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Research Article

Assessing Structural Components of Investment and Innovation Provision of Economic Security in the Basic Types of Economic Activity

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ABSTRACT

The article shows the progressive and practical value of a structural approach to the evaluation of investment and innovation provision of economic security, including the basic types of economic activity. The arguments have been distributed in relation to systemic, resource and functional approaches. Taking into account the multidimensionality of economic security of the basic types of economic activity, a methodological approach has been proposed in order to evaluate its investment and innovation provision, which incorporates Hellwig's scientific developments in calculating the taxonomic index of the level of economic development. The results of a systemic and structural analysis of investment and innovation provision of economic security of the basic types of Ukraine's economic activity have been grouped by quantitative and qualitative parameters. The retrospective and predictive dynamics of the main macroeconomic and technological measurement of the functioning of Ukrainian industry have been determined. The predictive evaluation of the structure of forming gross value added by basic types of economic activity of Ukraine has been carried out. A set of methods and instruments of investment and innovation provision of economic security of the basic types of economic activity has been offered.

Keywords: Economic Security, Investment and Innovation provision, Basic types of Economic Activity, Management, Development



1. Introduction

Ensuring economic security of the basic types of economic activity testifies to the ability of the entities of the economy to effectively carry out economic activity, realise economic interests and the innovative development potential, and support competitiveness in the markets. At the same time a wide range of means of ensuring this condition, taking into account both material, technical, technological and socio-psychological aspects.

The main focus in this choice should be on finding ways to create and realise the investment and innovation potential, which allows a number of important problems for the economy to be solved, such as ensuring self-sufficiency of the national economy, modernisation and more efficient use of resources and material and technological base of the production complex, the introduction of advanced scientific and technological developments into the creation and production of new knowledge-intensive, high-tech products. This confirms the priority of the investment and innovation component in ensuring economic security of the basic types of economic activity.

With the growing importance of investment and innovation provision, the need for a much better choice of ways and tools for forming a resource and functional base is increasing. The management system should aim to achieve the highest result of independence of the degree of the internal market development. In such circumstances, the processes of evaluation are of primary importance, because, in the context of such processes, the scale of attraction and formation of investment and innovative resources is defined. Such statements have been the subject of a number of scientific studies that have obtained sufficient practical results in their implementation.

The system of economic relations, especially in the field of the basic types of economic activity, is changing rapidly and this requires the use of more detailed approaches. Therefore, analytical procedures for measuring the degree of investment and innovation provision of economic security must meet systemic and structural characteristics and be divided into separate components based on the features of both investment and innovation activity.

2. Literature Review

Most of the assumptions regarding the policy on managing and evaluating investment and innovation provision of the economic security of the basic types of economic activity arise from the fact that economic security modelling is based on systemic, resource or functional approaches.

For example, a systemic approach to an assessment involves singling out the components of economic security, which lay the foundations for the functioning and development of priority types of economic security of the state, which produce tangible (intangible) goods (services). Fedorenko, Gryshchenko and Voronkova (2018), Ilyash, Dzhadan and Ostasz (2018), Vlasiuk (2016), Freeman (1995) emphasise that a large number of features of the basic types of economic activity and strategic directions of developing investment and innovation activity of their economic agents for ensuring active innovative growth requires the systematic and integrated use of organisational, institutional, economic, product and socio-psychological mechanisms. A significant number of papers by well-known foreign economists, in particular (Cohen, Levinthal, 1989; Kugler, 2006; Tidd and Thuriaux-Aleman, 2016; Zhang, Tan and Wong, 2015) are devoted to fundamental research on the problems of innovation and investment development, the formation of sources of investment in innovation, as well as the need to improve the innovation and investment environment in the search for mechanisms for economic security management. Vasylytsiv, Klipkova, Lupak, Mitsenko and Mishchuk (2019) improved the fact that in the analytical modelling of economic security, one needs to keep in mind that innovative development is rather limited in time,

scale of implementation and relevance of business ideas and it requires significant amounts of financial and resource support. The advantages of this approach are the universality and integrity of characteristics describing the state of economic security of the basic types of economic activity. To make high-quality management decisions on investment and innovative provision of economic security, it is necessary to develop a comprehensive evaluation system consisting of the analysis of the relevant parameters at the macro, meso and micro levels (Ilyash, Yildirim, Doroshkevych, Smoliar, Vasylytsiv and Lupak, 2020). The approach focuses on the processes that determine the basic systemic and structural conditions of economic activity (Lundvall, 1992). There are a number of disadvantages, in particular, the factors of production (investment, legal, socio-economic) are not fully characterised (Paranchuk and Korbutyak, 2013); the resource and investment, financial and institutional components are singled out with insufficient justification (Mazzucato, 2013); greater emphasis is placed on addressing investment and innovation problems without adequately considering other needs (such as infrastructure, technology, institutional needs, etc.) that directly affect the state of economic security of industries (light and food industries, agriculture) (Vasylytsiv, Lupak and Osadchuk, 2017).

A resource approach makes it possible to characterise investment and innovative provisions of the economic security of the basic types of economic activity more broadly and comprehensively, as it takes into account the entire set of tangible and intangible resources necessary for ensuring the stability and development of economic entities. It takes into account the need for effective use of the financial and investment potential (Cherevko, Nazarenko, Zachosova, Nosan, 2019; Korol and Poltorak, 2018), as well as increased innovation activity (Mowery, 2009; Frolova, Zhadko, Ilyash, Yermak and Nosova, 2021), and the impact of material and technical support on the implementation of innovative approaches to providing economic security (Kobielieva and Ponomarenko, 2019; Perez, 2002) and the institutional system of investment support for innovative development (Bilousov, 2018; Guliaieva, Vavdiichyk and Matusova, 2018) of the basic types of economic activity. The following aspects of investment and innovation provision of economic security of the basic types of economic activity are singled out: organisational and economic, infrastructural and institutional ones. It is worth agreeing with the scientists (Haber, Bukhtiarova, Chorna, Iastremska and Bolgar, 2018) that with such a list of resources, one manages to better represent the financial and investment, innovation and technological characteristics of how well the subjects of the basic types of economic activity formed the possibilities for self-developing and progressing. There are a number of unfounded relationships, and there is a need to clarify a range of investment and innovation components that ought to be replaced or detailed. Nicolai J. Foss (1998) singles out a set of problems that give rise to this approach. In particular, the lack of basic research on the creation of new resources, which usually gives the future a retrospective nature and complicates its application to management practice.

