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FORECASTING THE INNOVATION OF UKRAINE'S ECONOMIC DEVELOPMENT IN A GLOBAL DIMENSION

Purpose. To analyze the state and trends of innovative development of the countries of the world, to define the place of Ukraine in the international arena and forecast its innovation.

Methodology. The methodological basis was formed by general scientific theoretical methods: generalization, explanation, grouping; statistical method (for a comprehensive assessment of the state and trends of innovative activity of the economies of the countries of the world and Ukraine); methods of analysis and synthesis, economic and mathematical methods of forecasting, methods of abstraction and visualization (for a visual demonstration of the actual data and the results of the study).

Findings. The level of innovativeness of the world's economies and Ukraine's position in the ranking of the Global Innovation Index (GII) are analyzed. The positive/stimulating influence of globalization processes on the spread of innovations, as well as discriminatory methods of innovative development (“dumping” of second-order technologies in developing countries) are noted. The GII forecast is determined using a regression model of the dependence of this indicator on the specific weight of innovation-active enterprises in the total number of industrial enterprises and innovation costs. The forecasting results showed a slight downward trend in the value of the GII of Ukraine. It is argued that in order to increase the level of innovativeness of the national economy, to strengthen Ukraine's competitive position, and taking into account the fact that the economies of other countries do not stop in their development, it is necessary to significantly intensify innovative activity in Ukraine.

Originality. A scientific-methodical approach to predicting the innovativeness of economic development is proposed depending on the specific weight of innovatively active enterprises in the total number of industrial enterprises and innovation costs. There is an opportunity to carry out predictive and planning calculations of the selected forecasting object, to investigate the behavior of the macroeconomic system in the context of the innovativeness of its development, to make adjustments to the strategic management system at the state level in order to stimulate innovative processes and influence the results of the innovative development of Ukraine in the global dimension.

Practical value. The proposed scientific-methodical approach makes it possible to assess the trends of the level of innovativeness of development in the future and becomes an informative basis for developing a system of measures for the activation of innovative activity.

Keywords: *economic development, innovation, Global Innovation Index, rating, forecasting*

Introduction. The key aspect of ensuring the competitive advantages of the countries of the world and their socio-economic development today is the production and use of high-tech innovations. Innovative activity in different countries of the world may differ depending on many factors: the prevailing industries in the economy, institutional conditions, national development priorities, geographical and cultural characteristics of the country or region, etc. Countries in the modern world are trying to implement models of economic development that would ensure competitiveness and long-term growth, depending on the existing conditions, potential opportunities, formed mechanisms for implementing the development of industries in the system of national economies or individual components of life, the system for regulating types of activities (stimulating or limiting processes), existing infrastructure, and others.

The exhaustion of the factors of extensive economic development, and the issue of respect for the environment cause increased attention to the intensive components of ensuring the development of the economies of the world. Therefore, in order not to remain on the sidelines of world civilization processes, the innovative model of ensuring economic development is actually without alternatives, which determines the relevance of the research of the existing level and the forecast of innovativeness of economic development.

Literature review. The state, trends, problems and factors of the development of innovative activity, its features in different countries of the world are studied by many domestic and foreign scientists. Specifically, B. Vyshnivska (2016) notes that innovations are a determining factor in the development of all branches of the country's economy, as they are able to ensure the effective functioning of economic entities. The researcher defined innovative activity as “a complex process of transformation of newly acquired ideas and knowledge into an object of economic relations” [1]. H. Zhang, et al. (2020) [2] define the new economy as an economy associated with the intensive introduction of innovations and new ways of doing business, which affect the growth of labor productivity. The need to intensify investment and innovation activities in the system of ensuring the growth of labor productivity is also described by M. Dykha, et al. in the article [3]. The innovative economy is characterized by a certain behavioral type. Thus, V. Alekseenko, et al. believe that an innovative economy is possible only if the scientific type is implemented [4]. K. Brockova, et al. point out that the innovative economy is a dynamic economy that is able to quickly and flexibly adapt to changing internal and external conditions [5]. The authors identified the role of innovation as a leading factor in economic growth, developed a conceptual apparatus, and identified the main cause-and-effect relationships. T. Krulický, et al. [6] note that innovations should take into account the riskiness of decisions in conditions of high uncertainty, focus on the rapid achievement of

