

Socio-economic and Political Channels for Promoting Innovation as a Basis for Increasing the Economic Security of the State: Comparison of Ukraine and the Countries of the European Union

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Abstract

The article reveals scientific approaches to the creation of a roadmap for reforms based on the establishment of relevant channels for promoting innovative changes, considering international experience, which will make it possible to achieve the efficiency of the transformation processes in the national economy and accelerate the pace of its development. It was proposed to determine the relevant channels for promoting innovative changes based on the analysis of the total innovative index of countries using the econometric tools. The characteristics of the innovation implementation process in Ukraine are given according to the individual components of the total innovation index, which, according to the results of the calculation of the European Innovation Scoreboard, gives an idea of the different categories of innovators countries in terms of the degree of innovative provision of their economies. Based on the analysis of the international statistical reporting, the tendencies of the development of the innovation index in Ukraine and the European Union for the short-term period based on the Holt method are established, which allows constructing exponentially-smoothed series of each indicator, depending on the obtained predictive values of the innovative development indexes, to determine the significance of trends and generate the corresponding forecasts. The diversification methodology of regulatory measures in the management system of innovation development is developed depending on their priority in management intervention in the process of promoting innovative changes in each individual channel based on the establishment of trigonometric coefficients of linear trends of indicators in the total innovation index and their comparative combination. The matrix of management measures is formed depending on the meaningful interpretation of zones, which were obtained considering different combinations of tangent values of the slopes of linear functions of discontinuities, depending on how the positive, negative and stably balanced values were combined in terms of basic and comparative indicators. The content of measures is proposed depending on the priority of the management impact for the formation of Ukrainian roadmap for reforms, which will ensure the targeting of innovative regulatory initiatives precisely in those directions where the national economy's response to the implemented influences will be the fastest and most effective.

Keywords: innovation, industrial revolution, potential, forecasting, reforms, trends, state economic security, socio-economic and political channels.

JEL Classification: F01, F63, O31.

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Introduction

Today, Ukraine changes the socio-economic paradigm for the development of the national economy. Crisis phenomena of a socio-economic nature stimulate the search for new approaches to the modernization of the national economy in different dimensions: technological, social and communication, educational, etc.

At the same time, the trends of the 3rd and 4th industrial revolutions become more visible in the economic activities of the society. The third industrial revolution, which is already embodied in the form of a digitalization of all spheres of life activity of society, is a prerequisite for the onset of the fourth industrial

revolution and the reaction of civilization to the emergence of new opportunities for economic development within the existing socio-economic formation. Within the framework of the 4th industrial revolution, it is expected that digital technologies will have a revolutionary impact primarily on production and business. In the context of globalization transformations is important in terms of the emergence of both new advantages and risks. It should be noted that the level of risk can be significantly lower if the socio-economic systems of the country will consciously prepare and plan the necessary changes at various levels of management.

Literature analysis shows that Ukraine did not fall into the list of countries that are beneficiaries of the fourth industrial revolution. Although, according to the results of the calculations given in the analytical materials of the World Economic Forum (WEF) (Tidd et al., 2001), most countries of the world are at a low level as for the readiness of cardinal innovation changes. Only 25 developed countries that are located in Europe, North America and East Asia have high chances to implement innovative trends in economic development.

In this context, it becomes clear the importance of state regulation of processes, which are designed to create the proper conditions for the timely implementation of world trends in the national economy in Ukraine considering world experience.

In scientific publications on the management of socio-economic development of society, the general issues of the relevance of industrial revolutions in the context of this study are mainly considered that does not allow to form a systematic view on the issues of carrying out reforms to enhance the state economic security.

Literature review

Formation of approaches to the creation of a scientific base for building a road map for reforms to improve the economic security of the state on the one hand is to justify the potential capabilities of the national economy to introduce innovations, on the other, to find effective ways of introducing innovative changes.

The results of scientific researches on the search for ways to introduce innovative changes (Agamirzyan, I.; Karintseva, O. I.; Melnyk, L. H.; [14]) are important for the national economy modernization, the formation of tools to stimulate innovation development. According to Heits V. M. et al. (2015), the issues of innovative development of the state need to work out a balanced state modernization policy that should be implemented through the transition from the traditional model of functioning the national economy to a technologically updated model in which an innovation promotion environment is created, opportunities for a more complete manifestation of the behavior of stakeholders development are formed, business risks are minimized, problems of innovation activity efficiency are solved.

Most scientists agree that the innovative potential of the country is the strategic basis for its development. Those countries that are striving for a constant intensive increase in the national innovation potential are developed at a faster pace and have an efficient economy, and countries that fail to ensure an increase in innovative capacity become dependent on developed countries (Kasyanenko, V. O., 2013).