In the context of the investment and innovative and analytical characteristics of the economic security of the basic types of economic activity, a *functional approach* is more objective. The scientists (Steblianko and Doroshkevych, 2017; Varnaliy, Onishchenko and Masliy, 2016) are of the opinion that the most optimal variant is the formation of long- and short-term strategic priorities for ensuring economic security by such functional components of investment and innovation activity as commodity, marketing, trade and technological, managerial, market and socio-economic components. Havlovskaya, Pokotylova, Korpan, Rudnichenko, Sokyrynyk (2019) emphasize the benefits of such an analytical approach are a comprehensive and in-depth study of the major factors affecting economic security and complex research into the main processes underpinning

it. Komelina, Zaiats, Rakhmetulina and Komelina (2018) improved the practical importance of this approach, in particular, the advantage of the successful identification of the areas of allocating and utilising resources by the enterprises of the basic types of economic activity and reliable consideration of the indicators that reflect the level of functional provision of economic security.

To determine the feasibility and features of using the above approaches as a tool for assessing the structural components of economic security, it is necessary to examine the nature of their relationship and interaction and answer the key question: are they alternatives or can they be combined with each other? We want to mention that only those approaches, which are singled out according to various classification features and those that belong to various classification groups can be combined with each other. *The system approach* is unalterable, in the management of economic security, as well as in all cases, without exception, when the system is the object of management. Naturally, this approach can be combined with all existing approaches to economic security management. *The resource approach* is not an alternative either, as it cannot be combined into one classification group with any of the considered approaches. This allows us to employ the resource approach as an addition to the system approach, which significantly increases the adequacy of the management tools that are being used. Thus, the functional approach successfully takes into account the internal and external aspects of ensuring economic security of the subjects of the basic types of economic activity and is indispensable in assessing the functional components of economic security, in particular investment and innovation components. Obviously, it helps to increase the level of coverage and the value of results of analytical research.

3. Methodology

It is well known that methods of a multivariate statistical analysis are used to determine the greatest number of characteristics that will affect the object of research. It should be noted that a taxonomic method is proposed to investigate the degree of a cumulative effect of factor traits on the level of innovation and investment security. The need to select a taxonomy method is conditioned by the search for a single summarising integrated indicator among a large number of indicators that characterise the level of innovation and investment security, which makes it possible to increase the efficiency of public administration and control in the field of innovation and investment security.

Taxonomic procedures are most often used to compare objects that are characterised by a large number of features, so a taxonomic index of a development level was one of the first methods to investigate the multidimensionality of objects (Hellwig, 1968). The problem of regulation of such a many-dimensional category as economic security in relation to normative standard vector was solved with using of taxonomy method too (Beshelev, 1994, Sablina 2009 and developed by Ilyash, 2015). This indicator is a synthetic value, «equally effective» for all features characterising the unit of the set under study, which allows the elements of this set to be arranged in a linear fashion with its help. The use of this method will make it possible to carry out a generalised assessment of the level of innovation and investment security of the basic types of economic activity in general and in terms of its functional components.

The following algorithm is used to calculate taxonomic measurement of investment and innovation provision of economic security of the basic types of economic activity:

- (1) to generate a matrix of output data for the study of an investment and innovation system of managing economic security;
- (2) to standardise the values of the matrix of the elements under study;

- (3) to form a vector-standard of the development of each functional component of the system;
- (4) to determine the distance between the individual variables and the vector-standard of the development of components of the system;
- (5) to determine a taxonomic indicator of the level of investment and innovation provision of economic security.

According to the first stage of calculating the taxonomic index, it is necessary to select quantitative integrated indicators of innovation and investment support for the level of economic security, which act as an information base for the corresponding calculations. The indicators of innovation and investment security should be divided into two functional components: investment security indicators and innovation security indicators.

The first group of indicators showing the economic security of Ukraine (an investment component) by the basic types of economic activity comprises: Level of depreciation of fixed assets, Share of investment in the cost of fixed assets, Ratio index of net growth of foreign direct investment to GDP growth rate and Index of protection of investors' interests. The second group of Economic Security Indicators by an innovation component in terms of the basic types of economic activity (industry, construction, agriculture, forestry, fisheries and transport) will include such indicators as: Share of innovatively active industrial enterprises, Share of principally new products in the total volumes of sold innovative products, Index of inventive activity, Growth rates of the number of innovatively active enterprises, Level of innovative products in the gross volume of industrial production, Ratio of utilised objects of industrial property to registered ones, Share of state budget expenditures on science (in relation to GDP), Growth rates of the number of new types of technology, Growth rates of the number of new types of products. All these indicators were presented in the table as a source of information for taxonomic analysis of the level of economic security in terms of innovation and investment components.

The standardisation of its indicators is the next stage of conducting the taxonomic analysis of the level of innovation and investment provision of economic security. It is conditioned by the need to reduce the various units of measurement, which express the selected indicators to a non-dimensional number, which allows the values of these characteristics to be equalised. The indicators are standardised by the formula 1 (Sablina, 2009)

$$Z_i = \frac{X_i}{\bar{X}} \quad (1)$$

where: X_i is the value of the i -th index (indicator); \bar{X} is the average value for each index (indicator).

The standardised indicators of innovation and investment provision of economic security are put in two matrices (the rows of these matrices correspond to years, and the columns – to factors of influence):

- $Y^{(1)}$ – the first component includes the indicators that characterise the level of investment security (10×5 matrix size);
- $Y^{(2)}$ – the second component includes the indicators that characterise the level of innovation security (9×5 matrix size).

The standardised values of the elements of the matrix containing output data of the indicators of developing the housing and communal infrastructure will look like:

$$Y(1) = \begin{bmatrix} 1,04 & 1,05 & 1,00 & 0,96 & 0,95 \\ 0,91 & 1,16 & 1,04 & 0,89 & 1,00 \\ 1,12 & 1,15 & 0,78 & 0,99 & 0,69 \\ 1,58 & 0,83 & 0,81 & 0,77 & 1,01 \\ 0,61 & 0,75 & 1,87 & 0,89 & 0,88 \\ 0,70 & 0,43 & 1,97 & 0,90 & 1,00 \\ 0,56 & 0,46 & 1,77 & 1,21 & 1,01 \\ 0,02 & 3,76 & 0,55 & 0,38 & 0,28 \\ 1,14 & 1,42 & 0,14 & 1,29 & 3,88 \\ 0,95 & 1,04 & 0,97 & 1,03 & 1,01 \end{bmatrix}$$

$$Y(2) = \begin{bmatrix} 0,95 & 1,02 & 1,11 & 0,95 & 0,97 \\ 0,98 & 1,13 & 0,85 & 0,91 & 1,13 \\ 1,09 & 0,94 & 0,97 & 0,99 & 1,01 \\ 1,07 & 0,58 & 1,15 & 1,04 & 1,16 \\ 1,87 & 1,04 & 0,97 & 0,52 & 0,60 \\ 0,98 & 0,91 & 1,27 & 0,71 & 1,13 \\ 1,18 & 1,08 & 0,94 & 0,88 & 0,92 \\ 0,84 & 0,56 & 2,30 & 0,42 & 0,88 \\ 0,70 & 0,84 & 1,30 & 0,57 & 1,59 \end{bmatrix}$$