goals, competitive advantage. Implementation of innovative projects is important for ensuring innovative development. In this context, the publication [7] deserves attention, in which N. Hrypynska et al. proposed a scientific and methodological approach to the most effective distribution of funds between *m* projects. To ensure the accelerated use of the latest technologies, increase the competitiveness of products and services, the developed countries of the world use the venture industry. Venture entrepreneurship in the developed countries of the West enjoys comprehensive support both from the government and local authorities, and from large national and transnational companies. Unfortunately, modern Ukrainian venture funds do not quite meet the generally accepted criteria of venture entrepreneurship, because they do not invest in high-tech production. Business angels also play an important role in supporting innovative solutions and introducing new technologies, which is described in more detail in the publication by N. Pedchenko, et al. [8]. M. Zos-Kior, et al. developed and substantiated a methodological approach to assessing the level of globalization development of the countries of the world based on the calculation of the integral index of globalization development [9]. The annual results of research on the innovation activity of the countries of the world are published by such authoritative organizations as the European Institute of Business Management (INSEAD) together with the World Intellectual Property Organization (WIPO), the Organization for Economic Cooperation and Development (OECD) together with Eurostat and others.

The purpose of the article is to analyze the state and trends of innovative development of the countries of the world, and the place of Ukraine in the international arena as well as to forecast its innovation.

Methods. The methodological basis was general scientific theoretical methods: generalization, explanation, grouping; statistical method – for a comprehensive assessment of the state and trends of innovative activity of the economies of the world and Ukraine; special forecasting methods: trend extrapolation, correlation-regression analysis, induction and deduction, combining quantitative forecasting methods – for forecasting indicators of innovativeness of economic development, Global Innovation Index; methods of abstraction and visualization – for visual demonstration of actual data and obtained research results.

Results. World experience shows that the competitiveness of economies and economic growth depends not so much on resource potential as on innovation. Innovations determine economic growth, the possibility of meeting social needs, and ensuring the long-term well-being of the population of countries around the world. For example, innovations in medicine and biotechnology contribute to improving and preserving the health of the population; innovations in the field of telecommunications – the development of education and the social sphere in general, etc. [9]. Innovative development of the state is one of the priority tasks for the governments of all countries in the modern world. Modification of the economic nature of innovations determines the evolution of research in this field, which is engaged in by a number of authoritative international organizations that analyze the impact of innovative development and innovations on economic growth. In order to implement systematic monitoring of national innovation systems, an important condition is the inclusion of countries in international innovation ratings. For this, a system of indicators is monitored, which allows calculating the penetration of innovations into the economy and making interstate comparisons which make it possible to assess the efficiency of innovation processes and the competitiveness of economies.

To measure the parameters of innovative development of individual countries and regions of the world over the past 10–20 years, international institutions have calculated numerous indices and published ratings of countries based on research results. Among the international ratings of innovative

development, which are calculated by specialists on a professional basis, the following can be distinguished: Global Innovation Index (GII) [10], developed by the European Institute of Business Administration (INSEAD) together with the World Intellectual Property Organization (WIPO) and the European Innovation Scoreboard (EIS) [11], which is supported by the Organization for Economic Cooperation and Development (OECD) together with Eurostat. Also, sections in the calculations of ratings, which determine The Global Competitiveness Index (GCI), are devoted to the assessment of the level of innovative development [12], “Knowledge for Development” programs of the World Bank [13].

In our opinion, the GII most comprehensively reflects innovative development of the countries of the world (despite the fact that the statistical models for determining the GII sample of 2009–2010 and 2020 differed significantly, if not conceptually, then methodologically). Table 1 presents the number of countries covered by the study and the number of indicators that are taken into account in the calculation of the GII countries.