Based on the analysis of literary sources, it is established that in the most well-known and widely accepted indicators in world theory and practice measurement and comparative analysis of innovative development of countries are:

- The Global Innovation Index (GII), which counts by the analytical center of Lausanne School of Business INSEAD, Switzerland [11]. The index calculation determines the separation of two groups of indicators: the Innovation Input Index, consisting of five subindexes: Institutions; Human potential; ICT and common infrastructure; Market development; Business development; Innovation Output Index, which contains subindexes: Results of scientific research; Creative achievements and prosperity.
- International Innovation Index BCG (IntII BCG), which is calculated by the experts from the Boston Consulting Group, USA [36]. The index contains three groups of indicators: 1. Resource opportunities: human resources; financial and infrastructural capabilities. 2. Innovative activity of investment firms (IT costs, expenses for innovations) intercompany relations and entrepreneurship (internal innovations of small and medium-sized enterprises, joint state-private innovation and scientific projects) innovative performance (number of patents, number of national brands, balance of trade in technologies). 3. Results: innovators (SMEs that introduce product or process, marketing or organizational innovations, the resource effect of innovation activity – the share of innovation where innovations led to a significant reduction in the cost of salaries, consumption of materials and energy); the economic effect: employment in medium- and high-tech enterprises, employment in science-intensive enterprises, export of medium- and high-tech

enterprises, exports at high-tech enterprises, sales of goods, new to the market, the sale of goods, new to the enterprise;

- Innovation Capacity Index (ICI) of the international research structure EFD – Global Consulting Network [13];
- The innovative index of the European Innovation Scoreboard (Summary Innovation Index, SII), which annually provides a comparative assessment of the results of innovation development of the Member States of the European Union and its associated members on the strengths and weaknesses of their scientific, technical and innovation systems [9].

Studying the issues of the country's innovative potential, most scientists turn to the world-famous innovation index of the European innovation Scoreboard, which generally reflects the level of competitiveness of the economy. In general, there is a significant number of different methods of constructing indicators / indices of innovative development and calculation in accordance with the innovative potential, but, according to Egorov, I. Yu. (2016), only 150 of them are quite actively used in international practice. The active initiators of such an analysis are the World Bank, UNIDO, the World Economic Forum and the like. Monitoring the results of innovation potential assessment through the system of indicators and indices is considered in the leading countries of the world as an important component of an effective policy of socio-economic development.

However, the dynamic conditions of the world economy require the formation of a road map of reforms to improve the state economic security (built for the conditions of each state) and the improvement of innovation strategy based on the current state of key indicators of innovation development. Today it is necessary to have a special toolkit that would give an opportunity to assess the potential capabilities of the national economy, relying not only on their own forces, but also on the forces of European countries, most of which are the standard of innovative development.

Taking this into account, the purpose of this study is to establish socio-economic and political channels for promoting innovation in the context of an international vision of Ukrainian innovative development and to develop management solutions for diversifying innovation management measures.

Methodology

It should be noted that we are not aiming to determine the advantages or disadvantages of individual groups of indicators in innovative development of countries and to offer a problem solution to identifying bottlenecks for promoting innovations at the national level. The integral index SII was chosen as the target criterion in this study among others (Global Index of Innovation (GII), International Index of Innovations BCG (IntII BCG), Index of capacity innovation (ICI)), since it is calculated annually for the member states of the European Union (EU) and associate members about the advantages and disadvantages of the innovation system and innovation promotion.

Based on multiannual empirical research, the European Commission established a list of control SII "candidates", which form the basis of the standard for the European system of scientific and technological development [8, 9]. The methodology for collecting and calculating the values of indicators of the European Innovation Scoreboard is based on the use of unified procedures, including weighted statistical sampling of national statistical agencies and organizations [8].

The components of this index are: potentially innovative-active population (H_R), the integration of researchers into the world scientific space and the attractiveness of research for international cooperation (R_S), the environment for supporting and promoting innovation (I_{FE}), financial support for innovations (F_S), firms' investment of firms in innovations (F_I), active subjects-innovators (individuals and legal entities) (I_N), development of entrepreneurial relations and partnerships in innovations (L_E), intellectual assets (I_A), the impact of innovations on employment (E_I), economic effects of innovations (S_I) (Table 1).

Therefore, it is worth noting that each subgroup described above is formed due to sufficiently informative and objective indicators, but some of them are not currently included into national statistical collections, and therefore may be absent in the generalized assessment of innovative potential that are formed by scientists at this stage development. These indicators can be considered in the future, which will allow us to synchronize the Ukrainian and European approaches to identifying the phenomena being investigated.

