5; 2)	(6; 4)	(7; 1)	(8; 10)	(9; 7)	(10; 8)	(11; 8)

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Built for a cluster № 4

1 (2):	1	0,007358	24		
2 (2):	2	0,01253	15		
3 (2):	3	0	18		
4 (3):	4	0,009001	5	0,05668	6
5 (3):	7	0,051116	13	0,015411	20
6 (2):	8	0,032165	23		
7 (3):	9	0,066585	11	0,02795	19
8 (2):	10	0,000418	16		
9 (2):	12	0,013663	21		
10 (2):	14	0,001589	25		
11 (2):	17	0,008057	22		

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Matrix of interchain distances

Ланюжки	1	2	3	4	5	6	7	8	9	10	11
1	0	0,100754	0,699169	0,373154	0,235322	0,263361	0,049113	0,078058	0,150517	0,044362	0,011471
	(0; 0)	(24; 2)	(1; 3)	(1; 4)	(24; 20)	(1; 8)	(1; 19)	(24; 16)	(24; 12)	(24; 25)	(24; 22)
2	0,100754	0	0,807282	0,481266	0,122037	0,371474	0,157225	0,022278	0,037232	0,054803	0,081226
	(24; 2)	(0; 0)	(2; 3)	(2; 4)	(15; 20)	(2; 8)	(2; 19)	(2; 10)	(15; 12)	(2; 14)	(2; 17)
3	0,699169	0,807282	0	0,260335	0,941849	0,403643	0,555522	0,784585	0,857044	0,750889	0,717998
	(1; 3)	(2; 3)	(0; 0)	(3; 6)	(3; 20)	(3; 23)	(3; 9)	(3; 16)	(3; 12)	(3; 25)	(3; 22)
4	0,373154	0,481266	0,260335	0	0,615833	0,077627	0,229507	0,45857	0,531028	0,424874	0,391982
	(1; 4)	(2; 4)	(3; 6)	(0; 0)	(4; 20)	(4; 23)	(4; 9)	(4; 16)	(4; 12)	(4; 25)	(4; 22)
5	0,235322	0,122037	0,941849	0,615833	0	0,506041	0,291792	0,156845	0,071142	0,18937	0,215794
	(24; 20)	(15; 20)	(3; 20)	(4; 20)	(0; 0)	(20; 8)	(20; 19)	(20; 10)	(20; 21)	(20; 14)	(20; 17)
6	0,263361	0,371474	0,403643	0,077627	0,506041	0	0,119714	0,348777	0,421236	0,315081	0,28219
	(1; 8)	(2; 8)	(3; 23)	(4; 23)	(20; 8)	(0; 0)	(8; 9)	(8; 16)	(8; 12)	(8; 25)	(8; 22)
7	0,049113	0,157225	0,555522	0,229507	0,291792	0,119714	0	0,134528	0,206987	0,100833	0,067941
	(1; 19)	(2; 19)	(3; 9)	(4; 9)	(20; 19)	(8; 9)	(0; 0)	(19; 16)	(19; 12)	(19; 25)	(19; 22)
8	0,078058	0,022278	0,784585	0,45857	0,156845	0,348777	0,134528	0	0,07204	0,032106	0,05853
	(24; 16)	(2; 10)	(3; 16)	(4; 16)	(20; 10)	(8; 16)	(19; 16)	(0; 0)	(10; 12)	(16; 14)	(16; 17)
9	0,150517	0,037232	0,857044	0,531028	0,071142	0,421236	0,206987	0,07204	0	0,104565	0,130989
	(24; 12)	(15; 12)	(3; 12)	(4; 12)	(20; 21)	(8; 12)	(19; 12)	(10; 12)	(0; 0)	(12; 14)	(12; 17)
10	0,044362	0,054803	0,750889	0,424874	0,18937	0,315081	0,100833	0,032106	0,104565	0	0,024834
	(24; 25)	(2; 14)	(3; 25)	(4; 25)	(20; 14)	(8; 25)	(19; 25)	(16; 14)	(12; 14)	(0; 0)	(25; 17)
11	0,011471	0,081226	0,717998	0,391982	0,215794	0,28219	0,067941	0,05853	0,130989	0,024834	0
	(24; 22)	(2; 17)	(3; 22)	(4; 22)	(20; 17)	(8; 22)	(19; 22)	(16; 17)	(12; 17)	(25; 17)	(0; 0)
Minimum distances between chains	0,011471	0,022278	0,260335	0,077627	0,071142	0,077627	0,049113	0,022278	0,037232	0,024834	0,011471
	(1; 11)	(2; 8)	(3; 4)	(4; 6)	(5; 9)	(6; 4)	(7; 1)	(8; 2)	(9; 2)	(10; 11)	(11; 1)

Built for a cluster № 5

1 (2): | 1 | 0,079738 | 3 |

2 (2): | 2 | 0,023154 | 23 |

3 (11): | 4 | 0 | 8 | 0 | 9 | 0,095241 | 10 | 0,095241 | 11 | 0 | 14 | 0 | 15 | 0 | 17 | 0 | 18 | 0 | 20 | 0 | 21 |

4 (3): | 5 | 0,002073 | 13 | 0,01494 | 19 |

5 (5): | 6 | 0,041619 | 25 | 0,099045 | 7 | 0,117908 | 12 | 0,069618 | 24 |

6 (2): | 16 | 0,033537 | 22 |
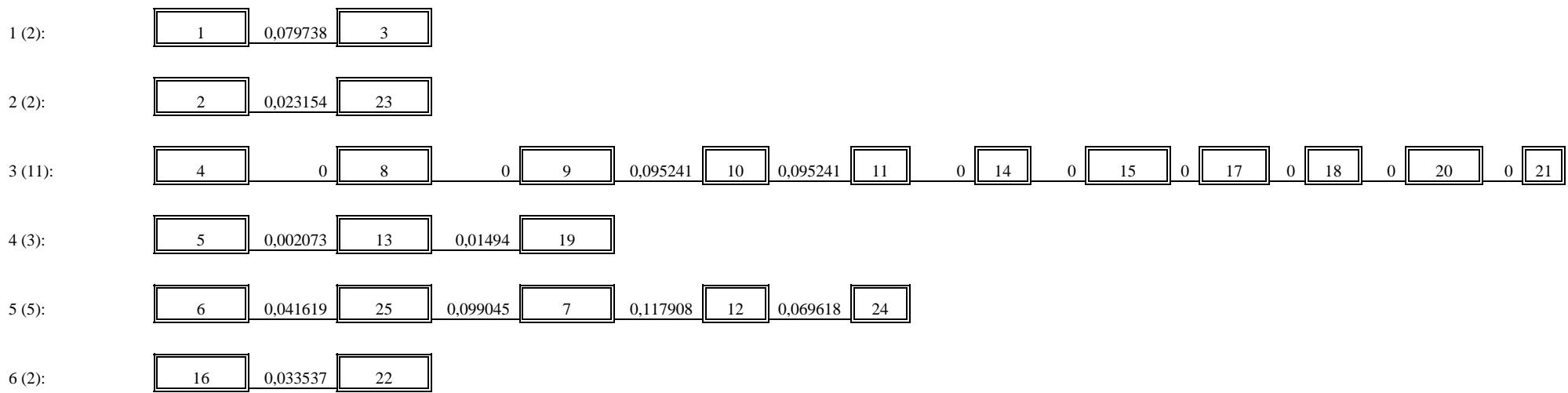
Matrix of interchain distances

Chains	1	2	3	4	5	6
1	0	0,889477	1	0,816513	0,38721	0,689151
	(0; 0)	(1; 2)	(0; 0)	(1; 19)	(1; 7)	(1; 16)
2	0,889477	0	0,209445	0,055951	0,314741	0,166789
	(1; 2)	(0; 0)	(23; 10)	(2; 5)	(2; 24)	(2; 22)
3	1	0,209445	0	0,28855	0,54734	0,399388
	(0; 0)	(23; 10)	(0; 0)	(10; 5)	(10; 24)	(10; 22)
4	0,816513	0,055951	0,28855	0	0,241777	0,093825
	(1; 19)	(2; 5)	(10; 5)	(0; 0)	(19; 24)	(19; 22)
5	0,38721	0,314741	0,54734	0,241777	0	0,114415
	(1; 7)	(2; 24)	(10; 24)	(19; 24)	(0; 0)	(24; 16)
6	0,689151	0,166789	0,399388	0,093825	0,114415	0
	(1; 16)	(2; 22)	(10; 22)	(19; 22)	(24; 16)	(0; 0)
Minimum distances between chains						
	0,38721	0,055951	0,209445	0,055951	0,114415	0,093825
	(1; 5)	(2; 4)	(3; 2)	(4; 2)	(5; 6)	(6; 4)