The Global Innovation Index is calculated according to the methodology of the International Business School INSEAD (France). The research is conducted as part of a joint project of INSEAD International Business School, Cornell University and the World Intellectual Property Organization (WIPO) [11]. The GII has been compiled annually since 2007 on the basis of multi-stage aggregation of indicators for 107–132 countries at different levels of economic development. The GII covers multidimensional aspects of innovation, because the level of economic development is related to both the availability of innovative potential and the conditions for its implementation. Therefore, the GII is calculated as a weighted sum of assessments of two groups of indicators: available resources and conditions for innovation (Innovation Input) and achieved innovation results (Innovation Output), combined into seven blocks (Fig. 1).

Thus, the final Index shows the effectiveness of innovation development efforts in the studied countries in a synthesized manner.

Switzerland, Sweden and the USA lead the ranking of countries by the level of innovative development; the following positions in the rating are occupied by Great Britain, South Korea and the Netherlands. For several years, China, Vietnam, India and the Philippines have been the countries with the highest growth rates according to the GII innovation rating. Today, these four are among the 50 leading countries.

In 2020, in addition to Singapore, another Asian country – the Republic of Korea – entered the top ten for the first time. In the 2020 Global Innovation Index ranking, Ukraine ranks 45th, entering the TOP-2 countries of the economic group of countries with a level of income below the average. Almost all countries with the best results in the GII still belong to the group of countries with a high level of income (Table 2).

In terms of individual indicators characterizing innovativeness, leadership belongs not only to countries with a high level of income. For example, Thailand ranks first in R&D spending in the commercial sector, and Malaysia is the global leader in net exports of high-tech products.

An important role in the activation of innovative activity is played by works that describe the relationship between the economic integration of countries and the dynamic develop-

Table 1

Quantitative parameters of the Global Innovation Index, compiled on the basis of data [10, 14]

Indicator	2009–2010	2020
Number of indicators	60	82
Number of countries	132	131

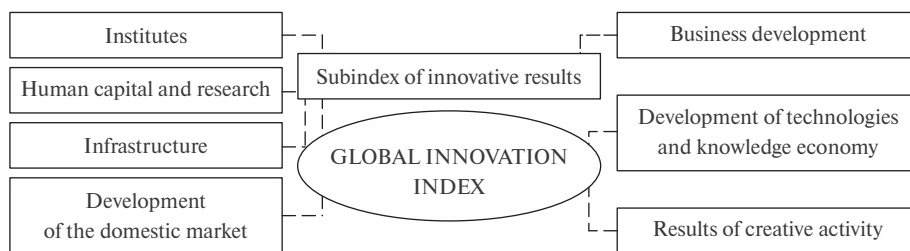


Fig. 1. Criteria for determining the Global Innovation Index [10]

Table 2
Countries in the sphere of innovation by income groups, 2020, compiled by the authors based on data [14]

Rating	Global Innovation Index	Rating	Global Innovation Index
High-income countries (49 in total)		Upper-middle-income countries (37 in total)	
1	Switzerland (1)	1	China (14)
2	Sweden (2)	2	Malaysia (33)
3	The United States of America (3)	3	Bulgaria (37)
4	The United Kingdom (4)	4	Thailand (44)
5	The Netherlands (5)	5	Romania (46)
6	Denmark (6)	6	Russian Federation (47)
7	Finland (7)	7	Montenegro (49)
8	Singapore (8)	8	Turkey (51)
9	Germany (9)	9	Mauritius (52)
10	The Republic of Korea (10)	10	Serbia (53)
Lower-middle-income countries (29 in total)		Low-income countries (16 in total)	
1	Vietnam (42)	1	The United Republic of Tanzania (88)
2	Ukraine (45)	2	Rwanda (91)
3	India (48)	3	Nepal (95)
4	The Philippines (50)	4	Tajikistan (109)
5	Mongolia (58)	5	Malawi (111)
6	The Republic of Moldova (59)	6	Uganda (114)
7	Tunisia (65)	7	Madagascar (115)
8	Morocco (75)	8	Burkina Faso (118)
9	Indonesia (85)	9	Mali (123)
10	Kenya (86)	10	Mozambique (124)

ment of innovations. The results of the research by D. Brou, M. Ruta [15] prove that economic integration, provoked by the political cooperation of countries, can intensify innovative activity. We agree with K. Brockova, et al. that for the economic growth of an integration association based on innovation, a high level of institutionalization of innovation processes, the presence of an effective innovation infrastructure and the own development of market mechanisms of innovative cooperation between the state and business are necessary [5].