Thus, the practical value of countries comparison by calculating an integrated indicator of innovation development is that it determines how much the economic growth of any country is based on innovation.

Table 1. List of indicators of the European innovation Scoreboard and Ukraine (2010-2016)

#	Indicator	2010*	2016*
	SII	33,1	28,9
1.1	H_R	66,1	66,1
1.1.1	New graduates of doctoral and post-graduate studies at the age of 25-34 (per 1000 population)	61,5	61,5
1.1.2	Percentage of population with completed higher education at the age of 30-34	–	–
1.1.3	Lifelong Learning	–	–
1.2	R_s	13,0	14,9
1.2.1	International scientific publications, prepared jointly by representatives of science and business sector (per million population)	0,7	5,6
1.2.2	Scientific publications, most cited in the world	16,6	17,8
1.2.3	Proportion of doctoral and post-graduate students from other countries	–	–
1.3	I_{FE}	–	–
1.3.1	Broadband penetration	–	–
1.3.2	Opportunity-driven entrepreneurship	–	–
1.4	F_s	23,9	19,0
1.4.1	Expenditure on research and development in the public sector,% of GDP	41,2	32,5
1.4.2	Venture Capital Expenses	2,1	2,1
1.5	F_I	70,5	46,8
1.5.1	Expenses for research and development in the business sector,% of GDP	38,3	33,9
1.5.2	Expenditure on innovation, not related to research and development,% of turnover	116,1	66,1
1.5.3	Share of enterprises providing information and communication technologies	–	–
1.6	I_N	17,1	15,7
1.6.1	Small and medium-sized enterprises (SMEs) that implement product / process innovation,% of total SMEs	0,0	0,0
1.6.1	Small and medium-sized enterprises that implement marketing / organizational innovations,% of total SMEs	0,0	0,0
1.6.3	Small and medium-sized enterprises that implement their own innovative developments	51,4	47,3
1.7	L_E	5,7	4,6
1.7.1	Innovative SMEs that collaborate with others,% of total SMEs	5,0	3,0
1.7.2	Joint public-private publications	7,0	6,8
1.7.3	Personal co-financing of public research expenditures	–	–
1.8	I_A	16,8	23,6
1.8.1	International patenting under the PCT procedure (Patent Cooperation Treaty)	27,7	38,1
1.8.2	Trademarks (per billion GDP)	19,3	17,3
1.8.3	Projects and design (per billion GDP)	0,1	8,8
1.9	E_I	69,3	77,9
1.9.1	Employment in knowledge-intensive sectors,% of the number employed in the economy	82,1	92,3
1.9.2	Employment in rapidly developing firms	–	–
1.10	S_I	47,0	33,1
1.10.1	The share of medium- and high-tech products in the total volume of exports of goods	56,8	26,0
1.10.2	Export of knowledge-intensive sectors ,% of total export of services	63,1	67,4
1.10.3	Sale of new innovations for the market / firms, as% of turnover	16,4	1,6

Note: Comparative assessment with respect to the values of the European Union in 2010.

To calculate the predicted values of the i-th indicators of the SII index, the Holt method is used, which is used to predict the time series, when there is a tendency to increase or fall in the values of the time series. It is also used for series, when data is not a complete cycle, and seasonality can not yet be identified (for example, for an incomplete year for the forecast by months).

The calculation of exponentially smoothed series is carried out according to equation (Plastovets P.):

$$L_t = k \times Y_t + (1 - k) \times (L_{t-1} - T_{t-1}) \quad (1)$$

where L_t is the smoothed value for the current period; k is the coefficient of smoothing of the series; Y_t is current values of the indicator row; L_{t-1} is the smoothed value for the previous period; T_{t-1} is the trend value for the previous period.

The trend value is found by equation [29]:

$$T_t = b \times (L_t - L_{t-1}) + (1 - b) \times T_{t-1} \quad (2)$$

where T_t is the trend value for the current period; b is the coefficient of trend smoothing; L_t is the exponentially smoothed value for the current period; L_{t-1} is the exponentially smoothed value for the previous period; T_{t-1} is the trend value for the previous period. The trend value for the first period is 0 ($T_1 = 0$).

This allowed to build exponentially-smoothed rows of each of the indicators, determine the trends value and generate forecasts using the MS Excel package. The statistical base for this study was the retrospective data of the European innovation Scoreboard development for 2008-2016.

Results of research

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 individual indicators either worsens or is completely absent.