Built for a cluster № 6

1 (2):	1	0,002175	23				
2 (2):	2	0,015739	19				
3 (2):	3	0,003188	5				
4 (4):	4	0,005684	17	0,003314	9	0,025995	12
5 (6):	6	0	10	0	11	0	18 0 21 0 25
6 (3):	7	0,014784	13	0,046434	20		
7 (2):	8	0,018536	14				
8 (2):	15	0,019139	16				
9 (2):	22	0,011056	24				

Matrix of interchain distances

	1	2	3	4	5	6	7	8	9
1	0	0,030796	0,098831	0,276387	0,494033	0,513934	0,417121	0,248152	0,12973
	(0; 0)	(23; 2)	(23; 3)	(23; 4)	(1; 6)	(23; 20)	(23; 8)	(23; 15)	(23; 22)
2	0,030796	0	0,052297	0,229852	0,527003	0,467399	0,370586	0,201617	0,083195
	(23; 2)	(0; 0)	(19; 3)	(19; 4)	(2; 6)	(19; 20)	(19; 8)	(19; 15)	(19; 22)
3	0,098831	0,052297	0	0,174367	0,595039	0,411914	0,315102	0,146132	0,02771
	(23; 3)	(19; 3)	(0; 0)	(5; 4)	(3; 6)	(5; 20)	(5; 8)	(5; 15)	(5; 22)
4	0,276387	0,229852	0,174367	0	0,772594	0,202555	0,105742	0,009096	0,135601
	(23; 4)	(19; 4)	(5; 4)	(0; 0)	(4; 6)	(12; 20)	(12; 8)	(4; 16)	(4; 24)
5	0,494033	0,527003	0,595039	0,772594	0	1	0,913329	0,744359	0,625938
	(1; 6)	(2; 6)	(3; 6)	(4; 6)	(0; 0)	(0; 0)	(6; 8)	(6; 15)	(6; 22)
6	0,513934	0,467399	0,411914	0,202555	1	0	0,078276	0,246643	0,373148
	(23; 20)	(19; 20)	(5; 20)	(12; 20)	(0; 0)	(0; 0)	(20; 14)	(20; 16)	(20; 24)
7	0,417121	0,370586	0,315102	0,105742	0,913329	0,078276	0	0,14983	0,276336
	(23; 8)	(19; 8)	(5; 8)	(12; 8)	(6; 8)	(20; 14)	(0; 0)	(8; 16)	(8; 24)
8	0,248152	0,201617	0,146132	0,009096	0,744359	0,246643	0,14983	0	0,107366
	(23; 15)	(19; 15)	(5; 15)	(4; 16)	(6; 15)	(20; 16)	(8; 16)	(0; 0)	(15; 24)
9	0,12973	0,083195	0,02771	0,135601	0,625938	0,373148	0,276336	0,107366	0
	(23; 22)	(19; 22)	(5; 22)	(4; 24)	(6; 22)	(20; 24)	(8; 24)	(15; 24)	(0; 0)
Minimum distances between chains	0,030796	0,030796	0,02771	0,009096	0,494033	0,078276	0,078276	0,009096	0,02771
	(1; 2)	(2; 1)	(3; 9)	(4; 8)	(5; 1)	(6; 7)	(7; 6)	(8; 4)	(9; 3)

1 (3):	1	0,007382	21	0,035904	12
2 (2):	2	0,057165	9		
3 (2):	3	0,003237	23		
4 (2):	4	0,06044	6		
5 (3):	5	0,016425	8	0,024806	25
6 (2):	7	0	18		
7 (2):	10	0,005728	16		
8 (2):	11	0,023109	17		
9 (2):	13	0,071937	20		
10 (2):	14	0,008903	19		
11 (3):	15	0,002378	24	0,049352	22

Matrix of interchain distances

Chains	1	2	3	4	5	6	7	8	9	10	11
1	0	0,293259	0,451386	0,647079	0,234557	0,826866	0,026557	0,072907	0,082831	0,052383	0,121836
	(0; 0)	(12; 9)	(12; 3)	(12; 4)	(12; 25)	(12; 7)	(21; 16)	(12; 17)	(21; 20)	(12; 19)	(12; 24)
2	0,293259	0	0,100962	0,296655	0,017471	0,476442	0,35572	0,197243	0,411993	0,231972	0,12207
	(12; 9)	**(0; 0)**	(2; 3)	(2; 4)	(9; 5)	(2; 7)	(9; 16)	(9; 11)	(9; 20)	(9; 14)	(9; 22)
3	0,451386	0,100962	0	0,192455	0,175599	0,372242	0,513847	0,35537	0,570121	0,390099	0,280198
	(12; 3)	(2; 3)	**(0; 0)**	(23; 4)	(3; 5)	(23; 7)	(3; 16)	(3; 11)	(3; 20)	(3; 14)	(3; 22)
4	0,647079	0,296655	0,192455	0	0,371291	0,119347	0,70954	0,551063	0,765814	0,585792	0,475891
	(12; 4)	(2; 4)	(23; 4)	**(0; 0)**	(4; 5)	(6; 7)	(4; 16)	(4; 11)	(4; 20)	(4; 14)	(4; 22)
5	0,234557	0,017471	0,175599	0,371291	0	0,551078	0,297018	0,138541	0,353292	0,17327	0,063369
	(12; 25)	(9; 5)	(3; 5)	(4; 5)	**(0; 0)**	(5; 7)	(25; 16)	(25; 11)	(25; 20)	(25; 14)	(25; 22)
6	0,826866	0,476442	0,372242	0,119347	0,551078	0	0,889327	0,73085	0,945601	0,765579	0,655678
	(12; 7)	(2; 7)	(23; 7)	(6; 7)	(5; 7)	**(0; 0)**	(7; 16)	(7; 11)	(7; 20)	(7; 14)	(7; 22)
7	0,026557	0,35572	0,513847	0,70954	0,297018	0,889327	0	0,135368	0,050546	0,114845	0,184297
	(21; 16)	(9; 16)	(3; 16)	(4; 16)	(25; 16)	(7; 16)	**(0; 0)**	(16; 17)	(10; 20)	(16; 19)	(16; 24)
8	0,072907	0,197243	0,35537	0,551063	0,138541	0,73085	0,135368	0	0,191641	0,01162	0,02582
	(12; 17)	(9; 11)	(3; 11)	(4; 11)	(25; 11)	(7; 11)	(16; 17)	**(0; 0)**	(17; 20)	(17; 14)	(11; 24)
9	0,082831	0,411993	0,570121	0,765814	0,353292	0,945601	0,050546	0,191641	0	0,171118	0,240571
	(21; 20)	(9; 20)	(3; 20)	(4; 20)	(25; 20)	(7; 20)	(10; 20)	(17; 20)	**(0; 0)**	(20; 19)	(20; 24)
10	0,052383	0,231972	0,390099	0,585792	0,17327	0,765579	0,114845	0,01162	0,171118	0	0,060549
	(12; 19)	(9; 14)	(3; 14)	(4; 14)	(25; 14)	(7; 14)	(16; 19)	(17; 14)	(20; 19)	**(0; 0)**	(14; 24)
11	0,121836	0,12207	0,280198	0,475891	0,063369	0,655678	0,184297	0,02582	0,240571	0,060549	0
	(12; 24)	(9; 22)	(3; 22)	(4; 22)	(25; 22)	(7; 22)	(16; 24)	(11; 24)	(20; 24)	(14; 24)	**(0; 0)**
Minimum distances between chains	0,026557	0,017471	0,100962	0,119347	0,017471	0,119347	0,026557	0,01162	0,050546	0,01162	0,02582
	(1; 7)	(2; 5)	(3; 2)	(4; 6)	(5; 2)	(6; 4)	(7; 1)	(8; 10)	(9; 7)	(10; 8)	(11; 8)