The modern development of the economic systems of the countries of the world shows the unevenness of their innovative development. The reasons for such inequality are the specifics of various socio-economic systems. Among the factors that determine the unevenness of the innovative development of countries, it is worth highlighting the following: factors of an innovative nature (level of financing of innovative activities in the

country, features of the innovation system, regulatory and legal framework for regulation of innovations); factors of general economic influence (level of education in the country, level and dynamics of gross domestic product (GDP) per capita).

Globalization processes expand the boundaries of the movement of production factors, as well as innovation, increase the openness of innovation systems, which makes it possible for countries to reduce the cost of expensive research, use the resources of the world economy, use high-performance technologies, and accordingly increase the competitiveness of innovation systems.

Here it is necessary to take into account the international nature of scientific and technological progress, which leads to the unlimited dissemination of the latest technologies and scientific achievements in the world, which is contrary to interstate and inter-company competition. Also, in the global economy there are often various discriminatory aspects of technological development, methods of “dumping” second-order technologies into developing countries. At the same time, the speed and number of participants in innovative activity is increasing, and their relationships are changing and becoming more complicated. The main subjects of international business in the field of innovation are the largest transnational corporations, which increasingly seek to concentrate the production of their knowledge-intensive goods in developing countries.

Evaluating the position of Ukraine, we note that the level of its innovative activity is unsatisfactory. Ukraine is far behind the advanced countries of the world. Thus, at the international level, in the GII-2021 rating, Ukraine ranks 49th out of 132 countries, compared to 45th place in 2020 among 131 countries. From 2016 to 2020, Ukraine’s position varies from 43rd to 56th place (Fig. 2).

For an objective understanding of the state of innovative development of Ukraine, we will consider the main indicators of innovative activity of industrial enterprises. Statistical data [16] show that for the period 2010–2020, the specific weight of innovatively active enterprises in the total number of industrial enterprises increased from 13.8 to 16.8%. However, we note that throughout all the years of the study, the specific weight of innovatively active enterprises in all types of economic activity is low. It is also important to analyze the amount of financing of innovative activities. In absolute terms, the amount of financing of innovative activities in Ukraine during 2010–2020 increased from UAH 8045.5 million to UAH 14406.9 million. The main source of financing innovative activities is business entities’ own funds (about 65–70%); the share of state funds is mainly 1–2% of the total volume of financing; the rest of the expenses for innovative activities were carried out by foreign investors and from other sources of financing.



Fig. 2. Positions of Ukraine according to the Global Innovation Index for 2016–2021 [10, 14]

To forecast the GII of Ukraine, we use a combination of quantitative forecasting methods. We determine the forecast of GII (dependent variable – y) using a multivariate regression model of the dependence of this indicator on the specific weight of innovation-active enterprises in the total number of industrial enterprises, % (independent variable – x_1) and innovation costs, UAH million (independent variable – x_2).

The choice of factors is due to the fact that it is innovatively active enterprises that accumulate a complex of input conditions/factors that, on the one hand, have determined such activity, and on the other, will determine the results of innovative activity, because these economic entities are the main investors in innovation (variable – x_1); the achievement of a certain level of innovative development of the country is preceded by its financing, that is, the total amount of financing of innovative activities (variable – x_2).

Dependencies of this type can be described by a regression production function of the type

$$\hat{Y} = a_0 + a_1x_1 + a_2x_2, \quad (1)$$

where a_0, a_1, a_2 are coefficients of the regression model, which are calculated by the method of least squares; x_1, x_2 are independent variables; \hat{Y} is a dependent variable.