Based on the scientific approach to time series forecasting (using the Holt method), calculations were performed on the predicted values of the SII index components for Ukraine and the EU, and the effect of each indicator on it was analyzed. The results of forecasting the innovative potential indicators for Ukraine and the EU are given in Table 2.

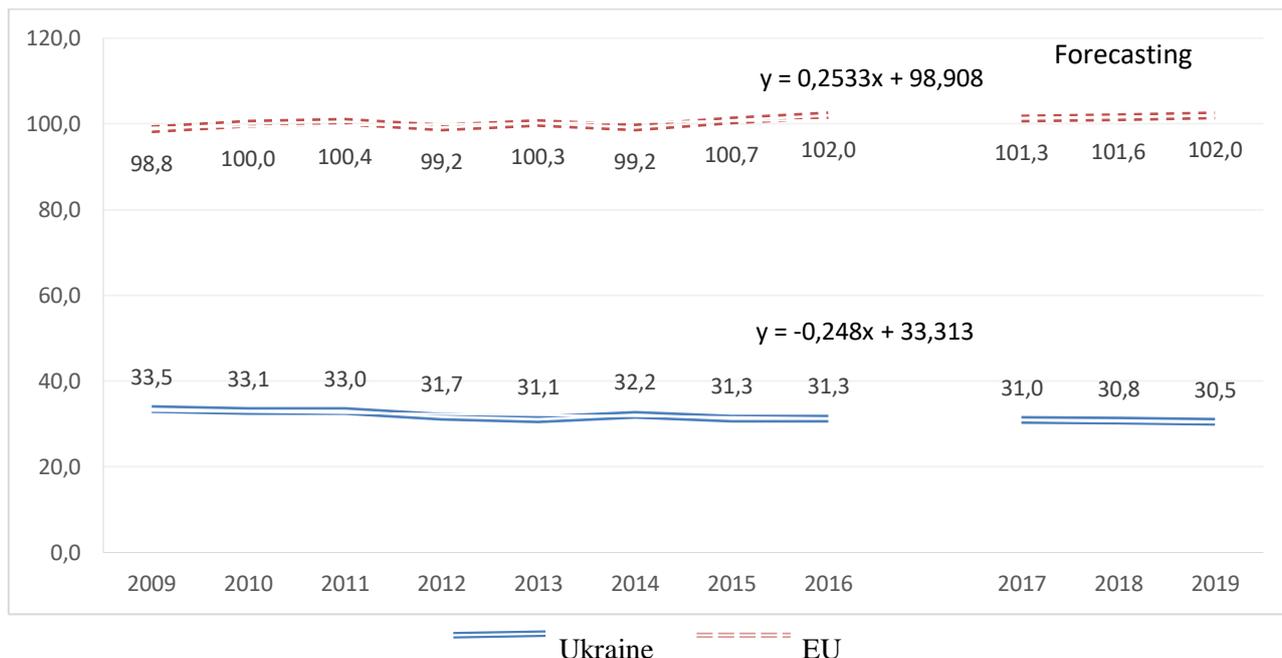
Table 2. Results of forecasting the innovative potential indicators for Ukraine and the EU

Indicator	European Union			Ukraine		
	2017	2018	2019	2017	2018	2019
<i>SII</i>	101,3	101,6	102,0	31,0	30,8	30,5
<i>H_R</i>	123,1	125,0	126,9	66,1	66,1	66,1
<i>R_S</i>	113,5	115,4	117,3	15,3	15,9	16,5
<i>I_{FE}</i>	104,1	104,0	104,0	–	–	–
<i>F_S</i>	82,1	80,4	78,8	18,6	18,4	18,2
<i>F_I</i>	116,5	119,4	122,4	75,6	76,1	76,5
<i>I_N</i>	83,2	81,0	78,7	15,6	15,5	15,4
<i>L_E</i>	95,9	95,9	96,0	4,3	4,1	4,0
<i>I_A</i>	101,4	101,4	101,4	24,1	24,8	25,5
<i>E_I</i>	100,7	100,7	100,6	79,0	79,9	80,8
<i>S_I</i>	100,1	100,1	100,1	31,4	29,6	27,9

Calculations confirm that the investment and innovation components of the national economy are characterized by lower dynamics and low volumes relative to the real needs of economic growth.

The overall dynamics of the total innovation indicator, with a predominantly negative character, has not been sufficiently stable over the past few years. The human resources, intellectual assets and the impact on employment are an indispensable resource of Ukrainian innovative development. In our opinion, this fact confirms the hidden potential of Ukrainian innovative potential, which can be used to form a roadmap for reforms to enhance the state economic security.