1 (2):	1	0,007358	24			
2 (2):	2	0,01253	15			
3 (2):	3	0	18			
4 (3):	4	0,009001	5	0,05668	6	
5 (3):	7	0,051116	13	0,015411	20	
6 (2):	8	0,032165	23			
7 (3):	9	0,066585	11	0,02795	19	
8 (2):	10	0,000418	16			
9 (2):	12	0,013663	21			
10 (2):	14	0,001589	25			
11 (2):	17	0,008057	22			

Chains	1	2	3	4	5	6	7	8	9	10	11
1	0	0,100754	0,699169	0,373154	0,235322	0,263361	0,049113	0,078058	0,150517	0,044362	0,011471
	(0; 0)	(24; 2)	(1; 3)	(1; 4)	(24; 20)	(1; 8)	(1; 19)	(24; 16)	(24; 12)	(24; 25)	(24; 22)
2	0,100754	0	0,807282	0,481266	0,122037	0,371474	0,157225	0,022278	0,037232	0,054803	0,081226
	(24; 2)	**(0; 0)**	(2; 3)	(2; 4)	(15; 20)	(2; 8)	(2; 19)	(2; 10)	(15; 12)	(2; 14)	(2; 17)
3	0,699169	0,807282	0	0,260335	0,941849	0,403643	0,555522	0,784585	0,857044	0,750889	0,717998
	(1; 3)	(2; 3)	**(0; 0)**	(3; 6)	(3; 20)	(3; 23)	(3; 9)	(3; 16)	(3; 12)	(3; 25)	(3; 22)
4	0,373154	0,481266	0,260335	0	0,615833	0,077627	0,229507	0,45857	0,531028	0,424874	0,391982
	(1; 4)	(2; 4)	(3; 6)	**(0; 0)**	(4; 20)	(4; 23)	(4; 9)	(4; 16)	(4; 12)	(4; 25)	(4; 22)
5	0,235322	0,122037	0,941849	0,615833	0	0,506041	0,291792	0,156845	0,071142	0,18937	0,215794
	(24; 20)	(15; 20)	(3; 20)	(4; 20)	**(0; 0)**	(20; 8)	(20; 19)	(20; 10)	(20; 21)	(20; 14)	(20; 17)
6	0,263361	0,371474	0,403643	0,077627	0,506041	0	0,119714	0,348777	0,421236	0,315081	0,28219
	(1; 8)	(2; 8)	(3; 23)	(4; 23)	(20; 8)	**(0; 0)**	(8; 9)	(8; 16)	(8; 12)	(8; 25)	(8; 22)
7	0,049113	0,157225	0,555522	0,229507	0,291792	0,119714	0	0,134528	0,206987	0,100833	0,067941
	(1; 19)	(2; 19)	(3; 9)	(4; 9)	(20; 19)	(8; 9)	**(0; 0)**	(19; 16)	(19; 12)	(19; 25)	(19; 22)
8	0,078058	0,022278	0,784585	0,45857	0,156845	0,348777	0,134528	0	0,07204	0,032106	0,05853
	(24; 16)	(2; 10)	(3; 16)	(4; 16)	(20; 10)	(8; 16)	(19; 16)	**(0; 0)**	(10; 12)	(16; 14)	(16; 17)
9	0,150517	0,037232	0,857044	0,531028	0,071142	0,421236	0,206987	0,07204	0	0,104565	0,130989
	(24; 12)	(15; 12)	(3; 12)	(4; 12)	(20; 21)	(8; 12)	(19; 12)	(10; 12)	**(0; 0)**	(12; 14)	(12; 17)
10	0,044362	0,054803	0,750889	0,424874	0,18937	0,315081	0,100833	0,032106	0,104565	0	0,024834
	(24; 25)	(2; 14)	(3; 25)	(4; 25)	(20; 14)	(8; 25)	(19; 25)	(16; 14)	(12; 14)	**(0; 0)**	(25; 17)
11	0,011471	0,081226	0,717998	0,391982	0,215794	0,28219	0,067941	0,05853	0,130989	0,024834	0
	(24; 22)	(2; 17)	(3; 22)	(4; 22)	(20; 17)	(8; 22)	(19; 22)	(16; 17)	(12; 17)	(25; 17)	**(0; 0)**
Minimum distances between chains	0,011471	0,022278	0,260335	0,077627	0,071142	0,077627	0,049113	0,022278	0,037232	0,024834	0,011471
	(1; 11)	(2; 8)	(3; 4)	(4; 6)	(5; 9)	(6; 4)	(7; 1)	(8; 2)	(9; 2)	(10; 11)	(11; 1)

