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STRATEGIC ORIENTATION OF INNOVATIVE ACTIVITY REGULATION: UKRAINE AND EU INTEGRATION PROCESS

Abstract. The article reveals scientific approaches to the creation of strategic guidelines for European integration processes based on the prediction of indicators of innovative development, considering international experience. This will make it possible to achieve the effectiveness of the processes of regulating innovation activity in the national economy and accelerate the pace of its development. The article proposes to identify relevant indicators of innovation activity to promote innovation changes based on the analysis of the overall innovation index of countries using econometric instruments. The characteristics of the process of introducing innovations in Ukraine are given in accordance with the individual components of the overall innovation index, which, according to the results of the calculation of the European Innovation Scoreboard, gives an idea of the various categories of countries-innovators in terms of the degree of innovative support for their economies. Based on the analysis of international statistical reporting, trends in the development of the innovation index in Ukraine and the European Union for a short-term period are established. Based on the Gompertz method, it is shown how the dynamics of each indicator will change, depending on the obtained predictive values of innovation development indices. This allows to determine the significance of regulatory instruments and generate appropriate forecasts. The methodology for finding regulatory instruments in the innovation development management system is developed depending on the speed of management intervention in the process of stimulating innovative changes. Strategic guidelines for the use of instruments for managing innovative development are formed depending on each index specifically. The content of the instruments is proposed depending on the priorities of the European integration activity and the influence of management on the formation of reforms, which will ensure the targeting of innovative regulatory initiatives in precisely those areas where the response of the national economy to the implemented influences will be most effective.

Keywords: innovation, indicators, forecasting, reforms, trends, economic instruments, finance.

JEL Classification C53, O33
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СТРАТЕГІЧНЕ РЕГУЛЮВАННЯ ІННОВАЦІЙНОЇ ДІЯЛЬНОСТІ: УКРАЇНА ТА ЄВРОПЕЙСЬКИЙ ІНТЕГРАЦІЙНИЙ ПРОЦЕС

Розкриваються наукові підходи до створення стратегічних орієнтирів євроінтеграційних процесів, заснованих на прогнозуванні індикаторів інноваційного розвитку з урахуванням міжнародного досвіду. Це дозволить досягти ефективності процесів регулювання інноваційної діяльності в національній економіці і прискорити темпи його розвитку. Запропоновано визначити відповідні індикатори інноваційної активності для просування інноваційних змін на основі аналізу загального інноваційного індексу країн з використанням економетричних інструментів. Характеристики процесу впровадження інновацій в Україні приведені у відповідність з окремими компонентами загального індексу інновацій, який, згідно з результатами розрахунку Європейського табло інновацій, дає уявлення про різні категорії країн-інноваторів з точки зору ступеня інноваційного забезпечення економіки. На основі аналізу міжнародної статистичної звітності встановлені тенденції розвитку індексу інновацій в Україні на короткостроковий період. На основі методу Гомперца показано, як буде змінюватися динаміка кожного показника, в залежності від отриманих прогностичних значень індексів інноваційного розвитку. Це дозволяє визначити значимість інструментів регулювання і сформувати відповідні прогнози. Методологія пошуку інструментів регулювання в системі управління інноваційним розвитком розробляється в залежності від необхідності негайного втручання менеджменту в процес стимулювання інноваційних змін. Стратегічні орієнтири управління інноваційним розвитком формуються в залежності від отримання бажаних результатів. Зміст інструментів пропонується в залежності від пріоритетів євроінтеграційної активності і впливу менеджменту на формування реформ, що забезпечить націлювання інноваційних регуляторних ініціатив саме в тих напрямках, де підтимка інноваційної активності буде найефективніша.

Ключові слова: інновація, індикатори, прогнозування, реформи, тенденції, економічні інструменти, фінанси.

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СТРАТЕГИЧЕСКОЕ РЕГУЛИРОВАНИЕ ИННОВАЦИОННОЙ ДЕЯТЕЛЬНОСТИ: УКРАИНА И ЕВРОПЕЙСКИЙ ИНТЕГРАЦИОННЫЙ ПРОЦЕСС

Раскрываются научные подходы к созданию стратегических ориентиров евроинтеграционных процессов, основанных на прогнозировании индикаторов инновационного развития с учетом международного опыта. Предложено определить соответствующие индикаторы инновационной активности для продвижения инновационных изменений на основе анализа общего инновационного индекса стран с использованием эконометрических инструментов. На основе метода Гомперца показано, как будет меняться динамика каждого показателя, в зависимости от полученных прогностических значений индексов инновационного развития. Методология поиска инструментов регулирования в системе управления инновационным развитием разрабатывается в зависимости от необходимости немедленного вмешательства менеджмента в процесс стимулирования инновационных изменений.