Unfortunately, the analysis of sources allows to draw a conclusion about the absence (or very low level) of the motivation of innovation environment subjects in the part of realizing the modernization shifts aimed at increasing the efficiency of the national economy. The lack of such motivation is manifested in low innovation activity, weak technological modernization and rather slow modernization process. The interest of enterprises to obtain quality management system certificates, including the environmental ones (only 1630 and 55 enterprises, respectively) remains extremely low; to obtain certificates, including the right to apply eco-labeling (it has only 60 producers for 230 products, whereas they are used up to 25 thousand products in the EU countries) [29].



Source: authors' calculations.

Figure 1. Forecasting SII by the Holt method

For all indicators of the specified SII index, the regression equation was obtained in Table 3.

Table 3. Results of forecasting the innovative potential indicators of Ukraine and the EU

Indicator	European Union	Ukraine
H_R	$y = 2,6587x + 97,689$	$y = 0,0011x + 66,086$
R_S	$y = 1,6926x + 97,369$	$y = 0,346x + 11,506$
I_{FE}	$y = 0,4392x + 99,348$	–
F_S	$y = -1,8851x + 100,38$	$y = -0,3946x + 22,11$
F_I	$y = 2,6087x + 90,508$	$y = 0,7361x + 68,182$
I_N	$y = -2,4983x + 107,36$	$y = -0,193x + 17,498$
L_E	$y = 0,1448x + 94,705$	$y = -0,2356x + 6,5259$
I_A	$y = 0,0024x + 101,37$	$y = 0,6539x + 17,767$
E_I	$y = 0,0548x + 100,99$	$y = 1,285x + 66,36$
S_I	$y = 0,1231x + 98,531$	$y = -1,8653x + 49,332$

In our opinion, in the future we will increase the unevenness of development in all spheres of innovation development that will affect the sensitivity of the national economy against the background of a critical narrowing of financial modernization of the state and increase the risks of changes in the country's development in the long term. In our opinion, the main causes of the crisis are the factors such as the dominance of low-tech industries, deformed branch structure, a significant integration of the most vulnerable segments of the global industrial market, poor use of the internal market potential to promote the sustainable development of the industry, the lack of effective state policy in the field of innovation quality of life.

According to Yu. Kindzerskyi (2013), the key problem in the system of structural and technological modernization is the correct choice of sectoral priorities, for the achievement of which human resources should be concentrated and state support should be provided (Karintseva, O. I., p. 362). But, unfortunately, political tension and all kinds of conflicts cause aggravation of socially-caused economic losses in the national economy system that is directly related to the loss of human resources.

According to the National Institute for Strategic Studies, at present, the direct foreign investments of the EU play an important role in the modernization of Ukrainian industry. Moreover, since 2014 the budget investment of industry has been stopped in Ukraine. The authors believe that the prospects for the modernization of Ukrainian industry largely depend on the ability to initiate joint projects with the EU in strategically important areas [29]. Overcoming crisis trends in the context of reforms implementation to improve economic security

in Ukraine is possible on the basis not only of attracting foreign investment, but also of solving problems of ensuring innovative development in reliance on its own investment resources. A new view is needed on the management of investment resources aimed at innovative changes in the business environment, since the specifics of the funds allocation and their real use require a new organizational and economic tool, the transformation mechanisms and relations within a system in the sphere of building an innovative and friendly environment, and increasing the social responsibility of business.

The indicator of building an innovative and friendly environment in the national economy reflects innovative cooperation between stakeholders of innovative development, private co-financing and partnership in socially significant projects. In general, the elements of social partnership and the creation of an appropriate infrastructure play a significant role in creating favorable conditions for the development of the national economy. This low indicator represents a generalized result of the state of many socio-economic components and factors of society development, characterizes the level of mutual trust and constructive cooperation; the above will show not always favorable conditions for the economic development of economic relations subjects.

According to experts, the state of protection of industrial property in Ukraine is much worse than in other countries. The development of innovators in Ukraine is hampered mainly by the reasons for the low self-esteem of Ukrainian innovation activity and the low state of institutional support for scientific and technical achievements. In addition, the positioning of Ukrainian enterprises on the international market is limited, which indicates the fairness of the negative dynamics of the forecast. One of the reasons for this situation is the high cost of patenting innovative products and obtaining protection documents for industrial property, which, according to the Ukrainian Institute of Industrial Property, for a legal entity ranges from 3 to 35 thousand euros [29].

Thus, the conducted research is a considerable basis for the formation of socio-economic and political channels for promoting innovative changes with a view to management tools diversification. The right choice of channels that allow to ensure the targeted reaction of the economy to regulatory influences in the shortest possible time and with high efficiency is the key to the effective implementation of the road map of reforms to improve economic security in Ukraine.