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Appendix C

Matrix of isomorphic distances

Region	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
1	0	0,147241	0,151408	0,231652	0,061528	0,046051	0,178842	0,111432	0,088876	0,064669	0,037899	0,031101	0,137633	0,052679	0,052038	0,044396	0,018995	0,110132	0,028189	0,011155	0,031422	0,153688	0,135966	0,028088	0,132833
2	0,147241	0	0,004167	0,378893	0,208769	0,10119	0,031601	0,258673	0,236117	0,082572	0,109342	0,116141	0,009608	0,19992	0,095204	0,191638	0,166236	0,037109	0,17543	0,136086	0,115819	0,300929	0,283207	0,17533	0,014408
3	0,151408	0,004167	0	0,38306	0,212936	0,105357	0,027434	0,26284	0,240284	0,086739	0,113509	0,120308	0,013775	0,204087	0,099371	0,195805	0,170403	0,041276	0,179597	0,140253	0,119986	0,305096	0,287374	0,179497	0,018575
4	0,231652	0,378893	0,38306	0	0,170124	0,277703	0,410494	0,12022	0,142776	0,296321	0,269551	0,262753	0,369285	0,178973	0,28369	0,187256	0,212657	0,341784	0,203463	0,242807	0,263074	0,077964	0,095686	0,203563	0,364485
5	0,061528	0,208769	0,212936	0,170124	0	0,107579	0,24037	0,049904	0,027348	0,126197	0,099427	0,092628	0,199161	0,008849	0,113565	0,017131	0,042533	0,17166	0,033339	0,072683	0,09295	0,09216	0,074438	0,033439	0,194361
6	0,046051	0,10119	0,105357	0,277703	0,107579	0	0,132791	0,157483	0,134927	0,018618	0,008152	0,01495	0,091582	0,09873	0,005987	0,090447	0,065046	0,064081	0,07424	0,034896	0,014629	0,199739	0,182017	0,07414	0,086782
7	0,178842	0,031601	0,027434	0,410494	0,24037	0,132791	0	0,290274	0,267718	0,114173	0,140943	0,147742	0,041209	0,231521	0,126805	0,223239	0,197837	0,06871	0,207031	0,167687	0,14742	0,33253	0,314808	0,206931	0,046009
8	0,111432	0,258673	0,26284	0,12022	0,049904	0,157483	0,290274	0	0,022556	0,176101	0,149331	0,142533	0,249065	0,058753	0,16347	0,067036	0,092437	0,221564	0,083243	0,122587	0,142854	0,042255	0,024534	0,083344	0,244265
9	0,088876	0,236117	0,240284	0,142776	0,027348	0,134927	0,267718	0,022556	0	0,153545	0,126775	0,119977	0,226509	0,036197	0,140914	0,04448	0,069881	0,199008	0,060687	0,100031	0,120298	0,064811	0,04709	0,060788	0,221709
10	0,064669	0,082572	0,086739	0,296321	0,126197	0,018618	0,114173	0,176101	0,153545	0	0,02677	0,033568	0,072964	0,117348	0,012632	0,109065	0,083664	0,045463	0,092858	0,053514	0,033247	0,218357	0,200635	0,092758	0,068164
11	0,037899	0,109342	0,113509	0,269551	0,099427	0,008152	0,140943	0,149331	0,126775	0,02677	0	0,006799	0,099734	0,090578	0,014138	0,082296	0,056894	0,072233	0,066088	0,026744	0,006477	0,191587	0,173865	0,065988	0,094934
12	0,031101	0,116141	0,120308	0,262753	0,092628	0,01495	0,147742	0,142533	0,119977	0,033568	0,006799	0	0,106533	0,08378	0,020937	0,075497	0,050095	0,079031	0,05929	0,019946	0,000321	0,184788	0,167067	0,059189	0,101733
13	0,137633	0,009608	0,013775	0,369285	0,199161	0,091582	0,041209	0,249065	0,226509	0,072964	0,099734	0,106533	0	0,190312	0,085596	0,18203	0,156628	0,027501	0,165822	0,126478	0,106211	0,291321	0,273599	0,165722	0,0048
14	0,052679	0,19992	0,204087	0,178973	0,008849	0,09873	0,231521	0,058753	0,036197	0,117348	0,090578	0,08378	0,190312	0	0,104717	0,008283	0,033684	0,162811	0,02449	0,063834	0,084101	0,101009	0,083287	0,024591	0,185512
15	0,052038	0,095204	0,099371	0,28369	0,113565	0,005987	0,126805	0,16347	0,140914	0,012632	0,014138	0,020937	0,085596	0,104717	0	0,096434	0,071032	0,058094	0,080227	0,040883	0,020616	0,205725	0,188004	0,080126	0,080796
16	0,044396	0,191638	0,195805	0,187256	0,017131	0,090447	0,223239	0,067036	0,04448	0,109065	0,082296	0,075497	0,18203	0,008283	0,096434	0	0,025402	0,154528	0,016207	0,055551	0,075818	0,109291	0,09157	0,016308	0,17723
17	0,018995	0,166236	0,170403	0,212657	0,042533	0,065046	0,197837	0,092437	0,069881	0,083664	0,056894	0,050095	0,156628	0,033684	0,071032	0,025402	0	0,129127	0,009194	0,03015	0,050417	0,134693	0,116971	0,009094	0,151828
18	0,110132	0,037109	0,041276	0,341784	0,17166	0,064081	0,06871	0,221564	0,199008	0,045463	0,072233	0,079031	0,027501	0,162811	0,058094	0,154528	0,129127	0	0,138321	0,098977	0,07871	0,263819	0,246098	0,13822	0,022701
19	0,028189	0,17543	0,179597	0,203463	0,033339	0,07424	0,207031	0,083243	0,060687	0,092858	0,066088	0,05929	0,165822	0,02449	0,080227	0,016207	0,009194	0,138321	0	0,039344	0,059611	0,125499	0,107777	0,000101	0,161022
20	0,011155	0,136086	0,140253	0,242807	0,072683	0,034896	0,167687	0,122587	0,100031	0,053514	0,026744	0,019946	0,126478	0,063834	0,040883	0,055551	0,03015	0,098977	0,039344	0	0,020267	0,164843	0,147121	0,039244	0,121678
21	0,031422	0,115819	0,119986	0,263074	0,09295	0,014629	0,14742	0,142854	0,120298	0,033247	0,006477	0,000321	0,106211	0,084101	0,020616	0,075818	0,050417	0,07871	0,059611	0,020267	0	0,18511	0,167388	0,05951	0,101411
22	0,153688	0,300929	0,305096	0,077964	0,09216	0,199739	0,33253	0,042255	0,064811	0,218357	0,191587	0,184788	0,291321	0,101009	0,205725	0,109291	0,134693	0,263819	0,125499	0,164843	0,18511	0	0,017721	0,125599	0,286521
23	0,135966	0,283207	0,287374	0,095686	0,074438	0,182017	0,314808	0,024534	0,04709	0,200635	0,173865	0,167067	0,273599	0,083287	0,188004	0,09157	0,116971	0,246098	0,107777	0,147121	0,167388	0,017721	0	0,107878	0,268799
24	0,028088	0,17533	0,179497	0,203563	0,033439	0,07414	0,206931	0,083344	0,060788	0,092758	0,065988	0,059189	0,165722	0,024591	0,080126	0,016308	0,009094	0,13822	0,000101	0,039244	0,05951	0,125599	0,107878	0	0,160922
25	0,132833	0,014408	0,018575	0,364485	0,194361	0,086782	0,046009	0,244265	0,221709	0,068164	0,094934	0,101733	0,0048	0,185512	0,080796	0,17723	0,151828	0,022701	0,161022	0,121678	0,101411	0,286521	0,268799	0,160922	0

Matrix of interchain distances

Region	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
1	0	0,180659	0,675668	0,638658	0,50385	1,124595	0,407667	0,600034	1,124595	0,631159	0,099056	0,45482	0,259323	0,568566	0,669619	0,491351	0,46202	0,045625	0,627076	0,617552	0,696744	0,855151	0,671748	0,572	0,077987
2	0,180659	0	0,495009	0,457999	0,323192	0,943936	0,227008	0,419376	0,943936	0,450501	0,279715	0,274162	0,078664	0,387907	0,48896	0,310693	0,281362	0,226284	0,446417	0,436893	0,516086	0,674492	0,491089	0,391341	0,102672
3	0,675668	0,495009	0	0,03701	0,171817	0,448927	0,268001	0,075633	0,448927	0,044508	0,774724	0,220847	0,416345	0,107101	0,006048	0,184316	0,213647	0,721293	0,048592	0,058116	0,021077	0,179484	0,00392	0,103668	0,597681
4	0,638658	0,457999	0,03701	0	0,134807	0,485937	0,230991	0,038623	0,485937	0,007498	0,737714	0,183837	0,379335	0,070092	0,030961	0,147306	0,176637	0,684283	0,011582	0,021106	0,058087	0,216493	0,03309	0,066658	0,560671
5	0,50385	0,323192	0,171817	0,134807	0	0,620744	0,096183	0,096184	0,620744	0,127309	0,602907	0,04903	0,244528	0,064716	0,165769	0,012499	0,04183	0,549476	0,123225	0,113701	0,192894	0,351301	0,167897	0,068149	0,425864
6	1,124595	0,943936	0,448927	0,485937	0,620744	0	0,716928	0,524561	0	0,493436	1,223651	0,669775	0,865272	0,556029	0,454976	0,633244	0,662575	1,17022	0,497519	0,507043	0,42785	0,269444	0,452847	0,552595	1,046608
7	0,407667	0,227008	0,268001	0,230991	0,096183	0,716928	0	0,192367	0,716928	0,223492	0,506723	0,047153	0,148344	0,160899	0,261952	0,083684	0,054353	0,453292	0,219409	0,209885	0,289078	0,447484	0,264081	0,164333	0,32968
8	0,600034	0,419376	0,075633	0,038623	0,096184	0,524561	0,192367	0	0,524561	0,031125	0,699091	0,145214	0,340712	0,031468	0,069585	0,108683	0,138014	0,645659	0,027042	0,017517	0,09671	0,255117	0,071714	0,028034	0,522048
9	1,124595	0,943936	0,448927	0,485937	0,620744	0	0,716928	0,524561	0	0,493436	1,223651	0,669775	0,865272	0,556029	0,454976	0,633244	0,662575	1,17022	0,497519	0,507043	0,42785	0,269444	0,452847	0,552595	1,046608
10	0,631159	0,450501	0,044508	0,007498	0,127309	0,493436	0,223492	0,031125	0,493436	0	0,730216	0,176339	0,371837	0,062593	0,03846	0,139808	0,169139	0,676784	0,004083	0,013608	0,065585	0,223992	0,040589	0,059159	0,553173
11	0,099056	0,279715	0,774724	0,737714	0,602907	1,223651	0,506723	0,699091	1,223651	0,730216	0	0,553877	0,358379	0,667623	0,768676	0,590408	0,561077	0,053431	0,726132	0,716608	0,795801	0,954208	0,770804	0,671056	0,177043
12	0,45482	0,274162	0,220847	0,183837	0,04903	0,669775	0,047153	0,145214	0,669775	0,176339	0,553877	0	0,195498	0,113746	0,214799	0,036531	0,0072	0,500446	0,172255	0,162731	0,241924	0,400331	0,216928	0,11718	0,376834
13	0,259323	0,078664	0,416345	0,379335	0,244528	0,865272	0,148344	0,340712	0,865272	0,371837	0,358379	0,195498	0	0,309243	0,410296	0,232029	0,202698	0,304948	0,367753	0,358229	0,437422	0,595828	0,412425	0,312677	0,181336
14	0,568566	0,387907	0,107101	0,070092	0,064716	0,556029	0,160899	0,031468	0,556029	0,062593	0,667623	0,113746	0,309243	0	0,101053	0,077215	0,106546	0,614191	0,05851	0,048986	0,128178	0,286585	0,103182	0,003434	0,49058
15	0,669619	0,48896	0,006048	0,030961	0,165769	0,454976	0,261952	0,069585	0,454976	0,03846	0,768676	0,214799	0,410296	0,101053	0	0,178268	0,207599	0,715244	0,042543	0,052067	0,027125	0,185532	0,002129	0,097619	0,591633
16	0,491351	0,310693	0,184316	0,147306	0,012499	0,633244	0,083684	0,108683	0,633244	0,139808	0,590408	0,036531	0,232029	0,077215	0,178268	0	0,029331	0,536976	0,135725	0,126201	0,205393	0,3638	0,180397	0,080649	0,413365
17	0,46202	0,281362	0,213647	0,176637	0,04183	0,662575	0,054353	0,138014	0,662575	0,169139	0,561077	0,0072	0,202698	0,106546	0,207599	0,029331	0	0,507645	0,165055	0,155531	0,234724	0,393131	0,209728	0,10998	0,384034
18	0,045625	0,226284	0,721293	0,684283	0,549476	1,17022	0,453292	0,645659	1,17022	0,676784	0,053431	0,500446	0,304948	0,614191	0,715244	0,536976	0,507645	0	0,672701	0,663177	0,74237	0,900776	0,717373	0,617625	0,123612
19	0,627076	0,446417	0,048592	0,011582	0,123225	0,497519	0,219409	0,027042	0,497519	0,004083	0,726132	0,172255	0,367753	0,05851	0,042543	0,135725	0,165055	0,672701	0	0,009524	0,069669	0,228075	0,044672	0,055076	0,549089
20	0,617552	0,436893	0,058116	0,021106	0,113701	0,507043	0,209885	0,017517	0,507043	0,013608	0,716608	0,162731	0,358229	0,048986	0,052067	0,126201	0,155531	0,663177	0,009524	0	0,079193	0,237599	0,054196	0,045552	0,539565
21	0,696744	0,516086	0,021077	0,058087	0,192894	0,42785	0,289078	0,09671	0,42785	0,065585	0,795801	0,241924	0,437422	0,128178	0,027125	0,205393	0,234724	0,74237	0,069669	0,079193	0	0,158407	0,024997	0,124745	0,618758
22	0,855151	0,674492	0,179484	0,216493	0,351301	0,269444	0,447484	0,255117	0,269444	0,223992	0,954208	0,400331	0,595828	0,286585	0,185532	0,3638	0,393131	0,900776	0,228075	0,237599	0,158407	0	0,183403	0,283151	0,777165
23	0,671748	0,491089	0,00392	0,03309	0,167897	0,452847	0,264081	0,071714	0,452847	0,040589	0,770804	0,216928	0,412425	0,103182	0,002129	0,180397	0,209728	0,717373	0,044672	0,054196	0,024997	0,183403	0	0,099748	0,593761
24	0,572	0,391341	0,103668	0,066658	0,068149	0,552595	0,164333	0,028034	0,552595	0,059159	0,671056	0,11718	0,312677	0,003434	0,097619	0,080649	0,10998	0,617625	0,055076	0,045552	0,124745	0,283151	0,099748	0	0,494013
25	0,077987	0,102672	0,597681	0,560671	0,425864	1,046608	0,32968	0,522048	1,046608	0,553173	0,177043	0,376834	0,181336	0,49058	0,591633	0,413365	0,384034	0,123612	0,549089	0,539565	0,618758	0,777165	0,593761	0,494013	0