Ключевые слова: инновация, индикаторы, прогнозирование, реформы, тенденции, экономические инструменты, финансы.

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Introduction. The economic security of any country from the position of global ratings can be assessed using indicators of innovative development. The presence or absence of positive dynamics in the implementation of innovation is a key criterion of the level of economic security. In previous studies, it was identified vectors for increasing the level of the country's economic security, considering innovative development, in particular: institutional, financial and economic, scientific and technical, informational and analytical. In the context of the implementation of a strategic orientation towards the direction of the economy according to the indicated vectors and stimulating the innovation activity of the business environment, it is necessary to form models and build predictive trends in the influence of management actions on the growth of the relevant indicators. This is possible in case of development institutions and infrastructure, as well as the increasing quality of institutional support for innovative security.

The formation and implementation of a strategy for regulating innovation depends on the definition of a scientifically based level of budget financing of scientific and scientific-technical activity.

Literature Review. The formation of strategic guidelines for the regulation of innovation activity in the system of integration processes consists of substantiating the potential possibilities of the national economy for introducing innovations and providing directions for introducing innovative changes.

The results of research by scientists regarding the substantiation of the potential for introducing innovative changes (Audretsch, 2006; Klump, 2015) are important for the national economy of any country. Modern trends in the development of the country's economy from the point of view of integration into the financial space of the European Union are due to the need to increase the competitiveness of countries based on the intensification of innovation activities. The effectiveness of such growth in the conditions of market competition should be manifested in the stimulation of innovations, the use of the achievements of scientific and technological progress, the intellectualization of production and the introduction of innovations in all spheres of life.

According to (Klump, 2015), innovative development of the country requires the development of a balanced state policy, which should be carried out through the transition from the traditional model of the national economy functioning. The new model should creates an environment for promoting innovation, opportunities for more responsible behavior of innovative development stakeholders, minimizes the risks business, solve the problem of efficiency of innovation.

Some scientists believe that the innovative potential of the country is a strategic basis for its development. Those countries that aspire to a constant intensive growth of the national innovative potential are developing at a faster rate and have an efficient economy, and countries that fail to ensure the growth of the innovative potential become dependent on developed countries (Economic, 2008).

The formation of strategic guidelines for regulating innovation is impossible without monitoring and evaluating the current state of the system and its developing. It has been established that there are a significant number of different approaches to the construction of indicators / indices for monitoring innovation development, but, as I. Egorov shows (Egorov, 2010), only 150 of them are actively used in international practice. Active initiators of this analysis are the World Bank, UNIDO, the World Economic Forum, and the like. Monitoring the assessment of the results of innovative development using a system of indicators and indices is considered in the leading countries of the world as an important component of effective socio-economic development policy. We have found that in the most well-known and widely accepted in world practice methods of monitoring the innovative development of countries for a comparative analysis, groups of indices are referred to:

–   Global Innovation Index (Global Innovation Index, GII). This index is calculated by the analytical center of the Lausanne School of Business INSEAD, Switzerland (Global, 2016). The calculation of the index is determined by two groups of indicators: the Innovation Input Index and the Innovation Output Index. The first index consists of five subindexes: institutions; human potential; information and communications technology and common infrastructure; the development of markets; business development; the second contains sub-index: the results of scientific research; creative achievements and well-being;

–   International Innovation Index BCG (International Innovation Index BCG, IntII BCG), which is calculated by experts from the Boston Consulting Group, USA (European, 2017). The index contains three groups of indicators:

1. Resource capabilities: human resources; financial and infrastructure capabilities.

2. Innovative activity of firms: investments (IT costs, costs for innovations) intercompany communications and entrepreneurship (domestic innovations of small and medium enterprises, joint public-private innovation and research projects) innovative performance (number of patents, number of national brands, technology trade balance.

3. Results of innovators (SMEs that introduce product or process, marketing or organizational innovations, the resource effect of innovation activities — the share of innovations companies, where innovations have led to a significant reduction in wage costs, consumption of

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materials and energy) economic effect: employment in medium and high-tech enterprises, employment in high-tech enterprises Export in medium and high-tech enterprises, export in high-tech enterprises, sales of goods, new for the market, sale of goods, new for the enterprise;

– Innovation Capacity Index (Innovation Capacity Index, ICI) of the international research structure of the EFD — Global Consulting Network (Global, 2016);

– Innovation Index of the European Innovation Scoreboard (European Innovation Scoreboard - Summary Innovation Index, SII), which annually provides a comparative assessment of the results of innovative development of the European Union member states and associated members with respect to the strengths and weaknesses of their scientific, technical and innovation systems (European, 2017).