Based on the analysis performed it is expedient to determine the channels that are conditioned by the level of the infrastructural and information environment for maintaining innovative activity in the country and that will allow stimulating innovative changes in the national economy of the country.

To define the list of relevant socio-economic and political channels, we propose a scientific approach based on a comparative combination of the following two parameters:

- 1) average weighted size of the gaps (GAP_i^{SII}) between the projected values of each i -th indicator of the integral innovation development indicator SII calculated for Ukraine and the EU for each t -th year of the period of perspective planning (2017, 2018, 2019);
- 2) the difference ($GAP_i^{tg,EU - tg,UA}$) of slopes of straight linear functions of gaps reflects the forecast dynamics (for the period 2017-2019) in the values of each i -th indicator of SII index, calculated for Ukraine (tg_i^{UA}) and the EU (tg_i^{EU}).

The results of the average gap between each projection and the second indicator of the integral index of innovations development SII show the systemic nature of innovations changes in the global environment, which is confirmed by the general correlation of the trends of individual indicators.

Intellectual assets in Ukraine have high potential, which can give hope for productive reforms in the national economy. However, in recent times, there is a real threat to the loss of national intellectual capital as a result of educational emigration in Ukraine (Libanova, E. M., Hwesyk, M. A., 2014; 246-247). In the context of social transformation, the issues of preparation for the introduction of innovations characterized by a high level of cognition and the products of the "digital revolution" are becoming of paramount importance. Therefore, with the development of the sphere of intellectual property, the availability and active functioning of the institute of education, cooperation between universities and business is a necessity.

The employment impact indicator characterizes the state of the national economy. The sector activities of the national economy are closely linked to the "knowledge" factor and employment in the rapidly growing sectors. Miller L. notes that "... in the course of the second industrial revolution, science is not an occupation of the weird loners and turns into productive power, organically stipulating the design and technological cycles of production systems, although the leading (in terms of labor costs and costs) are the production processes of production. In

the third industrial revolution, science, including design, becomes the dominant element of the overall cycle of product creation. At the same time, the impetus was given to the development of science, a colossal increase in the educational level of the population and the formation of automated bases of information processing (Melynk, L. H., 2016).

The issue of conducting reforms in the field of innovation development has become one of the key topic of the World Economic Forum in Davos in 2016, in which it was proclaimed the beginning of the Fourth Industrial Revolution, which is expected to “blur the boundaries between physics, electronics and biotechnology, which will allow for innovative solutions” (Plastovets, P.). In Ukraine, according to statistics, it is necessary to increase jobs in the IT industry by 35-40%.

We propose a scientific approach to the interpretation of trigonometric coefficients based on their comparative combination, which allows us to compare different variants of the combination of tangents angles direct linear functions of the discontinuities and to provide a qualitative characteristic of the investigated phenomena.

Indicator	GAP _t ^{SII}			EU		UA	
	2017	2018	2019	2008-2016	2017-2019	2008-2016	2017-2019
<i>H_R</i>	56,98	58,87	60,75				
<i>R_S</i>	98,25	99,54	100,83				
<i>I_{FE}</i>	104,07	104,04	104,01				
<i>F_S</i>	63,43	61,98	60,53				
<i>F_I</i>	40,81	43,35	45,90				
<i>I_N</i>	67,66	65,51	63,36				
<i>L_E</i>	91,52	91,79	92,05				
<i>I_A</i>	77,34	76,59	75,84				
<i>E_I</i>	21,75	20,79	19,82				
<i>S_I</i>	68,73	70,47	72,21				
<i>SII</i>	70,27	70,88	71,48				

Source: authors calculations.

Figure 2. Results of the average weighted gaps between the forecasted values of SII indicators

Table 4. Scientific approach to the identification of socio-economic and political channels of innovation promotion, depending on the combination of tangents angles direct linear functions of indicator discontinuities

Variants of a combination of tangents angles direct inclination functions of linear fracture			Interpretation of trigonometric coefficients based on their comparative combination
+	+	+	Indicators increase at the same time, but <i>I_b</i> grows faster
+	+	-	Indicators increase at the same, but <i>I_v</i> grows faster, than <i>I_b</i>
+	+	0	Indicators increase equally
+	-	+	<i>I_b</i> grows, <i>I_v</i> decreases
+	0	+	<i>I_b</i> grows, <i>I_v</i> is stable
-	-	+	Indicators decrease equally, <i>I_v</i> faster
-	-	-	Indicators decrease equally, but <i>I_v</i> decreases slower
-	-	0	Indicators decrease equally
-	+	-	<i>I_b</i> decreases, <i>I_v</i> grows
-	0	-	<i>I_b</i> decreases, <i>I_v</i> is stable
0	+	-	<i>I_v</i> is stable, <i>I_v</i> grows
0	-	+	<i>I_b</i> is stable, <i>I_v</i> decreases
0	0	0	All indicators are stable and balanced

Notes: “+” – positive value of the tangent of the angle of inclination of the linear trend of the indicator; “-” is the negative value of the tangent of the angle of inclination of the linear trend of the indicator; “0” – stable-balanced value of the tangent of the angle of inclination of the linear trend of the indicator; *I_b* – basic indicator value; *I_v* – comparative indicator value.