After standardising the indicators of the level of innovation and investment provision of economic security, the division of features into stimulators and destimulators to determine the impact of an individual indicator on the overall level of security is a necessary condition for carrying out the taxonomic analysis. It should be noted that the features that have a positive (stimulating) effect on the overall level of provision of the object are called stimulators and those with an opposite effect – destimulators. In this case, the indicators of the level of innovation and investment provision of economic security will be factor traits, and years will be the objects of the study. In the total set of indicators of the corresponding analysis, most of the selected indicators are stimulants; the level of depreciation of fixed assets is an exception.

The division of the indicators into stimulators and destimulators is the basis for constructing a vector – a standard. The elements of this vector have coordinates and they are formed by the values of the indicators according to the formula 2 (Sablina, 2009):

$$\begin{cases} X_{0i} = \max X_{ij} (\text{stimulator}) \\ X_{0i} = \min X_{ij} (\text{destimulator}) \end{cases} \quad (2)$$

Two vectors – standards of the level of providing innovation and investment security and in terms of its functional components were obtained:

$$Z(1) = (0,95; 1,00; 1,12; 0,83; 0,61; 0,70; 1,01; 0,28; 0,14; 1,01),$$

$$Z(2) = (0,97; 1,13; 1,09; 0,58; 1,87; 0,98; 0,92; 0,88; 1,30).$$

The important criterion for conducting the taxonomic analysis is to bring the output data to standardised indicators. In the first stage of standardisation, the indicators lose their cost and natural units of measurement (the results of the first stage of standardisation are described above

in the form of four matrices). In the second stage, the transformation of the indicators from stimulators and destimulators into one type of stimulators, which is defined as the distance between individual observations (periods) and the vector-standard. The taxonomic index itself increases as the stimulators' values rise and it decreases if they approach zero.

The distance between the individual observations (periods) and the vector standard was determined. In particular, the distance between the point with the figure one and the point with the vector-standard is calculated by formula 3 (Ilyash, 2015):

$$C_{i0} = \sqrt{\sum_{j=1}^m (z_{ij} - z_{0j})^2} \quad (3)$$

where: z_{ij} is the standardised value of the j -th indicator in the period i ; z_{0j} is the standardised value of the j -th indicator in the standard.

The distance obtained is the initial one for calculating the indicator of the level of innovation and investment provision of economic security. The taxonomic indicator of the level of innovation and investment provision of economic security should be determined by formula 4 (Ilyash, 2015):

$$K_i = 1 - d, \quad (4)$$

where: d is the deviation of the distance between the point of the figure one and the vector-standard point from the value of the distance between the features.

Just before calculating it, one must define a number of other indicators. The average distance should be calculated by formula 5 (Ilyash, 2015):

$$\bar{C}_0 = \frac{1}{m} \sum_{i=1}^m C_{i0} \quad (5)$$

where: m is the number of periods; C_{i0} is the distance between the point with the figure one and the point with the vector-standard.

The calculation of the mean square root of the average square of the difference between the values of the features is made by formula 6 (Beshelev, 1994, Ilyash, 2015):

$$S_0 = \sqrt{\frac{1}{m} \sum (C_{i0} - \bar{C}_0)^2} \quad (6)$$

where: S_0 is the mean square root of the average square of the difference between the values of the features; \bar{C}_0 is the average distance.

The distance can be standardised by the formulas 7,8 (Beshelev, 1994, Ilyash, 2015):

$$C_0 = \bar{C}_0 + 2S_0 \quad (7)$$

$$d_i = \frac{C_{i0}}{C_0} \quad (8)$$

where: d_i is the deviation of the distance between the point with the figure one and the point with the vector-standard from the value of the distance between the features; C_0 is the distance.

In addition, based on the data of the taxonomic indicators of Ukraine's economic security, the simplest models of trends were built and the corresponding forecasts of the value for the next three years were calculated. All calculations were performed using the STATGRAPFICS application package. The construction of an adequate forecasting model for predicting taxonomic indicators can be the subject of further research.

4. Results

There are different results and various suggestions concerning decomposition of investment and innovation (scientific and technological) constituents at macroeconomic level of managing economic security of the basic types of economic activity. In particular, in Ukraine, it is institutionalised (in the methodical recommendations of the executive authorities) as a structure of economic security of the state, and its constituents. For example, the values of the indicators of the investment component of the basic types of economic activity are given in Table 1.

Table 1: The indicators of economic security of Ukraine (investment component) by the basic types of economic activity in 2005, 2010, 2014 -2018

Indicators	Types of economic activity	Marginal value	Values						
			2005	2010	2014	2015	2016	2017	2018
The level of depreciation of fixed assets, %	Agriculture, forestry and fisheries	35	50.7	40.8	38.8	38.9	37.3	35.7	35.4
	Industry		56.3	63.0	60.3	76.9	69.4	59.1	66.4
	Construction		47.1	50.1	51.9	53.0	36.0	45.7	44.5
	Transportation, warehousing, postal and courier activities		48.8	94.4	97.9	51.7	50.6	47.6	62.9
Share of the volume of investment in the cost of fixed assets, %	Agriculture, forestry and fisheries	6	6.6	13.4	15.5	19.1	47.6	22.7	22.4
	Industry		7.7	6.4	4.4	2.7	12.4	5.7	6.3
	Construction		49.8	8.8	9.7	7.9	30.5	20.9	17.4
	Transport, warehousing, postal and courier activity		9.2	1.1	0.3	45.7	6.7	4.6	3.4
The ratio index of net growth of foreign direct investment to GDP growth rate, %		0.5-1	1.90	1.18	0.79	0.99	-0.1	-0.9	2.7
The index of protection of investors' interests		4.5	3.0	4.7	5.2	5.7	5.3	5.6	5.5

Source: calculated by the authors on the basis of State Statistics Service of Ukraine (2019), Doing Business (2020).