222

Matrix of interchain distances

Region	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
1	0	0,209646	0,559503	0,030662	0,387604	0,066034	0,559503	0,068165	0,009773	0,12479	0,356863	0,129531	0,474908	0,116913	0,123749	0,126524	0,256685	0,533273	0,065423	0,02043	0,381022	0,162979	0,143542	0,280382	0,420246
2	0,209646	0	0,769149	0,178984	0,177958	0,143612	0,769149	0,277811	0,219419	0,334436	0,147217	0,080115	0,265262	0,326559	0,085897	0,083122	0,047039	0,323627	0,144223	0,230076	0,171376	0,372625	0,066104	0,070736	0,2106
3	0,559503	0,769149	0	0,590166	0,947107	0,625537	0	0,491338	0,54973	0,434713	0,916366	0,689035	1,034411	0,44259	0,683252	0,686027	0,816188	1,092776	0,624926	0,539073	0,940525	0,396524	0,703045	0,839885	0,979749
4	0,030662	0,178984	0,590166	0	0,356942	0,035371	0,590166	0,098827	0,040436	0,155453	0,326201	0,098869	0,444246	0,147575	0,093087	0,095861	0,226022	0,50261	0,034761	0,051092	0,35036	0,193642	0,112879	0,249719	0,389583
5	0,387604	0,177958	0,947107	0,356942	0	0,32157	0,947107	0,455769	0,397377	0,512394	0,030741	0,258073	0,087304	0,504517	0,263855	0,26108	0,130919	0,145669	0,322181	0,408034	0,006582	0,550583	0,244062	0,107222	0,032642
6	0,066034	0,143612	0,625537	0,035371	0,32157	0	0,625537	0,134199	0,075807	0,190824	0,290829	0,063498	0,408874	0,182947	0,057715	0,06049	0,190651	0,467239	0,000611	0,086464	0,314988	0,229013	0,077508	0,214348	0,354212
7	0,559503	0,769149	0	0,590166	0,947107	0,625537	0	0,491338	0,54973	0,434713	0,916366	0,689035	1,034411	0,44259	0,683252	0,686027	0,816188	1,092776	0,624926	0,539073	0,940525	0,396524	0,703045	0,839885	0,979749
8	0,068165	0,277811	0,491338	0,098827	0,455769	0,134199	0,491338	0	0,058391	0,056625	0,425028	0,197696	0,543073	0,048748	0,191914	0,194688	0,32485	0,601438	0,133588	0,047735	0,449187	0,094814	0,211706	0,348547	0,488411
9	0,009773	0,219419	0,54973	0,040436	0,397377	0,075807	0,54973	0,058391	0	0,115017	0,366636	0,139305	0,484682	0,107139	0,133522	0,136297	0,266458	0,543046	0,075197	0,010656	0,390796	0,153206	0,153315	0,290155	0,430019
10	0,12479	0,334436	0,434713	0,155453	0,512394	0,190824	0,434713	0,056625	0,115017	0	0,481653	0,254322	0,599699	0,007878	0,248539	0,251314	0,381475	0,658063	0,190214	0,10436	0,505813	0,038189	0,268332	0,405172	0,545036
11	0,356863	0,147217	0,916366	0,326201	0,030741	0,290829	0,916366	0,425028	0,366636	0,481653	0	0,227332	0,118045	0,473776	0,233114	0,230339	0,100178	0,17641	0,29144	0,377293	0,024159	0,519842	0,213321	0,076481	0,063383
12	0,129531	0,080115	0,689035	0,098869	0,258073	0,063498	0,689035	0,197696	0,139305	0,254322	0,227332	0	0,345377	0,246444	0,005782	0,003008	0,127153	0,403741	0,064108	0,149961	0,251491	0,292511	0,01401	0,15085	0,290714
13	0,474908	0,265262	1,034411	0,444246	0,087304	0,408874	1,034411	0,543073	0,484682	0,599699	0,118045	0,345377	0	0,591821	0,351159	0,348385	0,218223	0,058365	0,409485	0,495338	0,093886	0,637888	0,331367	0,194527	0,054663
14	0,116913	0,326559	0,44259	0,147575	0,504517	0,182947	0,44259	0,048748	0,107139	0,007878	0,473776	0,246444	0,591821	0	0,240662	0,243436	0,373598	0,650186	0,182336	0,096483	0,497935	0,046067	0,260454	0,397294	0,537158
15	0,123749	0,085897	0,683252	0,093087	0,263855	0,057715	0,683252	0,191914	0,133522	0,248539	0,233114	0,005782	0,351159	0,240662	0	0,002775	0,132936	0,409524	0,058326	0,144179	0,257273	0,286728	0,019793	0,156633	0,296497
16	0,126524	0,083122	0,686027	0,095861	0,26108	0,06049	0,686027	0,194688	0,136297	0,251314	0,230339	0,003008	0,348385	0,243436	0,002775	0	0,130161	0,406749	0,0611	0,146953	0,254499	0,289503	0,017018	0,153858	0,293722
17	0,256685	0,047039	0,816188	0,226022	0,130919	0,190651	0,816188	0,32485	0,266458	0,381475	0,100178	0,127153	0,218223	0,373598	0,132936	0,130161	0	0,276588	0,191262	0,277115	0,124337	0,419664	0,113143	0,023697	0,163561
18	0,533273	0,323627	1,092776	0,50261	0,145669	0,467239	1,092776	0,601438	0,543046	0,658063	0,17641	0,403741	0,058365	0,650186	0,409524	0,406749	0,276588	0	0,46785	0,553703	0,152251	0,696252	0,389731	0,252891	0,113027
19	0,065423	0,144223	0,624926	0,034761	0,322181	0,000611	0,624926	0,133588	0,075197	0,190214	0,29144	0,064108	0,409485	0,182336	0,058326	0,0611	0,191262	0,46785	0	0,085853	0,315599	0,228403	0,078118	0,214958	0,354822
20	0,02043	0,230076	0,539073	0,051092	0,408034	0,086464	0,539073	0,047735	0,010656	0,10436	0,377293	0,149961	0,495338	0,096483	0,144179	0,146953	0,277115	0,553703	0,085853	0	0,401452	0,142549	0,163971	0,300812	0,440676
21	0,381022	0,171376	0,940525	0,35036	0,006582	0,314988	0,940525	0,449187	0,390796	0,505813	0,024159	0,251491	0,093886	0,497935	0,257273	0,254499	0,124337	0,152251	0,315599	0,401452	0	0,544002	0,237481	0,100641	0,039223
22	0,162979	0,372625	0,396524	0,193642	0,550583	0,229013	0,396524	0,094814	0,153206	0,038189	0,519842	0,292511	0,637888	0,046067	0,286728	0,289503	0,419664	0,696252	0,228403	0,142549	0,544002	0	0,306521	0,443361	0,583225
23	0,143542	0,066104	0,703045	0,112879	0,244062	0,077508	0,703045	0,211706	0,153315	0,268332	0,213321	0,01401	0,331367	0,260454	0,019793	0,017018	0,113143	0,389731	0,078118	0,163971	0,237481	0,306521	0	0,13684	0,276704
24	0,280382	0,070736	0,839885	0,249719	0,107222	0,214348	0,839885	0,348547	0,290155	0,405172	0,076481	0,15085	0,194527	0,397294	0,156633	0,153858	0,023697	0,252891	0,214958	0,300812	0,100641	0,443361	0,13684	0	0,139864
25	0,420246	0,2106	0,979749	0,389583	0,032642	0,354212	0,979749	0,488411	0,430019	0,545036	0,063383	0,290714	0,054663	0,537158	0,296497	0,293722	0,163561	0,113027	0,354822	0,440676	0,039223	0,583225	0,276704	0,139864	0