Studying the formation of strategic guidelines for the regulation of innovation, we found that most scientists turn to the European Innovation Scoreboard, which is well-known throughout the world, reflecting the level of competitiveness of the economy. Dynamic conditions of integration processes require clarification and improvement of the development strategy of the innovation sphere based on the current state of key indicators of innovation development. It is necessary to establish a point of growth of innovations and appropriate special instruments that would enable the assessment of the potential of the national economy. This should be done based not only on the monitoring of the country itself, which is being studied, but also on statistical data from European countries, most of which are the benchmark of innovative development for Ukraine. Taking this into account, the purpose of this study is to establish the strategic guidelines for the growth of the basic levers of the country's innovative development and the development of management decisions for regulating the processes of innovative development.

It should be noted that we aim to determine the bottlenecks of innovative development at the national level based on individual indicators. For this purpose, the SII Integral Index was chosen as the target criterion in this study, since it is calculated annually for the European Union member states and associate members regarding the advantages and disadvantages of the innovation activity system.

Based on long-term empirical research, the European Commission established a list of control «candidate indicators», which formed the basis of the standard of the European scientific and technological development system (European, 2017). The methodology for collecting and calculating the values of indicators of the European Innovation Scoreboard is based on the use of standardized procedures, including weighted statistical samples of national statistical agencies and organizations.

The components of this index are: potentially innovative-active population (HR), the integration of researchers into the global scientific space and the attractiveness of research for international cooperation (RS), the environment for supporting and promoting innovation (IFE), financial support for innovation (FS), investments by firms in innovation (FI), active subjects-innovators (individuals and legal entities) (IN), development of entrepreneurial relations and partnerships in the field of innovation (LE), intellectual assets (IA), the impact of innovation on employment of the population (EI), the economic effects of innovation (SI) (*Table 1*). Therefore, it is advisable to note that each of the subgroups described above is formed by informative and objective indicators, but some of them are not included in national statistical collections today, and therefore may not be present in the generalized assessment of innovative development. These figures can be considered in the future, which will allow synchronizing the Ukrainian and European approaches to the identification of the studied phenomena.

Scientists (Egorov, 2010) have shown that weighty prerequisites for the transition to an innovative model of economic development are not formed in Ukraine, despite the lag in the pace of scientific and technological progress and weak competitive positions of the state in the context of modern globalization processes. It is shown that the increase in innovation activity of enterprises and the intensification of the production of innovative products is a key condition for public welfare in the country, and an indicator of the recovery of positive dynamics of economic growth in Ukraine is the trend towards innovation.

Table 1

Indicators of the European innovation Scoreboard (Ukraine, 2010—2017) (European, 2017)

№	Indicator	2010	2017
	SII	**31,2**	**27,8**
1.1	**HR**	65,8	110,3
1.1.1	New graduates of doctoral and post-graduate studies (25-34)	61,5	88,3
1.1.2	Percentage of population with higher education at the age of 30-34	–	–
1.1.3	Lifelong Learning	–	–
1.2	**RS**	**18,4**	**19,6**
1.2.1	International scientific publications, prepared jointly by representatives of science and business sector	0	3,2
1.2.2	Scientific publications, most cited in the world	18,5	20,8
1.2.3	Proportion of doctoral and post-graduate students from other countries	24,5	26,4
1.3	**IFE**	**5,7**	**4,1**
1.3.1	Broadband penetration	7,7	4,2
1.3.2	Opportunity-driven entrepreneurship	–	–
1.4	**FS**	**24,5**	**15,5**
1.4.1	Expenditure on research and development in the public sector	41,1	14,6
1.4.2	Venture Capital Expenses	3,2	16,4
1.5	**FI**	**70,7**	**40,1**
1.5.1	Expenses for research and development in the business sector	37,0	26,4
1.5.2	Expenditure on innovation, not related to research	116,1	60,4
1.5.3	Providing information and communication technologies	–	–
1.6	**IN**	**18,2**	**18,6**
1.6.1	Small and medium-sized enterprises (SMEs) that implement product / process innovation,% of total SMEs	0	0
1.6.1	Small and medium-sized enterprises that implement marketing / organizational innovations,% of total SMEs	2,4	0
1.6.3	Small and medium-sized enterprises that implement their own innovative developments	51,4	50,7
1.7	**LE**	**12,5**	**9,5**
1.7.1	Innovative SMEs that collaborate with others,% of total SMEs	5,0	3,0
1.7.2	Joint public-private publications	19,1	15,3
1.7.3	Privat co-financing of public research expenditures	–	–
1.8	**IA**	**7,9**	**13,3**
1.8.1	International patenting under the PCT procedure	7,6	15,5
1.8.2	Trademarks	18,5	16,0
1.8.3	Projects and design	0,1	8,8
1.9	**EI**	**69,2**	**77,5**
1.9.1	Employment in knowledge-intensive sectors	83,1	84,7
1.9.2	Employment in fast developing firms	–	–
1.10	**SI**	**45,4**	**31,5**
1.10.1	The share of medium- and high-tech products in the total volume of export	59,6	26,7
1.10.2	Export of knowledge-intensive sectors, % of total export of services	55,8	61,1
1.10.3	Sale of new innovations for the market / firms, as% of turnover	16,4	1,5