The indicator «the level of depreciation of fixed assets» is not directly related to innovations, but it is an important characteristic of the investment provision of economic entities. The enterprises that have an excessively high level of depreciation of fixed assets, first, are less economically efficient, because they have a worst depreciation policy and direct part of their means at more expensive servicing of outmoded fixed assets, and, consequently, they limit their own financial possibilities, which would be directed at innovation activity. Secondly, they do not take care of the proper level of their own technical and technological safety, which largely depends on the creation or acquisition of modern high tech and, so, this safety is determined by innovation activity.

The argument is a significant excess of the established marginal knowledge (the Ministry of Economic Development and Trade of Ukraine, 2013). With a critical value of depreciation of fixed assets at 35.0%, the level of this indicator in 2018 was 35.4% for agricultural enterprises, 66.4% for industry, 44.5% for construction and 62.9% for transport. This testifies to the low investment and innovation activity and insufficient attention of the heads of enterprises to the modernization of the technical and technological base and the financing for innovation in this area.

These tendencies partly negatively affect such an indicator of investment security of the economy of Ukraine as a “share of investment in the cost of fixed assets”. At the marginal value of this indicator of 6.0%, in 2018 (Ministry of Economic Development and Trade of Ukraine, 2013), the share of investment in the cost of fixed assets of transport enterprises was only 3.4%, and for industry – 6.3%. On the plus side, this indicator was higher for other types of economic activity. For example, in construction it was 17.4%, in agriculture – 22, 4%.

The index of protection of investors’ interests (by the method of the World Bank (The ease of doing business ranking)) was only 5.5 (maximal value – 10.0), that has a negative impact and shows a low level of protection of non-residents that make investments in Ukraine (Doing Business, 2020).

The drawbacks in an investment sphere influenced the results of innovation activity of Ukrainian subjects of the basic types of economic activity (Table 2). Despite the maximum value of the indicator «a share of innovatively active industrial enterprises» at 50.0 % in 2018 (Ministry of Economic Development and Trade of Ukraine, 2013), there were only 16.4 % of such economic subjects in the industry of Ukraine and the share of principally new products in the total volumes of innovative products was 31.6 %, which was 11.6 p.p. less than in 2005.

Table 2: The indicators of economic security (innovation component) of the basic types of economic activity of Ukraine in 2005, 2010, 2014-2018

Indicators	Critical values or directions of improving	The values by years						
		2005	2010	2014	2015	2016	2017	2018
1. Share of innovatively active industrial enterprises, %	50.0	11.9	13.8	16.1	17.3	18.9	16.2	16.4
2. Share of principally new products in the total volumes of sold innovative products, %	increase	43.2	32.6	27.5	31.6	23.6	25.3	31.6
3. Index of inventive activity (the number of obtained copyright protection documents per 1 million of individuals of the present population), units	400.0	163.1	165.7	124.2	107.0	110.0	113.0	115.0
4. Growth rates of the number of innovatively active enterprises, %	100.0	87.9	103.6	93.8	51.2	101.2	91.0	102.3
5. Level of innovative products in the gross volume of industrial production, %	5.0	4.2	3.8	2.5	1.4	1.3	0.7	0.8
6. Ratio of utilised objects of industrial property to registered ones, %	90.0	78.8	88.4	68.9	64.3	89.0	50.1	79.3
7. Share of state budget expenditures on science (in relation to GDP), %	1.7	0.4	0.75	0.60	0.55	0.48	0.45	0.47
8. Growth rates of the number of new types of technology, %	100.0	104.7	107.8	103.9	69.8	286.6	52.4	109.3
9. Growth rates of the number of new types of products, %	100.0	79.2	89.8	70.9	85.6	131.8	57.7	160.9

Source: calculated by the authors on the basis of the State Statistics Service of Ukraine (2019).

In spite of an increase in innovation activity of industrial enterprises of Ukraine (the share of innovatively active economic subjects rose in 2018 by 0.2 p.p. compared to 2017, and by 4.5 p.p. compared to 2005), the volumes of investment and innovation activity of the subjects of the basic types of economic activity remain small. Among the factors, which caused such a state, except for the objective ones (lack of financial and investment resources, insufficient support from the subjects of innovative and research infrastructure, unwillingness to carry out and unawareness of an objective need for development and introduction of innovations), are:

a) low inventive activity of the population (for example, the number of received copyright protection documents per 1.0 million people of the present population in 2018 was 115.0 units, but it diminished in 2005 by 48.1 units, while the acceptable value of this indicator according to methodical recommendations must be not less than 400.0 units) (Ministry of Economic Development and Trade of Ukraine, 2013).

b) the presence of frequent cases of failure to commercialise already created and registered objects of intellectual property (for example, the ratio between the number of introduced objects of industrial property and the number of registered ones in 2018 was 79.3%, i.e. about 20.7% of such objects after their creation were not used or used without the proper account);

c) a small portion of state budget expenditure on science in GDP (in 2018, 0.5 % of money was directed at the indicated aims, while a scientifically grounded minimum quota must make up 1.7%; moreover, the share of expenditure on science and research in Ukraine goes down annually).

At the beginning of 2018, the share of expenditure on R&D in the GDP of the countries belonging to EU-28 on average was 2.06%. It was higher than the average in Sweden – 3.40%, Austria – 3.16%, Denmark – 3.05%, Germany – 3.02%, Finland – 2.76%, Belgium – 2.58%, France – 2.19% and smaller than the average in Macedonia, Romania, Latvia, Malta and Cyprus (from 0.36% to 0.56%) (Eurostat, 2020).

A decrease in the share of innovative industrial products doesn't look quite rational against a backdrop of a general increase in the intensity of creating new standards of equipment in Ukraine. It is rather a sign of low efficiency of investment and innovation activity of Ukrainian economic subjects as well as its instability, conditioned by the shortcomings of the planned work in this sphere. Despite the increase in the intensity of developing samples of new goods, this indicator varied from side to side (in 2010, it was 103.9%, but in 2015, it dropped (to 69.8%)).

The problem of arranging the multidimensionality of such a category as the level of innovation and investment provision of economic security in relation to the normative vector-standard is solved using the method of taxonomy. The division of all factor features (indicators of economic security) into stimulators and destimulators for each subsystem made it possible to calculate the Euclidean distances between the vectors of the standardized data and the vector-standard and to determine auxiliary values $\bar{c}_0^{(k)}$, $s_0^{(k)}$, $c_0^{(k)}$, and coefficients $d_i^{(k)}$ of the level of innovation and investment provision of economic security (Formula 1-8).

A generalised matrix with the calculations of the taxonomic indicator of the level of providing innovation and investment security has been formed based on analytical results, (Table 3).

Table 3: Taxonomic indicators of the level of innovation and investment provision of economic security of the basic types of economic activity of Ukraine in 2014-2018.