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Matrix of interchain distances

Region	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
1	0	0,01354	0,242804	0,282901	0,861657	0,035858	0,850584	0,011515	0,03688	0,036012	0,060386	0,251496	0,35138	0,198708	0,053878	0,191167	0,033471	0,338144	0,090823	0,361647	0,11981	0,090539	0,047033	0,222784	0,233803
2	0,01354	0	0,229263	0,26936	0,875197	0,022318	0,864124	0,025056	0,02334	0,049552	0,073927	0,265037	0,364921	0,212249	0,067418	0,204707	0,047011	0,351685	0,104364	0,375188	0,133351	0,076998	0,060574	0,236325	0,247343
3	0,242804	0,229263	0	0,040097	1,104461	0,206946	1,093388	0,254319	0,205924	0,278816	0,30319	0,4943	0,594184	0,441512	0,296681	0,433971	0,276275	0,580948	0,333627	0,604451	0,362614	0,152265	0,289837	0,465588	0,476607
4	0,282901	0,26936	0,040097	0	1,144558	0,247042	1,133485	0,294416	0,24602	0,318912	0,343287	0,534397	0,634281	0,481609	0,336778	0,474068	0,316372	0,621045	0,373724	0,644548	0,402711	0,192362	0,329934	0,505685	0,516704
5	0,861657	0,875197	1,104461	1,144558	0	0,897515	0,011073	0,850142	0,898537	0,825645	0,801271	0,610161	0,510277	0,662949	0,807779	0,67049	0,828186	0,523512	0,770834	0,50001	0,741847	0,952196	0,814624	0,638873	0,627854
6	0,035858	0,022318	0,206946	0,247042	0,897515	0	0,886442	0,047373	0,001022	0,07187	0,096244	0,287355	0,387239	0,234567	0,089736	0,227025	0,069329	0,374003	0,126681	0,397505	0,155668	0,05468	0,082891	0,258643	0,269661
7	0,850584	0,864124	1,093388	1,133485	0,011073	0,886442	0	0,839069	0,887464	0,814572	0,790198	0,599088	0,499203	0,651875	0,796706	0,659417	0,817113	0,512439	0,759761	0,488937	0,730774	0,941123	0,803551	0,627799	0,616781
8	0,011515	0,025056	0,254319	0,294416	0,850142	0,047373	0,839069	0	0,048395	0,024497	0,048871	0,239981	0,339865	0,187193	0,042362	0,179652	0,021956	0,326629	0,079308	0,350132	0,108295	0,102054	0,035518	0,211269	0,222288
9	0,03688	0,02334	0,205924	0,24602	0,898537	0,001022	0,887464	0,048395	0	0,072892	0,097266	0,288377	0,388261	0,235589	0,090758	0,228047	0,070351	0,375025	0,127703	0,398527	0,15669	0,053658	0,083913	0,259665	0,270683
10	0,036012	0,049552	0,278816	0,318912	0,825645	0,07187	0,814572	0,024497	0,072892	0	0,024374	0,215484	0,315369	0,162697	0,017866	0,155155	0,002541	0,302133	0,054811	0,325635	0,083798	0,12655	0,011021	0,186773	0,197791
11	0,060386	0,073927	0,30319	0,343287	0,801271	0,096244	0,790198	0,048871	0,097266	0,024374	0	0,19111	0,290994	0,138322	0,006509	0,130781	0,026915	0,277758	0,030437	0,301261	0,059424	0,150925	0,013353	0,162398	0,173417
12	0,251496	0,265037	0,4943	0,534397	0,610161	0,287355	0,599088	0,239981	0,288377	0,215484	0,19111	0	0,099884	0,052788	0,197619	0,060329	0,218025	0,086648	0,160673	0,110151	0,131686	0,342035	0,204463	0,028712	0,017693
13	0,35138	0,364921	0,594184	0,634281	0,510277	0,387239	0,499203	0,339865	0,388261	0,315369	0,290994	0,099884	0	0,152672	0,297503	0,160214	0,31791	0,013236	0,260557	0,010267	0,23157	0,441919	0,304347	0,128596	0,117577
14	0,198708	0,212249	0,441512	0,481609	0,662949	0,234567	0,651875	0,187193	0,235589	0,162697	0,138322	0,052788	0,152672	0	0,144831	0,007542	0,165237	0,139436	0,107885	0,162939	0,078898	0,289247	0,151675	0,024076	0,035095
15	0,053878	0,067418	0,296681	0,336778	0,807779	0,089736	0,796706	0,042362	0,090758	0,017866	0,006509	0,197619	0,297503	0,144831	0	0,137289	0,020407	0,284267	0,036946	0,30777	0,065933	0,144416	0,006844	0,168907	0,179925
16	0,191167	0,204707	0,433971	0,474068	0,67049	0,227025	0,659417	0,179652	0,228047	0,155155	0,130781	0,060329	0,160214	0,007542	0,137289	0	0,157696	0,146978	0,100344	0,17048	0,071357	0,281706	0,144134	0,031618	0,042636
17	0,033471	0,047011	0,276275	0,316372	0,828186	0,069329	0,817113	0,021956	0,070351	0,002541	0,026915	0,218025	0,31791	0,165237	0,020407	0,157696	0	0,304674	0,057352	0,328176	0,086339	0,12401	0,013562	0,189313	0,200332
18	0,338144	0,351685	0,580948	0,621045	0,523512	0,374003	0,512439	0,326629	0,375025	0,302133	0,277758	0,086648	0,013236	0,139436	0,284267	0,146978	0,304674	0	0,247321	0,023503	0,218334	0,428683	0,291111	0,11536	0,104342
19	0,090823	0,104364	0,333627	0,373724	0,770834	0,126681	0,759761	0,079308	0,127703	0,054811	0,030437	0,160673	0,260557	0,107885	0,036946	0,100344	0,057352	0,247321	0	0,270824	0,028987	0,181362	0,04379	0,131961	0,14298
20	0,361647	0,375188	0,604451	0,644548	0,50001	0,397505	0,488937	0,350132	0,398527	0,325635	0,301261	0,110151	0,010267	0,162939	0,30777	0,17048	0,328176	0,023503	0,270824	0	0,241837	0,452186	0,314614	0,138863	0,127844
21	0,11981	0,133351	0,362614	0,402711	0,741847	0,155668	0,730774	0,108295	0,15669	0,083798	0,059424	0,131686	0,23157	0,078898	0,065933	0,071357	0,086339	0,218334	0,028987	0,241837	0	0,210349	0,072777	0,102974	0,113993
22	0,090539	0,076998	0,152265	0,192362	0,952196	0,05468	0,941123	0,102054	0,053658	0,12655	0,150925	0,342035	0,441919	0,289247	0,144416	0,281706	0,12401	0,428683	0,181362	0,452186	0,210349	0	0,137572	0,313323	0,324342
23	0,047033	0,060574	0,289837	0,329934	0,814624	0,082891	0,803551	0,035518	0,083913	0,011021	0,013353	0,204463	0,304347	0,151675	0,006844	0,144134	0,013562	0,291111	0,04379	0,314614	0,072777	0,137572	0	0,175751	0,18677
24	0,222784	0,236325	0,465588	0,505685	0,638873	0,258643	0,627799	0,211269	0,259665	0,186773	0,162398	0,028712	0,128596	0,024076	0,168907	0,031618	0,189313	0,11536	0,131961	0,138863	0,102974	0,313323	0,175751	0	0,011019
25	0,233803	0,247343	0,476607	0,516704	0,627854	0,269661	0,616781	0,222288	0,270683	0,197791	0,173417	0,017693	0,117577	0,035095	0,179925	0,042636	0,200332	0,104342	0,14298	0,127844	0,113993	0,324342	0,18677	0,011019	0