According to the *table 1*, HR and EI are the strongest innovation dimensions. LE and IFE are the weakest innovation dimensions. Comparative analysis of composite indicators for Ukraine and the EU indicates that Ukraine is classified as a «moderate innovator» by the European innovation Scoreboard. The status of some indicators is completely absent.

Methodology and research methods. Our research focuses on the international organizations statistical data and empirical analysis. The aim of the research and practical value of the research are forming strategic benchmarks for regulating innovation activity. The following research problem has been formulated in relation to the above-mentioned main research goals: «How we can compare indicators of different countries and show marginal perspectives for some indicators of innovation development?».

The first step of the analysis was the identification of SII focusing on the «finance and support» and «firm investment» evaluation of SII. The decisive factor in this selection was the data completeness condition for the subsequent analysis (absolute values). The second step will help to determine the parameters of time, when and how much growth is possible for indicators of a country, which development is based on innovations. The following research methods are used: the analysis and synthesis, inductive and deductive, statistical, chronological methods, Gompertz function mathematical model.

To show this process, we used the Gompertz curve. It has the following form:

$$y = ae^{-y_{ad} \cdot e^{-g \cdot t}}, \tag{1}$$

where y — indicator, that shows the innovative development;
a — an asymptote;
y_{ad} — additional variable, which shows the development of indicator of the innovative development;
g — the growth rate of y;
e — Euler's Number;
t — years of forecasting.

In research we need to know y_{ad} i g. The system of equations is:

$$\begin{cases} y_{(t=0)} = ae^{-y_{ad} \cdot e^{-g \cdot 0}} = y_{init}; \\ y_{(t=t_{impl})} = ae^{-y_{ad} \cdot e^{-g \cdot t}} = y_{fin}. \end{cases} \tag{2}$$

Results. The analysis of statistical data led to the conclusion that during 2005—2017 there was no clear tendency to change the proportion of Ukrainian enterprises that introduced innovations. If in 2005—2007 the share of innovation-oriented business entities grew (in 2007 compared with 2005, it increased by 3,4 %), then during 2008—2011. It remained at about the same level, and in 2012—2014 — decreased and reached 12,1 % in 2014. This was caused by socio-political uncertainty. Despite this, in 2017 compared to 2005, the share of such enterprises increased by 7,1 % (*Fig. 1*).
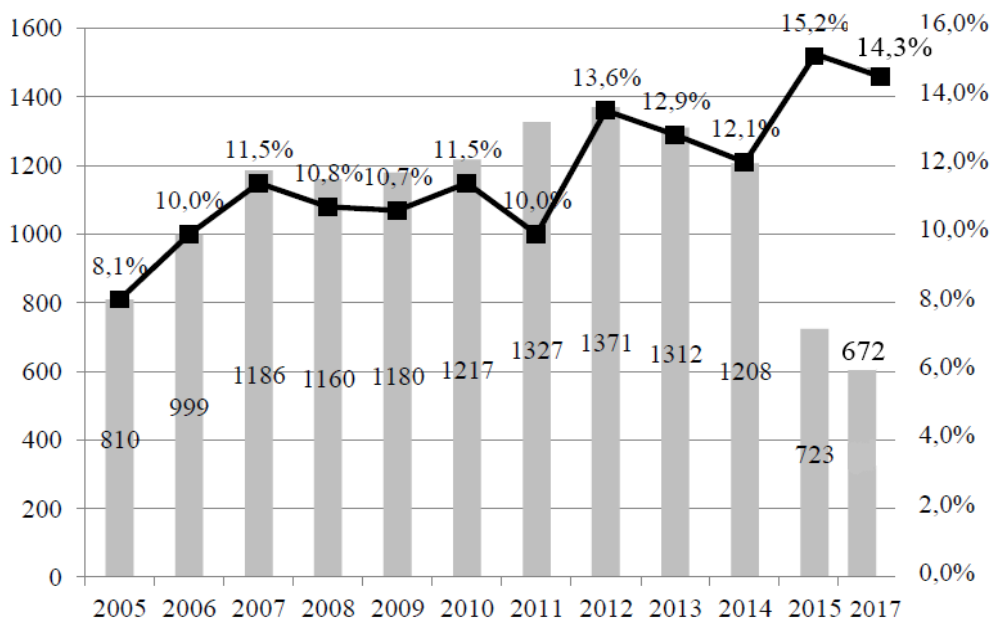

Fig. 1. Enterprises that implemented innovations and their share in the total number of industrial enterprises in Ukraine in 2005—2017.