Years (objects)	Investment component			Innovation component		
	$c_{i0}^{(1)}$	$d_i^{(1)}$	$k_i^{(1)}$	$c_{i0}^{(2)}$	$d_i^{(2)}$	$k_i^{(2)}$
2014	1.57	0.32	0.68	0.83	0.39	0.61
2015	3.88	0.79	0.21	1.02	0.48	0.52
2016	1.99	0.41	0.59	1.83	0.86	0.14
2017	1.24	0.25	0.75	1.70	0.80	0.20
2018	4.05	0.82	0.18	1.43	0.67	0.33
		$\overline{C_o} = 2.55$			$\overline{C_o} = 1.36$	
		$S_o = 1.18$			$S_o = 0.39$	
		$C_o = 4.91$			$C_o = 2.13$	

Source: Calculated by the authors

The state of investment security of the basic types of economic activity in 2014-2018 was brought about by an insufficient level of gross accumulation; insufficient investment in high-tech industries; a reduction in the share of the cost of newly introduced fixed assets in relation to the volume of capital investment; lack of foreign direct investment in Ukraine, as well as its growth rate in comparison with the dynamics of economic growth; insufficient development of research and development centres and infrastructure; a low level of innovation in business. The taxonomic analysis reflects the low efficiency of the mechanism for state regulation of investment activity. Let us summarise the results obtained in Fig. 1.

The implementation of the proposed mechanism for investment and innovation provision of economic security of the basic types of economic activity and the introduction of such a mechanism into the management practice will make it possible to regenerate knowledge intensity of industrial technologies in the medium-term (until 2020) to the level of 2013, if the share of high-tech production (25.8%) in the technological structure of the industry of Ukraine rises to the values, which are represented by the forecast solutions.

Among a wide array of models of short-term forecasting in world practice, econometric modeling is mostly used. A retrospective analysis of the construction of econometric models showed that models of the countries with an extensive system of market relations are not suitable for short-term forecasting of the basic macroeconomic and technological measurement of the functioning of the industry in Ukraine. Therefore, in this study we used the method of short-term forecasting of the volume of sold industrial products, knowledge intensity of industrial technologies and technological structure of the basic types of economic activity.

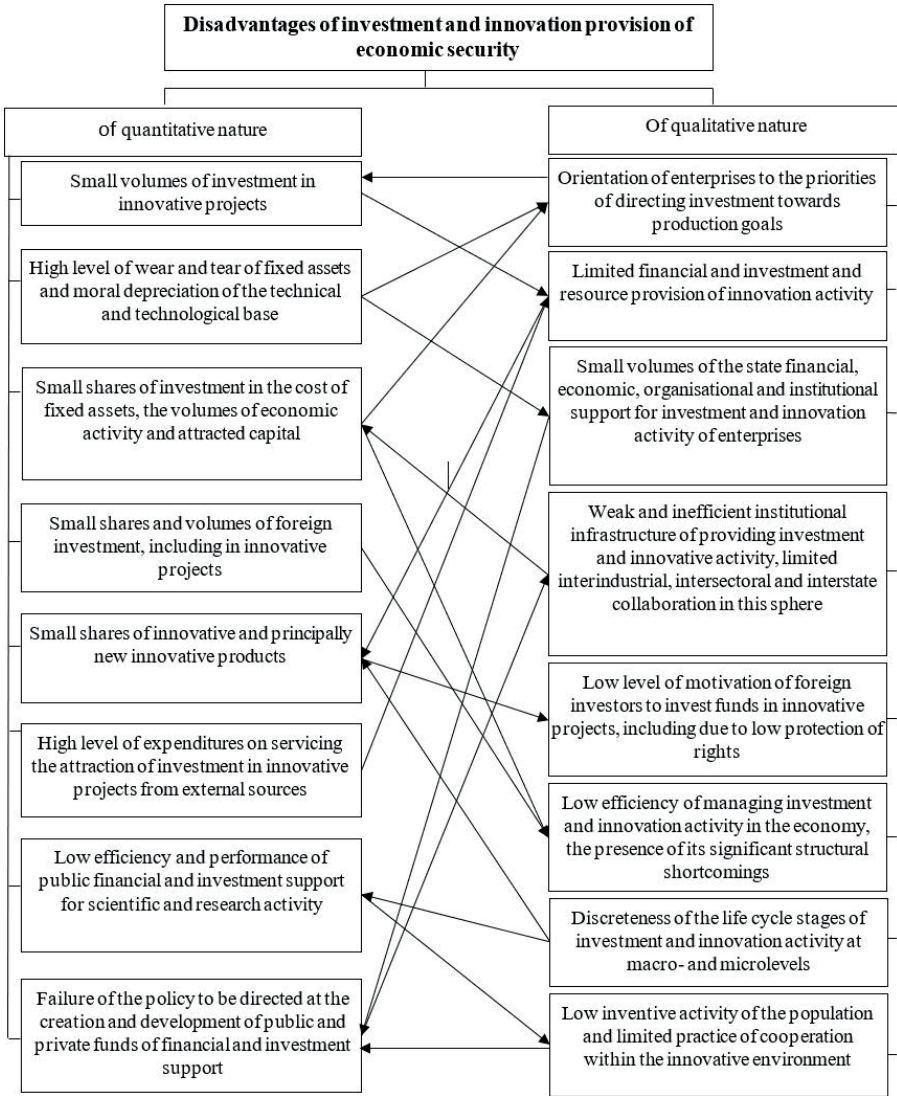


Figure 1. The results of the systemic and structural analysis of investment and innovation provision of economic security of the basic types of economic activity in Ukraine

Source: Designed by the authors

Using the methods of multifactor forecasting and the production function of factors, a linear correlation-regression equation of gross value added by the basic types of economic activity of Ukraine is obtained, the independent variables of which are certain factors.

Separately, the additional study was conducted on the compliance of the future econometric model with the analytical form of recording the production function. The use of the method of the

production function is conditioned by the fact that the object of forecasting is gross value added - an indicator that characterizes the development of industry.

The econometric model of short-term forecasting determined in this way is directly used for constructing the correlation-regression equation when performing forecast calculations of gross value added by the basic types of economic activity of Ukraine. As a result of the calculations, the construction of the econometric model of short-term forecasting allowed us to obtain the value of gross value added by the basic types of economic activity of Ukraine for the retrospective period. This fact is crucial when applying the methodology in the absence or untimely receipt of statistical information on macroeconomic indicators.

During the same period (up to 2022), the volume of sold industrial products will also be regenerated (restored) (up to the volume at the level of 139.9 billion US dollars). However, this will not ensure a sufficient recovery (up to the level of 2013), since it will require simultaneous rationalisation and a massive expansion of investment and innovation support of the real sector of the economy (Table 4).