Based on the results of the weighted average size of the gap between the predicted values of the SII indicators, a trigonometric analysis of the dynamics of the forecast indicators for 2017-2019 was carried out, which allowed to interpret trigonometric coefficients of trends based on their comparative combination and to determine the difference between the tangents of the angles of the slope of linear linear functions of the discontinuities that reflect the dynamics of the predicted the values of each and the second indicator of the SII index (Figure 3).

Indicator	tg_i^{EU}	tg_i^{UA}	$GAP_i^{tgEU-tgUA}$	Interpretation of trigonometric coefficients based on their comparative combination (tg_i^{EU} , tg_i^{UA} , $GAP_i^{tgEU-tgUA}$)
H_R	3,0023	0,0011	3,0012	the growth trend in the EU and UA is the same, but in the EU more dynamic
R_S	1,8929	0,3685	1,5244	the growth trend in the EU and UA is the same, but in the EU more dynamic
I_{FE}	0,491	0	0,491	growth trend in the EU, in UA is no trend
F_S	-2,1121	-0,456	-1,6561	slowing trend observed in the EU and the UA , but in UA the trend is slower
F_I	2,8875	0,8225	2,065	the growth trend in the EU and UA is the same, but in the EU more dynamic
I_N	-2,801	-0,2168	-2,5842	slowing trend observed in the EU, and in UA the dynamics of trend growth
L_E	0,1706	0,2669	-0,0963	the growth trend in the EU and UA is the same, but in UA is faster
I_A	0,0026	0,7295	-0,7269	the growth trend in the EU and UA is the same, but in UA is faster
E_I	0,0859	1,4417	-1,3558	the growth trend in the EU and UA is the same, but in UA is faster
S_I	0,1309	-2,0909	-1,96	the growth trend in the EU, in UA downward trend in faster
SII	0,2828	-0,2796	0,0032	the growth trend in the EU, UA a downward trend dynamics

Source: author’s calculations.

Figure 3. Results of trigonometric analysis of the dynamics of forecast indicators for 2017-2019 years

The economic effects of innovation are characterized by the export of high-tech and serene-technological products, as well as the export of high-level information services and the opening of new markets for innovative products. According to the European Statistical Agency, this indicator has significantly decreased in Ukraine and will maintain such a tendency, which can not but cause concern.

Libanova, E. M. and Hwesyk, M. A. (2014) note that “in 2009-2012 there is an increase in structural imbalances and internal shocks in industrial production”, and then they argue that “from the end of 2011, the decline in production slowed down as a result of a certain stabilization of economic development and the restoration of external demand, which has been intensified by modern regressive sociopolitical processes ...”