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The results of the analysis showed that the share of innovation-active business entities that were engaged in innovations is insignificant, due to the lack of focus on the country's development strategy in the innovation sphere, the situational use of financial regulation instruments combined with the inefficiency of the national innovation system and its low level of effectiveness. We believe that there is no result from the adopted by state authorities and the management of regulatory acts aimed at improving the performance of innovative activities of enterprises, and the provisions contained in them have remained unimplemented. Therefore, socio-economic development on an innovation basis is possible only through effective financial regulation in the context of optimizing the use of the potential of its influence on the national innovation system.

We think that the creation of favourable conditions for the development of innovations and the application of the results of scientific and technical developments in the real economy is one of the basic factors for ensuring the effectiveness of the national innovation system. Although Ukraine has a quantitatively significant scientific and technical potential, a wide network of scientific organizations that can be the basis for ensuring economic growth. However, the Ukrainian scientific sphere is characterized by deep crisis phenomena caused by the lack of a clear state strategy for the development of science and technology, limited amounts of its funding, lack of education of national innovation system that does not ensure continuity of links between components, in particular the integration of scientific-technical activities in the process of launching modern high-tech industries, cause low development of innovations, as it is evidenced by the figures given in *Table 1*.

The analysis of the formation of innovative infrastructure shows (in terms of the trend of functioning of technology parks, research parks, business incubators, innovation clusters, industrial parks) that there is no adequate infrastructure support for innovation activity and the promotion of existing and creation of new projects. Innovation infrastructure is a prerequisite for the successful implementation of innovations with the use of financial regulation instruments.

The analysis of total expenditure on research and development showed that more than half (55 %) of the total expenditure on research and development in the EU in 2015 was funded by business enterprises, almost one-third (31 %) by government, and a further 11 % from abroad. Between 2006 and 2016, most of the research and development expenditure was in the business enterprise sector, rising from 1,12 % of GDP in 2006 to 1,32 % by 2016, an overall increase of 17,9 %. In 2015, expenditure on R & D in the EU was two thirds of that recorded by the US, but 49 % higher than in China, more than double the R & D expenditure in Japan, and over five times as high as in South Korea.

We systematized the foreign experience of financial regulation of innovation activities in the context of integration processes and identified the following directions for its implementation in Ukrainian practice:

1) achieving an optimal balance between direct and indirect regulatory instruments (based on experience of France, USA, and Canada);

2) focus on stimulating innovation activities of small and medium enterprises (based on the Netherlands and Portugal);

3) diversification of methods for regulating innovation, considering the experience of transparency in the application of financial regulation instruments (Australia);

4) introduction of a full exemption from income tax for enterprises that are exclusively engaged in research and development (Croatia);

5) study of the prospects for restoring the functioning of free economic zones where innovative products are manufactured (Poland).

The concept of forming strategic orientations of the innovative development of the national economy lies in the strategy of financial regulation of innovation activities in Ukraine, considering the directions of increasing the level of investment and support.

We propose directions for implementing the strategy of financial regulation of innovation activities in Ukraine within the framework of the institutional block, namely: 1) making changes to regulatory acts in terms of ensuring consistency, eliminating gaps, improving to meet modern

challenges; 2) the formation of an integrated system of regulatory institutions, a clear definition of their tasks and functions, ensuring the process of coordination of actions; 3) integration of the innovation potential of regions into a single innovation system, the creation of a system for analysing indicators of its functioning.

In order to predict results that will be based on decision making and time, the modelling of the indicators «firm investment» and «finance and support» are performed *(Table 1)*.

Assume that for this purpose several economic and institutional instruments have been adopted with which, over the period t_{impl}= 15 years, the share of indicators of innovative development will reach y_{fin} = 75 %. At the initial moment of time (2017), the indicator "firm investment" is on the level 40,1 with a growth rate of 0,765 (for 2010—2017 gg.) *(Table 1)*. Suppose that in a period t_{impl} this percentage will increase to y_{fin} = 75 % due to the implementation of special organizational, economic and institutional instruments for stimulating the innovation process.

For Ukraine, the values calculated for (2) will be next; y_{ad}≈6,215, g≈0,815.

Explicitly we assume that a = 1.