Table 4: Retrospective and forecast dynamics of the basic macroeconomic and technological measurement of the functioning of the industry in Ukraine in 2001-2022

Periods, years		The volume of sold industrial products	Knowledge intensity of industrial technologies	Technological structure of the basic types of economic activities, %	
		billion US dollars	relative value	low-technology	high-technology
Retrospective period, years	2001	39.5	7.12	-	-
	2002	43.2	6.77	-	-
	2003	54.2	5.84	-	-
	2004	79.7	4.72	-	-
	2005	92.8	5.05	-	-
	2006	109.3	4.55	-	-
	2007	142.0	4.12	-	-
	2008	113.4	3.55	-	-
	2009	83.7	3.12	88.4 %, including	11.6 %, including:
	2010	134.4	3.01	low-technology – 37.0%;	medium-high technology
	2011	167.1	2.56	medium-low technology	– 10.4 %;
	2012	175.3	3.12	– 51.4%	high-technology – 1.2 %
	2013	169.6	3.45		
	2014	91.1	2.54		
	2015	75.6	2.61		
	2016	82.3	2.52	77.6 (30.0/47.6)	22.4 (19.1/3.3)
	2017	93.0	2.57		
	2018	97.5	2.89		
	2019	116.8	3.12		
Forecast period	2020	136.8	3.36	73.5 (26.3/47.2)	26.5 (20.5/6.0)
	2021	138.0	3.39		
	2022	139.9	3.42		

Source: developed by the authors on the basis of the State Statistics Service of Ukraine (2019).

With the use of the econometric apparatus, a medium-term forecast for the volume of sold industrial production (up to 2022) was made. In case the proposed mechanism for managing in-

vestment and innovation provision of economic security of the basic types of economic activity is introduced into the management practice, the volume of sold industrial products is likely to rise to almost the same level as in 2013. One of the decisive conditions for increasing the share of high-tech industries in the basic types of economic activity (i.e. medium-high-tech ones up to 20.5%, high-tech – up to 6.0%) is the practical use of the complex of direct and indirect methods by the correlates (by defined levels) suggested by the author. The above-mentioned will cause a change in the structure of forming gross value added to the form presented in Fig. 2.

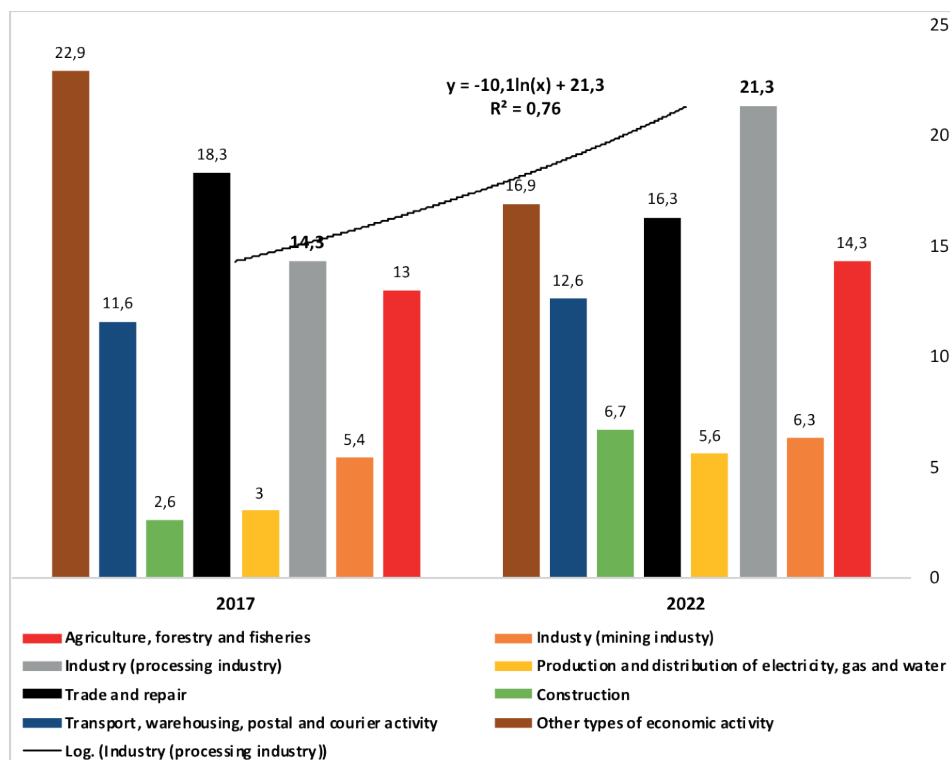


Figure 2. The comparison of the retrospective and forecast structure of forming gross value added by the basic types of economic activity of Ukraine in 2017, 2022

Source: Designed by the authors

According to the forecast assessments, the following trends in the basic types of economic activity can be expected: a rise in the share of the processing industry in the gross value added up to 21.3% (due to an increase in knowledge intensity of processing enterprises – with a coefficient of determination of 0.76), the growth of production and distribution of electricity, gas and water (if energy efficiency rises) – up to 5.6%, an increase in construction – up to 6.7%, agriculture – up to 14.3%. To achieve the projected results, it is necessary for the country to carry out a number of functional and structural reforms. (Fig.3)