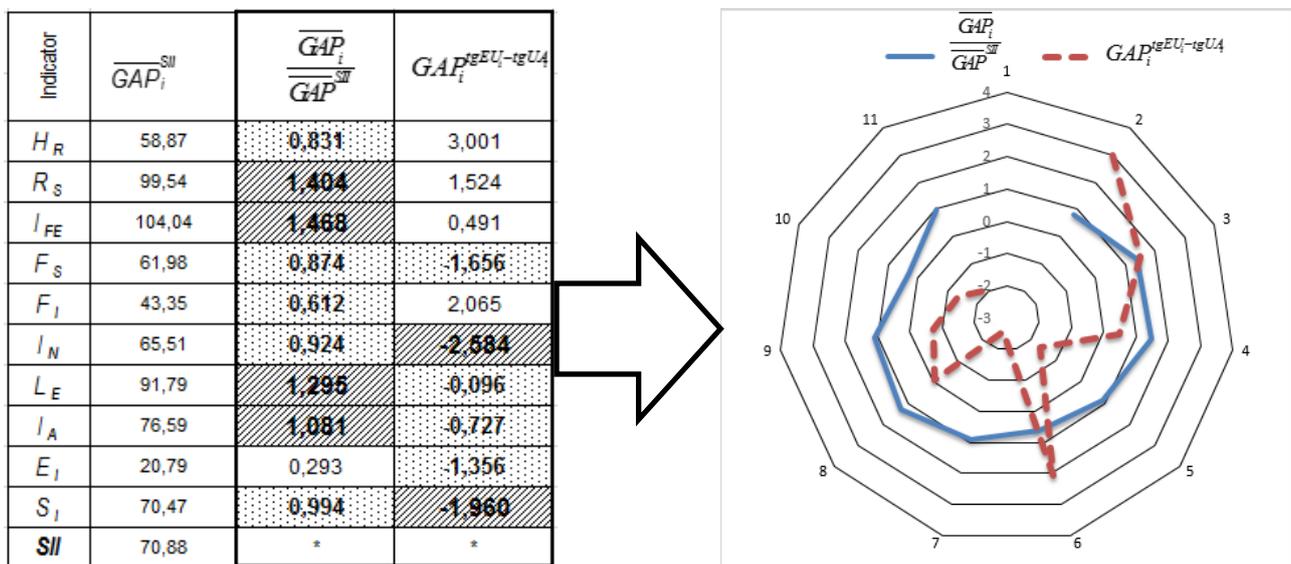


Figure 4. Graphical representation of trigonometric analysis of the dynamics of forecast indicators for 2017-2019 years

For more complete disclosure of the scientific problem and for the practical application of the proposed approaches, we have formed a matrix of diversification of management activities depending on the priority of the impact on a particular channel. This will ensure the targeting of regulatory initiatives implemented through relevant channels, as well as the directing of financial resources in those areas where the reaction of the national economy to the impacts will be the fastest and most effective. The need for state intervention in the pretext of innovation development decreases with an increase in the number of priorities. The smaller the value of the established priority, the more prompt and decisive should be the managerial intervention in the process of promoting innovation changes on a separate channel.

Table 5. Diversification of managerial activities depending on priority

Combination of zones	Priority	The content of activities depends on the priority of management influence
	6	preventive measures (supporting and controlling)
	5	measures of stimulus aimed at reducing the risks that trigger the trend of falling indicator
	4	(depreciation tools, formation of buffer zones)
	3	stabilization measures aimed at breaking the tendencies in a latent crisis
	2	measures of prolonged anti-crisis regulation (anti-stress instruments)
	1	measures of reactive anti-crisis regulation (radical instruments, shock therapy)

The calculations for Ukraine (Figures 2, 3) showed the absence of such socio-economic and political channels, under which the “throughput” ability is critically low (Priority No. 1 for immediate state intervention). S_I , I_N , L_E and I_A channels were the slowest in terms of stimulating modernization changes, that is, in order to develop the infrastructure and information environment within these channels, the state needs to make the most of its efforts (Priority No. 2).

The speed of the reaction of the national economy to regulatory influences through the F_S channel is somewhat higher than the previous ones, that is, the improvement of the regulatory framework and mechanisms for financing innovation is extremely important today (priority number 3). Actual channels for promoting innovation in Ukraine are: R_S and I_{FE} channels, therefore, state bodies that carry out regulatory actions through these channels (priority number 4), can expect their performance to be quite high.

The fastest and the most effective in Ukraine today were the FI channel (investment of firms in innovation), H_R channel (potentially innovative active population), EI -channel (influence of innovations on employment of the population). This is confirmed by the statistics for 2016: 97.2% of the total amount of costs for innovation – is the own funds of enterprises-innovators. Therefore, it is precisely their actions, decisions made, projects being implemented by important drivers of the road map of reforms for increasing economic security in Ukraine.

Conclusions

Thus, it is established that in Ukraine the weak tendency of the development of the integral index of innovation development of SII persists, while its individual indicators (intellectual assets, investment of firms in innovation, the impact of innovations on employment) are the driving forces of innovation the potential of the development of the national economy. Against the backdrop of rather negative trends in the development of the innovative potential of the Ukrainian economy, it can be argued that in the future the overall character of the components of innovation development will be preserved, but it is necessary to identify its driving forces and identify channels, the speed of response to regulatory influences in which can create more effective prerequisites for the implementation of innovation the potential.

We concluded that the analysis of forecast data on the development of innovation activity is completely inadequate for conducting productive reforms in order to increase economic security in Ukraine. It is important to search for approaches to synchronizing Ukrainian indicators of innovation potential and the European level for the proper identification of the phenomena under study. On the basis of the analysis of the comparative combination of parameters of predictive values of trend indicators of the integrated index of innovative development of SII , it is proposed to diversify management measures depending on the priority of their application in the channels for the promotion of innovation changes. The proposed approach is the basis for the formation of a roadmap for reforms in the field of innovation change in Ukraine.

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