Consider the case when we will use the relevant strategic instruments for regulation of innovative development is postponed at the time t_{delay} = 3 years. Assume that the growth rate remains the same and is g≈0,815. In order to determine the value of the parameter y_{ad}. We renormalize the value a in such a way that at t = 0 the function passes through the point yinit. It takes on the following form:

$$y = (a - y_{init})e^{-yad \cdot e^{-g \cdot (t+t_{delay})}} + y_{init}, \tag{4}$$

Find the value of y_{ad}:

$$y_{ad} = -ln\left(\frac{y_{init}}{a}\right)e^{-g \cdot t_{delay}}. \tag{5}$$

After substituting the values we get $y_{ad(\text{firm investment})} \approx 29,286$; $y_{ad(\text{finance and support})} \approx 507,402$.

By analogy, we also calculate the value for the delay time t_{delay} = 6 years. The value of the parameter c will also be 0,765 in first case, and 0,805 in another. The value of $y_{ad(\text{firm investment})} \approx 938,557$ and $y_{ad(\text{finance and support})} \approx 138196,6$.

We construct the graphs of these functions *(Fig. 2—3)* on a coordinate plane and compare the level of indicators that carried out the innovation environment processes (on the example of «firm investment» and «finance and support»).
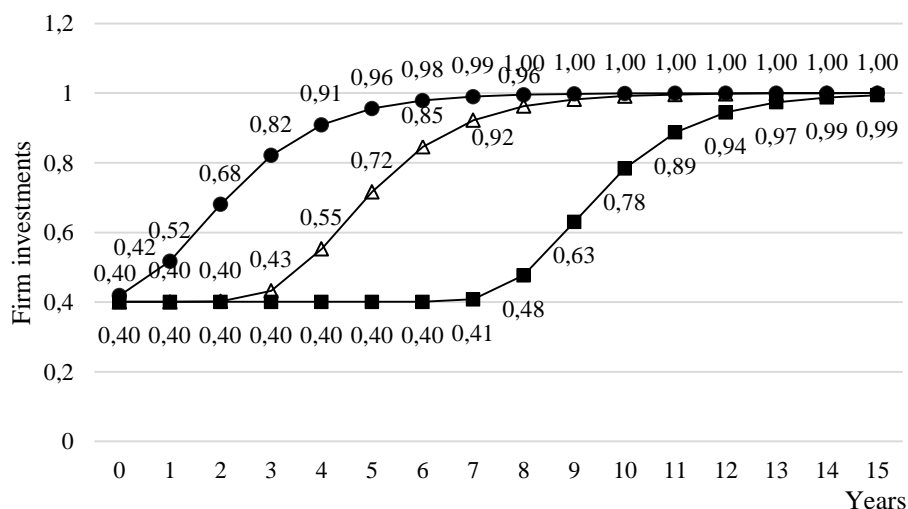

Fig. 2. Predicting changes of indicators «Firm Investment»,
depending on the regulative activities.

The calculations have shown that, subject to the immediate application of the regulatory instruments for innovation activity, the indicators will exceed the threshold of 90 % in 6 years. If the current policy of innovation will be continued, the changes will come no earlier than in 11 years.
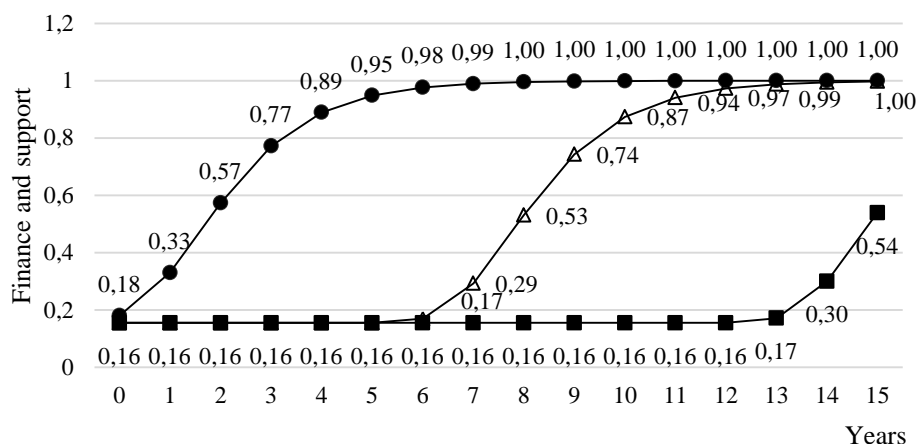

Fig. 3. Predicting changes of indicators «Finace and Support»,
depending on the regulative activities.

In the case of changing the strategic guidelines of innovation policy, the growth of indicators can be expected not earlier than in 14 years. Predicting has shown that radical management decisions aimed at financial support and investment of firms in innovation are needed in order to increase the indicators to 90 %. Effective measures under the current legislation will help to achieve near 70 % of effectiveness, while focusing on strategic planning in the short term will not produce such results. These models should become the basis for the formation of complex state programs for the finance regulation of innovation activity.