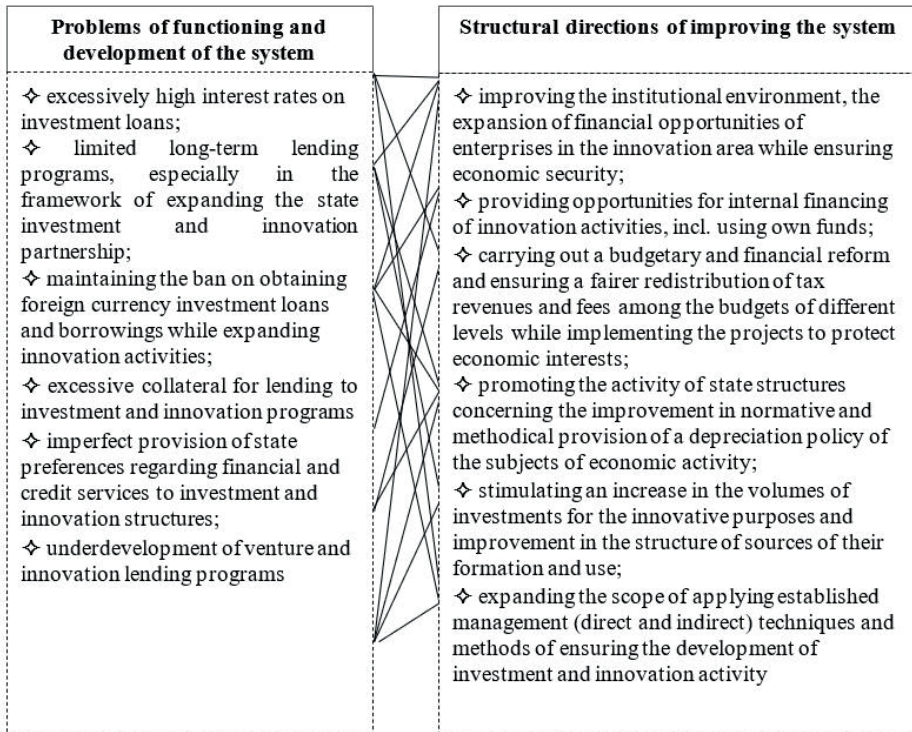


Figure 3. Functional and structural directions of improving the system of investment and innovation provision of economic security of the basic types of economic activity

Source: Designed by the authors

The bodies of executive power must aspire to improve possibilities of the internal financing for innovation activity, i.e. using their own money (without regard to the expansion of the financial and credit potential and resources of the subjects of the infrastructure of investment and innovation activity). Except for other advantages for the subjects of the basic types of economic activity, it is a precondition for lower input intensity and higher financial and economic firmness in the process of investment and innovation activity. In order to carry out this task there are two main variants of solution. The first one is related to an increase in the volume of management of enterprises (which is limited by external factors); the second one is associated with the optimisation of expenditures or the stimulation of redistributing the part of them to necessary purposes. The second variant is more predictable, and the spheres of its realisation are the depreciation and tax policies of the state.

The taxation system of Ukraine does not presuppose sufficient incentives to increase the volume of investment and innovation activity of the economic entities of Ukraine. With carrying out budget and financial reform and ensuring fairer redistribution of tax receipts and collections between central and regional budgets, one should envisage tax preferences for the economic subjects that are engaged in investment and innovation activity. It can be a favourable rate of income tax or the functioning of a fund that finances the projects of the subjects of entrepreneurial activity in

the indicated sphere, the money of which is formed from some part of tax receipts to regional and local budgets.

The heads of the enterprises must realise advantages, and also directions of using money of depreciation funds for the purposes of investment and innovation activity, including, by expanding the applied methods of charging of depreciation and exercising the right to increase gross expenses due to depreciation that is charged for enterprises, the fixed assets and intangible assets of which are involved in investment and innovation activity.

Overcoming the disadvantages should become a goal of the state policy on perfecting investment and innovation provision of the basic types of economic activity. The special attention should be paid to stimulating an increase in the volume of investment in innovation goals and improving the structure of sources of its formation and utilisation.

Besides well-grounded and proposed means of improving investment and innovation support for economic security of the basic types of economic activity of Ukraine, the entities of different levels should apply well-established management techniques and methods. In particular, such as:

– direct management means: delegation of powers and tasks; criticism and encouragement; corporate supervision and results control; informatization and consolidation of communications; optimisation of receipt, selection, dissemination, transformation, accumulation, broadcasting and application of information bases;

– quasi-means of management: a clear definition (or restriction) of centralisation depending on the scale of the resource provision; formalisation of organisational management structures in accordance with the conditions of functioning of a certain type of economic activity and with the needs of the national economy; consolidation of industrial-economic, inter-regional and inter-sectoral interaction; motivation of investment and innovation activity, etc.

5. Discussion

The analysis of the structural components of economic security allows the problematic aspects to be revealed, and the deviation of the factual parameters of its development from maximum permissible ones to be identified. Such an analytical basis makes it possible to estimate the level integrally as well as reach conclusions regarding the necessary and promising directions of work on strengthening the state of security. Let us also pay attention to this aspect. It is worth noting that investment and innovation activity is related to investing and other forms of financing for innovation activity, i.e. without the division into investment and innovative components. It is also necessary to investigate the current state of the investment component and then the innovation component of economic security separately. Such an approach will help us to draw conclusions concerning the current preconditions and the disadvantages of the complex investment and innovation activity.

The study of quantitative parameters (the indices of the state of provision of structural indicators) of developing investment and innovation activity of the subjects of the basic types of economic activity is insufficient for systemic and comprehensive conclusions and it needs to be supplemented by qualitative characteristics (by the development and effectiveness of the institutional infrastructure, by rationality of attracting and using a base of sources of financing for innovation activity etc.). Only in this way, it is possible to get a valuable information base from the results of a vertical and horizontal analysis of the structural constituents of investment and innovation provision of economic development, which will be sufficient for making conscious and effective administrative decisions in the system of providing economic security of the basic types of economic activity.

With regards to the institutional infrastructure of support, provision and promotion of investment and innovation activity in the economy of Ukraine, the limited quantity of such structures and their low capability is observed. The creation of technoparks and innovative structures (innovative clusters, venture funds, academic innovative business-incubators) is not at a proper level at all in Ukraine. The 70 declared technoparks, innovative centres, business-incubators, centres of commercialisation of intellectual property and innovative venture funds, not more than 15 of such organisation's functions in the separate regions of Ukraine (moreover, they don't function very actively and with insignificant volumes of activity).

The largest share in the structure of expenditures (88.2%) is occupied by investment using enterprises' own funds. This corresponds to the practice of economically developed countries, since the target character and the efficiency of private investment are always higher (Table 5).

Table 5: Sources and financing for innovation activity in Ukraine in 2005, 2015, 2017-2019

Sources of funding	Retrospective period, years										Growth rates deviations by volumes, % by structure, %			
	2005		2015		2017		2018		2019		2019 / 2005	2019 / 2018	2019 / 2005	2019 / 2018
	Volumes, UAH million	Structure, %	Volumes, UAH million	Structure, %	Volumes, UAH million	Structure, %	Volumes, UAH million	Structure, %	Volumes, UAH million	Structure, %				
Total	5751.6	100	13813.7	100	9117.5	100	12180.1	100	14220.9	100	247.3	211.8	-	-
Own funds	5045.4	87.7	13427	97.2	7704.1	84.5	10742	88.2	12474.9	87.7	247.3	212.9	0.0	-0.5
State budget	28.1	0.5	55.1	0.4	227.3	2.5	639.1	5.2	556.5	3.9	1980.4	2274.4	3.4	-1.3
Foreign investors	157.9	2.7	58.6	0.4	107.8	1.2	107	0.9	42.5	0.3	26.9	67.8	-2.4	-0.6
Other sources	520.2	0.9	273	8.7	1078.3	11.8	692	5.7	1147.0	8.1	220.5	133.0	7.2	2.4

Source: calculated by the authors on the basis of State Statistics Service of Ukraine (2019).