1 (2):	1	0,011155	20		

2 (3):	2	0,004167	3	0,027434	7

3 (3):	4	0,077964	22	0,017721	23

4 (3):	5	0,008849	14	0,008283	16

5 (3):	6	0,005987	15	0,012632	10

6 (2):	8	0,022556	9		

7 (3):	11	0,006477	21	0,000321	12

8 (3):	13	0,0048	25	0,022701	18

9 (3):	17	0,009094	24	0,000101	19

Matrix of interchain distances

	1	2	3	4	5	6	7	8	9
1	0	0,136086	0,135966	0,044396	0,034896	0,088876	0,019946	0,098977	0,018995
	(0; 0)	(20; 2)	(1; 23)	(1; 16)	(20; 6)	(1; 9)	(20; 12)	(20; 18)	(1; 17)
2	0,136086	0	0,283207	0,191638	0,082572	0,236117	0,109342	0,009608	0,166236
	(20; 2)	**(0; 0)**	(2; 23)	(2; 16)	(2; 10)	(2; 9)	(2; 11)	(2; 13)	(2; 17)
3	0,135966	0,283207	0	0,074438	0,182017	0,024534	0,167067	0,246098	0,107777
	(1; 23)	(2; 23)	**(0; 0)**	(23; 5)	(23; 6)	(23; 8)	(23; 12)	(23; 18)	(23; 19)
4	0,044396	0,191638	0,074438	0	0,090447	0,027348	0,075497	0,154528	0,016207
	(1; 16)	(2; 16)	(23; 5)	**(0; 0)**	(16; 6)	(5; 9)	(16; 12)	(16; 18)	(16; 19)
5	0,034896	0,082572	0,182017	0,090447	0	0,134927	0,008152	0,045463	0,065046
	(20; 6)	(2; 10)	(23; 6)	(16; 6)	**(0; 0)**	(6; 9)	(6; 11)	(10; 18)	(6; 17)
6	0,088876	0,236117	0,024534	0,027348	0,134927	0	0,119977	0,199008	0,060687
	(1; 9)	(2; 9)	(23; 8)	(5; 9)	(6; 9)	**(0; 0)**	(9; 12)	(9; 18)	(9; 19)
7	0,019946	0,109342	0,167067	0,075497	0,008152	0,119977	0	0,072233	0,050095
	(20; 12)	(2; 11)	(23; 12)	(16; 12)	(6; 11)	(9; 12)	**(0; 0)**	(11; 18)	(12; 17)
8	0,098977	0,009608	0,246098	0,154528	0,045463	0,199008	0,072233	0	0,129127
	(20; 18)	(2; 13)	(23; 18)	(16; 18)	(10; 18)	(9; 18)	(11; 18)	**(0; 0)**	(18; 17)
9	0,018995	0,166236	0,107777	0,016207	0,065046	0,060687	0,050095	0,129127	0
	(1; 17)	(2; 17)	(23; 19)	(16; 19)	(6; 17)	(9; 19)	(12; 17)	(18; 17)	**(0; 0)**

	1	2	3	4	5	6	7	8	9
	0,018995	0,009608	0,024534	0,016207	0,008152	0,024534	0,008152	0,009608	0,016207
Minimum distances between chains	(1; 9)	(2; 8)	(3; 6)	(4; 9)	(5; 7)	(6; 3)	(7; 5)	(8; 2)	(9; 4)

1 (4):	1	0,045625	18	0,053431	11	0,177043	25		
2 (2):	2	0,078664	13						
3 (5):	3	0,00392	23	0,002129	15	0,027125	21	0,158407	22
4 (3):	4	0,007498	10	0,004083	19				
5 (2):	5	0,012499	16						
6 (2):	6	0	9						
7 (3):	7	0,047153	12	0,0072	17				
8 (2):	8	0,017517	20						
9 (2):	14	0,003434	24						

Matrix of interchain distances

	1	2	3	4	5	6	7	8	9
1	0	0,102672	0,591633	0,549089	0,413365	1	0,32968	0,522048	0,49058
	(0; 0)	(25; 2)	(25; 15)	(25; 19)	(25; 16)	(0; 0)	(25; 7)	(25; 8)	(25; 14)
2	0,102672	0	0,410296	0,367753	0,232029	0,865272	0,148344	0,340712	0,309243
	(25; 2)	**(0; 0)**	(13; 15)	(13; 19)	(13; 16)	(13; 6)	(13; 7)	(13; 8)	(13; 14)
3	0,591633	0,410296	0	0,030961	0,165769	0,269444	0,207599	0,052067	0,097619
	(25; 15)	(13; 15)	**(0; 0)**	(15; 4)	(15; 5)	(22; 6)	(15; 17)	(15; 20)	(15; 24)
4	0,549089	0,367753	0,030961	0	0,123225	0,485937	0,165055	0,009524	0,055076
	(25; 19)	(13; 19)	(15; 4)	**(0; 0)**	(19; 5)	(4; 6)	(19; 17)	(19; 20)	(19; 24)
5	0,413365	0,232029	0,165769	0,123225	0	0,620744	0,029331	0,096184	0,064716
	(25; 16)	(13; 16)	(15; 5)	(19; 5)	**(0; 0)**	(5; 6)	(16; 17)	(5; 8)	(5; 14)
6	1	0,865272	0,269444	0,485937	0,620744	0	0,662575	0,507043	0,552595
	(0; 0)	(13; 6)	(22; 6)	(4; 6)	(5; 6)	**(0; 0)**	(6; 17)	(6; 20)	(6; 24)
7	0,32968	0,148344	0,207599	0,165055	0,029331	0,662575	0	0,138014	0,106546
	(25; 7)	(13; 7)	(15; 17)	(19; 17)	(16; 17)	(6; 17)	**(0; 0)**	(17; 8)	(17; 14)
8	0,522048	0,340712	0,052067	0,009524	0,096184	0,507043	0,138014	0	0,028034
	(25; 8)	(13; 8)	(15; 20)	(19; 20)	(5; 8)	(6; 20)	(17; 8)	**(0; 0)**	(8; 24)
9	0,49058	0,309243	0,097619	0,055076	0,064716	0,552595	0,106546	0,028034	0
	(25; 14)	(13; 14)	(15; 24)	(19; 24)	(5; 14)	(6; 24)	(17; 14)	(8; 24)	**(0; 0)**