Conclusions. We believe that the implementation of the strategy within the framework of strategic orientation for the development of innovation activity provides: first, the immediate use of the instruments of budget regulation and tax incentives; secondly, the formation of a national innovation system on the formulated principles of settling the relations of the stakeholders of innovation activity.

Measures should also be taken for creation of innovation infrastructure in terms of: creation of technology parks on the basis of leading universities; technopolises for implementation of developments in the real sector with the foreseeable benefits; development of legislation on the regulation of business incubators; formation of innovative clusters to strengthen the competitiveness of the regions; creation of industrial parks; use of the potential of the Ukrainian Bank for Reconstruction and Development and the State Innovation Finance and Credit Institution to stimulate innovation activities and support of domestic innovation-oriented commodity producers; stimulating the development of venture funds; formation of public opinion on the possibility of constructing an innovative model of development with the assignment of corresponding functions to the Ministry of Information Policy.

From the point of view of European integration, strategically oriented regulation provides for: 1) Adjustment to the regulatory framework in accordance with EU standards; 2) attraction of loans from international financial organizations, including the EBRD; 3) Improvement of customs and tariff regulation taking into account the necessity of import of the latest developments, which will help to produce the finest innovative products in Ukraine; 4) establishing within the EU scientific and educational cooperation and exchange of scientists, the beginning of long-term (at least six months) internship programs.

Література

1. Audretsch D. B. Entrepreneurship and Economic Growth / D. B. Audretsch, M. C. Keilbach, E. E. Lehmann. — Oxford : Oxford University Press, 2006.

2. Competitiveness, Subsidiary and Industrial Policy / edited by P. Devine, Y. Katsoulacos, R. Sugden. — London, 1996. — 268 p.

3. Chrysostomos D. Mathematical Formulation of Fuzzy Cognitive Maps Groumpos Mathematical Formulation of Fuzzy Cognitive Maps / D. Chrysostomos, E. Stylios, P. Groumpos // Proceedings of the 7th Mediterranean Conference on Control and Automation (MED99) (Haifa, Israel). — 1999. — June 28—30. — P. 2251—2261.

4. Rahe M. Entrepreneurship. Entrepreneur skills / M. Rahe, C. Morales // Report. EADA. R+D+I Department. — 2006.

5. Solow R. M. Growth Theory and After / R. M. Solow // The American Economic Review. — 1988. — Vol. 78. — № 3. — P. 307—317.

6. Klump R. Economic Policy. Instruments, aims and Institutions: third revised edition / R. Klump. — Tbilisi : Publishing house of TSU, 2015.

7. EUROPEAN COMMISSION. Directive of the European Parliament and of the Council [Electronic resource]. — 2017. — Available at : http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52016PC0767R%2801%29.

8. Economic Forum. Geneva, Switzerland 2008 [Electronic resource] // World Economic Forum. — 2008. — Available at : http://www.weforum.org.

9. Egorov I. Government and entrepreneurship in transition economies: the case of small firms in business services in Ukraine / I. Egorov, D. Smallbone, F. Welter, A. Voytovich // Service Industries Journal. — 2010. — № 30 (5). — P. 655—670.

10. Tarantola S. European innovation scoreboard 2006 comparative analysis of innovation performance [Electronic resource] / S. Tarantola, D. Gatelli, H. Hollanders. — 2007. — Available at : http://publications.jrc.ec.europa.eu/repository/bitstream/JRC36794/reqno_jrc36794_final%5b2%5d.pdf.

11. European innovation scoreboard 2017 [Electronic resource] // European Commission. — 2017. — Available at : http://ec.europa.eu/growth/industry/innovation/facts-figures/scoreboards_en.

12. Global Innovation Index 2019 [Electronic resource]. — Available at : http://www.globalinnovationindex.org/gii/main/reports/index.cfm.

13. Innovation for Development Report 2010—2011 [Electronic resource]. — Available at : http://www.innovationfordevelopmentreport.org.

14. Hanour M. The Ukrainian Competitiveness Report 2015 [Electronic resource] / M. Hanour, T. Geiger // World Economic Forum. — Available at : http://www.weforum.org.

15. Енергетичний баланс України 2015—2017 [Електронний ресурс] / Державна служба статистики України. — Режим доступу : http://www.ukrstat.gov.ua.

16. Internationalisation of R&D: trends, issues and implications for S&T policies: a review of the literature / OECD and Belgian Science Policy ; Background report for the forum of the Internationalisation of R&D. — Brussels, 2008.

17. The Global Competitiveness Report 2007—2008 [Electronic resource] // World Economic Forum. — Geneva : Switzerland, 2008. — Available at : http://www.weforum.org.