At the same time, the following disadvantages were singled out:

(1) the volumes, as well as the share of financing for innovation activity of economic entities at the expense of the state budget remain small (3.9% and only 556.5 million UAH in 2018), although one can observe a 3.4% increase compared to 2005.

(2) the volumes of funds for supporting investment and innovation activity that are being allocated from the local budgets in Ukraine are scanty (0.1% and 13.4 million UAH in 2018);

(3) the activity of investors regarding the support of investment and innovation activity of subjects of the domestic economy is low (for example, in 2019, the Ukrainian investors financed investment and innovative projects in the amount of 42.5 million UAH, that amounted to only 0.3% of the total volumes of financing; besides, the part of this source of investment during 2005-2018 reduced by 0.5 p.p. (from 1.4% to 0.9%).

Along with the previously mentioned, the activity of foreign investors was significantly higher, but still insufficient. In 2019, they financed the projects in the amount of 42.5 million UAH, which was 0.3% of the total volumes of investment; for the period of 2005-2019, the volume of foreign investment, which was directed at realising investment and innovation activity by domes-

tic enterprises, decreased by 2.4% (and in the structure – by 1.8%). There was a decrease in foreign investment by 2.5 times in 2019 compared to 2018.

The low investment activity of the state and local communities in the financial support of the innovation sphere is an especially significant drawback. It is usual that budgetary resources are more limited because of the crisis. Government agencies carry out the budgetary subsidization, guaranteeing, insuring, lending, financing for specialised funds, which have a prevailing statutory share of the state and local communities, support for innovation activity in the communal sector etc. in the utterly limited volumes.

Domestic entities of the economy are aware of an objective need for the implementation of innovation activity. In addition, the volume of investment and innovation lending for 2005-2018 rose to 64.2 million UAH, accounting for 3.9% in the overall structure of investment. There is a sharp decrease in the volume of financing for innovation activity from this source. Only for 2015, the volumes of credit money reduced by 79.8% or 6.5 p.p. in the structure of sources of financing for innovation activity in Ukraine, making domestic economic subjects finance innovation activity almost fully using their own means, when, even in 2011, a bit more than 50.0% of own financial resources were allocated for it.

The investment potential of foreign investment, financial and credit structures, off-budget funds and private investors exists, but is not used to a large extent. The Ukrainian subjects of the basic types of economic activity appeal to foreign banking structures and funds to a small extent. However, these structures finance and lend money to some projects in the innovation sphere on a targeted basis (for example, the European bank for reconstruction and development), take part in projects of international and cross-border cooperation, realise joint innovative projects and programmes within the framework of interindustrial and intersectoral collaboration. For attracting more and more international financial resources in order to support the investment and innovation component of the development and economic security of the basic types of economic activity of Ukraine, it is necessary to form the transparent market investment and innovative environment with a developed institutional infrastructure and with international standards of accounting, reporting, disclosure and distribution of information in effect.

6. Conclusions

The ability of the subjects of the basic types of economic activity to achieve a sufficient level of economic security depends primarily on investment and innovation provision. Accordingly, there is a need for a constant search for instruments and management tools that can solve this problem. To do this, the subjects of the basic types of economic activity mainly use standard approaches (systemic, resource or functional), the advantages and disadvantages of which are highlighted by a number of scientists.

Despite the formation of management models of investment and innovation activity, one should not focus on their typical nature due to a set of certain advantages in order to ensure economic security. The state of economic security of the basic types of economic activity is not constant and this requires the use of new management models. Here we speak about the applied significance of a multidimensional methodology that uses a variety of management technologies in the field of investment and innovation.

A successful tool for assessing the investment and innovation system of ensuring economic security of the basic types of economic activity is the use of taxonomic methods, the help of which makes it possible to combine all the functional features of the management process. Taxonomic as-

assessment, on the one hand, is a highly standardized procedure, and on the other – a multisystem with a significant set of step-by-step operations, which qualitatively combines different content and important aspects of investment and innovation activity. The use of such a technique in substantiating the results allows us to identify the factor impact on economic security and not only in terms of investment and innovation, but also related trends (macroeconomic, legislative, market, etc.).

It is established that as the problems in the sphere of the basic types of economic activity are solved in Ukraine (a high level of depreciation of fixed assets, a low share of investments in their cost, insufficient rates of net growth of foreign direct investment compared to GDP growth rate, a low level of protection of investors' interests, an insignificant number of innovatively active industrial enterprises and slow rates of their development, insufficient inventive activity, low state budget expenditures on science, slow growth rates of new types of technology and innovative products etc) it will be possible to form an investment and innovation model. With the help of this model, in the Ukrainian innovation market, the objects with high investment attractiveness will be created, while the state will provide free access to them; in the capital market, new sources of investment and schemes for investing funds will be developed, which will be easily approved by state institutions; in the market of financial services, participants will have the opportunity to quickly establish exchange and redistributive relations connected to the processes of purchase and sale of financial resources against a background of the adoption of state legislation that will clearly regulate them.

The conducted taxonomic analysis showed the low efficiency of state regulation of investment and innovation activity and, accordingly, it served to develop a mechanism for managing investment and innovation provision of economic security of the basic types of economic activity. Thus, the retrospective and forecast dynamics of the main macroeconomic and technological dimensions of the functioning of the basic types of Ukraine's economic activity indicate a growing need for systemic and structural reforms. These reforms presuppose that the attention of public administration should be focused on improving the institutional investment and innovation environment, carrying out budgetary and financial reforms of investment and innovation activity, improving the activity of state structures that control investment and innovation processes, encouraging the subjects of the basic types of economic activity to increase the volume of investment for innovative purposes and expanding the scope of application of the established management technologies in the field of economic security. At the same time, the investment support given by the executive authorities is important, as they will perform the function of basic financial support and regulatory control of innovation provision of economic security; also, the quality of development and implementation of project solutions by the subjects of the basic types of economic activity is of vital importance.

The assessment shows that the reform changes should relate to the redistribution of financial flows in the direction of stimulating domestic production of high-tech products. We can expect the emergence of new sources of investment support for innovation for Ukrainian manufacturing enterprises. Investments will have a clear definition of facilities, the reproduction environment, factors influencing the efficiency of use, and so on. Therefore, it will be possible to form and effectively employ intra-industry funds of investment and innovation development, create and bring product innovations of the Ukrainian standard to the domestic market and increase the level of investment attractiveness of industrial entrepreneurship and, ultimately, the level of investment and innovation security.

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