	1	2	3	4	5	6	7	8	9
	0,102672	0,102672	0,030961	0,009524	0,029331	0,269444	0,029331	0,009524	0,028034
Minimum distances between chains	(1; 2)	(2; 1)	(3; 4)	(4; 8)	(5; 7)	(6; 3)	(7; 5)	(8; 4)	(9; 8)

2 (3):	2	0,047039	17	0,023697	24		
3 (2):	3	0	7				
4 (3):	5	0,006582	21	0,024159	11		
5 (2):	6	0,000611	19				
6 (2):	8	0,047735	20				
7 (3):	10	0,007878	14	0,046067	22		
8 (4):	12	0,003008	16	0,002775	15	0,019793	23
9 (3):	13	0,054663	25	0,113027	18		

Matrix of interchain distances

	1	2	3	4	5	6	7	8	9
1	0	0,178984	0,54973	0,326201	0,034761	0,010656	0,107139	0,093087	0,389583
	(0; 0)	(4; 2)	(9; 3)	(4; 11)	(4; 19)	(9; 20)	(9; 14)	(4; 15)	(4; 25)
2	0,178984	0	0,769149	0,076481	0,143612	0,230076	0,326559	0,066104	0,139864
	(4; 2)	**(0; 0)**	(2; 3)	(24; 11)	(2; 6)	(2; 20)	(2; 14)	(2; 23)	(24; 25)
3	0,54973	0,769149	0	0,916366	0,624926	0,491338	0,396524	0,683252	0,979749
	(9; 3)	(2; 3)	**(0; 0)**	(3; 11)	(3; 19)	(3; 8)	(3; 22)	(3; 15)	(3; 25)
4	0,326201	0,076481	0,916366	0	0,290829	0,377293	0,473776	0,213321	0,032642
	(4; 11)	(24; 11)	(3; 11)	**(0; 0)**	(11; 6)	(11; 20)	(11; 14)	(11; 23)	(5; 25)
5	0,034761	0,143612	0,624926	0,290829	0	0,085853	0,182336	0,057715	0,354212
	(4; 19)	(2; 6)	(3; 19)	(11; 6)	**(0; 0)**	(19; 20)	(19; 14)	(6; 15)	(6; 25)
6	0,010656	0,230076	0,491338	0,377293	0,085853	0	0,048748	0,144179	0,440676
	(9; 20)	(2; 20)	(3; 8)	(11; 20)	(19; 20)	**(0; 0)**	(8; 14)	(20; 15)	(20; 25)
7	0,107139	0,326559	0,396524	0,473776	0,182336	0,048748	0	0,240662	0,537158
	(9; 14)	(2; 14)	(3; 22)	(11; 14)	(19; 14)	(8; 14)	**(0; 0)**	(14; 15)	(14; 25)
8	0,093087	0,066104	0,683252	0,213321	0,057715	0,144179	0,240662	0	0,276704
	(4; 15)	(2; 23)	(3; 15)	(11; 23)	(6; 15)	(20; 15)	(14; 15)	**(0; 0)**	(23; 25)
9	0,389583	0,139864	0,979749	0,032642	0,354212	0,440676	0,537158	0,276704	0
	(4; 25)	(24; 25)	(3; 25)	(5; 25)	(6; 25)	(20; 25)	(14; 25)	(23; 25)	**(0; 0)**

Minimum distances between chains	0,010656	0,066104	0,396524	0,032642	0,034761	0,010656	0,048748	0,057715	0,032642
	(1; 6)	(2; 8)	(3; 7)	(4; 9)	(5; 1)	(6; 1)	(7; 6)	(8; 5)	(9; 4)

1 (3):	1	0,011515	8	0,025056	2
2 (2):	3	0,040097	4		
3 (2):	5	0,011073	7		
4 (3):	6	0,001022	9	0,053658	22
5 (2):	10	0,002541	17		
6 (3):	11	0,006509	15	0,006844	23
7 (3):	12	0,017693	25	0,011019	24
8 (3):	13	0,010267	20	0,023503	18
9 (2):	14	0,007542	16		
10 (2):	19	0,028987	21		

Matrix of interchain distances

	1	2	3	4	5	6	7	8	9	10
1	0	0,229263	0,839069	0,022318	0,021956	0,035518	0,211269	0,326629	0,179652	0,079308
	(0; 0)	(2; 3)	(8; 7)	(2; 6)	(8; 17)	(8; 23)	(8; 24)	(8; 18)	(8; 16)	(8; 19)
2	0,229263	0	1	0,152265	0,276275	0,289837	0,465588	0,580948	0,433971	0,333627
	(2; 3)	**(0; 0)**	(0; 0)	(3; 22)	(3; 17)	(3; 23)	(3; 24)	(3; 18)	(3; 16)	(3; 19)
3	0,839069	1	0	0,886442	0,814572	0,790198	0,599088	0,488937	0,651875	0,730774
	(8; 7)	(0; 0)	**(0; 0)**	(7; 6)	(7; 10)	(7; 11)	(7; 12)	(7; 20)	(7; 14)	(7; 21)
4	0,022318	0,152265	0,886442	0	0,069329	0,082891	0,258643	0,374003	0,227025	0,126681
	(2; 6)	(3; 22)	(7; 6)	**(0; 0)**	(6; 17)	(6; 23)	(6; 24)	(6; 18)	(6; 16)	(6; 19)
5	0,021956	0,276275	0,814572	0,069329	0	0,011021	0,186773	0,302133	0,155155	0,054811
	(8; 17)	(3; 17)	(7; 10)	(6; 17)	**(0; 0)**	(10; 23)	(10; 24)	(10; 18)	(10; 16)	(10; 19)
6	0,035518	0,289837	0,790198	0,082891	0,011021	0	0,162398	0,277758	0,130781	0,030437
	(8; 23)	(3; 23)	(7; 11)	(6; 23)	(10; 23)	**(0; 0)**	(11; 24)	(11; 18)	(11; 16)	(11; 19)
7	0,211269	0,465588	0,599088	0,258643	0,186773	0,162398	0	0,086648	0,024076	0,102974
	(8; 24)	(3; 24)	(7; 12)	(6; 24)	(10; 24)	(11; 24)	**(0; 0)**	(12; 18)	(24; 14)	(24; 21)
8	0,326629	0,580948	0,488937	0,374003	0,302133	0,277758	0,086648	0	0,139436	0,218334
	(8; 18)	(3; 18)	(7; 20)	(6; 18)	(10; 18)	(11; 18)	(12; 18)	**(0; 0)**	(18; 14)	(18; 21)
9	0,179652	0,433971	0,651875	0,227025	0,155155	0,130781	0,024076	0,139436	0	0,071357
	(8; 16)	(3; 16)	(7; 14)	(6; 16)	(10; 16)	(11; 16)	(24; 14)	(18; 14)	**(0; 0)**	(16; 21)
10	0,079308	0,333627	0,730774	0,126681	0,054811	0,030437	0,102974	0,218334	0,071357	0
	(8; 19)	(3; 19)	(7; 21)	(6; 19)	(10; 19)	(11; 19)	(24; 21)	(18; 21)	(16; 21)	**(0; 0)**
Minimum distances between chains	0,021956	0,152265	0,488937	0,022318	0,011021	0,011021	0,024076	0,086648	0,024076	0,030437
	(1; 5)	(2; 4)	(3; 8)	(4; 1)	(5; 6)	(6; 5)	(7; 9)	(8; 7)	(9; 7)	(10; 6)

Scientific publication

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INNOVATION AND INVESTMENT COMPONENT OF INTERNATIONAL COMPETITIVENESS IN CONDITIONS OF IMPLEMENTATION OF THE EUROPEAN INTEGRATION COURSE OF UKRAINE

Monograph

Published in the author's edition

The monograph provides a comprehensive study of the innovation and investment component of international competitiveness in terms of implementing the course of European integration of Ukraine. Theoretical bases of innovations and investment potential for ensuring international competitiveness are determined. The organizational and financial determinants of the innovative component of the country's competitiveness, the factors that shape the international competitiveness of Ukraine, the cluster analysis of systems of interaction in innovation processes in the context of Ukraine's European integration course are studied. Proposals for optimizing the innovation and investment component of international competitiveness have been developed. The book is recommended for scientists, managers and specialists of management structures, graduate students, students of higher educational institutions.