18. Andrew J. P. The Innovation Imperative in Manufacturing. How the United States Can Restore Its Edge / J. P. Andrew, E. S. DeRocco, A.Taylor / Report BCG. — 2009. — 32 p.

19. The World Bank [Electronic resource]. — Available at : http://data.worldbank.org.

20. UNCTAD. World Investment Report 2017: Transnational Corporations and the Internationalization of R&D. — New York, Geneva : United Nations, 2017. — 105 p.

21. Aurik J. Which countries are best prepared for the future of production? [Electronic resource] / Aurik J., Leurent H. — 2018. — Available at : https://www.weforum.org/agenda/2018/01/time-for-action-who-is-really-ready-for-the-future-of-production.

22. World Development Indicators [Electronic resource]. — Available at : https://data.worldbank.org/products/wdi.

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References

1. Audretsch, D. B., Keilbach, M. C. & Lehmann, E. E. (2006). Entrepreneurship and Economic Growth. Oxford: Oxford University Press.

2. Devine, P., Katsoulacos, Y. & Sugden, R. (Eds.). (1996). Competitiveness, Subsidiary and Industrial Policy. London.

3. Chrysostomos, D., Stylios, E., & Groumpos, P. (1999). Groumpos Mathematical Formulation of Fuzzy Cognitive Maps. *Proceedings of the 7th Mediterranean Conference on Control and Automation (MED99) Haifa. Israel*.

4. Rahe, M., & Morales, C. (2006). Entrepreneurship. Entrepreneur skills. *Report. EADA. R+D+I Department*.

5. Solow, R. M. (1988). Growth Theory and After. The American Economic Review, 78 (3), 307—317.

6. Klump, R. (2015). Economic Policy. Instruments, aims and Institutions, third revised edition. Tbilisi: Publishing house of TSU.

7.   EUROPEAN COMMISSION. (2017). Directive of the European Parliament and of the Council. Retrieved from http://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:52016PC0767R%2801%29.

8.   Economic Forum. Geneva, Switzerland. (2008*). World Economic Forum*. Retrieved from http: www.weforum.org.

9.   Egorov, I., Smallbone, D., Welter, F., & Voytovich, A. (2010). Government and entrepreneurship in transition economies: the case of small firms in business services in Ukraine. *Service Industries Journal, 30* (5), *655—670.* doi: 10.1080/02642060802253876.

10.   Tarantola, S., Gatelli, D., & Hollanders, H. (2006). European innovation scoreboard 2006 comparative analysis of innovation performance. Retrieved from http://publications.jrc.ec.europa.eu/repository/bitstream/JRC36794/reqno_jrc36794_final%5b2%5d.pdf.

11.   European innovation scoreboard 2017. (n. d.). Retrieved from http://ec.europa.eu/growth/industry/innovation/facts-figures/scoreboards_en.

12.   Global Innovation Index 2019. (n. d.). Retrieved from http://www.globalinnovationindex.org/gii/main/reports/index.cfm.

13.   Innovation for Development Report 2010—2011. (n. d.). Retrieved from http://www.innovationfordevelopmentreport.org.

14.   Hanour M. D. & Geiger T. (n. d.). The Ukrainian Competitiveness Report 2015. *World Economic Forum.* Retrieved from www.weforum.org.

15.   Derzhavna sluzhba statystyky Ukrainy. (n. d.). *Enerhetychnyi balans Ukrainy 2015—2017 [Energy Balance of Ukraine 2015—2017].* Retrieved from https://ukrstat.org/uk/operativ/operativ2012/energ/en_bal/arh_2012.htm [in Ukrainian].

16.   OECD and Belgian Science Policy. (2008). Internationalisation of R&D: trends, issues and implications for S&T policies: a review of the literature. Brussels.

17.   The Global Competitiveness Report 2007—2008. (2008). *World Economic Forum.* Geneva. Retrieved from www.weforum.org.

18.   Andrew, J. P., DeRocco, E. S., & Taylor, A. (2009). The Innovation Imperative in Manufacturing. How the United States Can Restore Its Edge.

19.   The World Bank. (n. d.). *worldbank.org*. Retrieved from http://data.worldbank.org.

20.   UNCTAD. (2017). World Investment Report 2017: Transnational Corporations and the Internationalization of R&D. New York, Geneva: United Nations.

21.   Aurik J.& Leurent H. (2018). Which countries are best prepared for the future of production? Retrieved from https://www.weforum.org/agenda/2018/01/time-for-action-who-is-really-ready-for-the-future-of-production.

22.   World Development Indicators. (n. d.). *worldbank.org.* Retrieved from https://data.worldbank.org/products/wdi.