Using the method of least squares, as a result of data processing, we obtain the coefficients of the regression model: $a_0 = 36.48$; $a_1 = 0.03$ and $a_2 = -0.00004$, which provide grounds for constructing the regression function of the Global Innovation Index. Thus, the Global Innovation Index regression equation looks like this

$$\hat{Y} = 36.48 + 0.03x_1 - 0.00004x_2.$$

The average error of the regression model is 1.95 %, which indicates a slight deviation of the actual value of the Global Innovation Index and its theoretical value during 2010–2020.

At the initial stage, using the built-in LINEST function, based on data for the previous 2010–2020 (11 years), we build a model of GII dependence on the specific weight of innovation-active enterprises in the total number of industrial enterprises and the costs of innovation (Fig. 3).

At the next stage, we make the GII forecast for the period 2022–2026. To do this, we will first find the forecast values of independent indicators for this period: the specific weight of

innovation-active enterprises in the total number of industrial enterprises, % (independent variable – x_1) and innovation costs, UAH million (independent variable – x_2).

We forecast the specific weight of innovatively active enterprises in the total number of industrial enterprises using the 3-point moving average method. At the same time, we take into account the fact that the moving average method does not cover the entire range of data, but only the last few values, in this case the last 3 values of the specific weight of innovatively active enterprises in the total number of industrial enterprises. It should be noted that the smaller the number of values on the basis of which the moving average is calculated, the more accurately it reflects changes in the baseline [17].

Holt's method allows forecasting for several time periods ahead, based on equations (3–5)

$$\hat{y}t + k = Lt + kTt; \quad (3)$$

$$Lt = \alpha \cdot yt + (1 - \alpha) \cdot (Lt - 1 + Tt - 1); \quad (4)$$

$$Tt = \beta \cdot (Tt - 1) + (1 - \beta) \cdot Tt - 1. \quad (5)$$

Holt's method makes it possible to directly smooth the level and slope values. The values of the smoothing constants α and β are between 0 and 1. The variable Lt indicates the long-term level of values or the baseline value of the time series data. The variable Tt indicates the possible increase or decrease in values in one period [17]. Holt's method should be used if the data has a clear trend.

Holt's method was used to build a forecast of innovation costs, UAH million (independent variable – x_2). When selecting α and β , we use "Search for a solution" according to the criterion of minimizing the average absolute error (Fig. 4).

As a result of the calculations, it was determined that the forecast value of the independent variable x_1 – the specific weight of innovatively active enterprises in the total number of industrial enterprises for 2022–2026 is from 16.33 to 16.39 %, that is, we note a trend of the growth of this indicator, although not significant. The average value of the absolute error of the forecast of the specific weight of innovatively active enterprises in the total number of industrial enterprises is 6.45 %.

Based on the "Solution Search" program, $\alpha = 0.04$ and $\beta = 1.00$ were determined, while the minimum value of the average absolute error of the forecast of innovation costs is 22.2 %.

Years	Share of the number of innovatively active enterprises in the total number of industrial enterprises, % (independent variable – x_1)	Costs for innovation, UAH million (independent variable – x_2)	Global Innovation Index (dependent variable – y)	Regression model (Global Innovation Index)	Model error, %	Costs for innovation, UAH million (independent variable – x_2)	Share of the number of innovatively active enterprises in the total number of industrial enterprises, % (independent variable – x_1)	Global Innovation Index (dependent variable – y)
2010	13.80	8045.50	35.58	36.59	2.83	-0.00004	0.03	36.48
2011	16.20	14333.90	35.76	36.43	1.87	a_2	a_1	a_0
2012	17.40	11480.60	36.10	36.57	1.29	–	–	–
2013	16.80	9562.60	35.80	36.62	2.28	–	$\alpha =$	0.04
2014	16.10	7695.90	36.30	36.66	1.00	–	$\beta =$	1
2015	17.30	13813.70	36.50	36.48	0.05			
2016	18.90	23229.50	35.70	36.20	1.39			
2017	16.20	9117.50	37.60	36.62	2.62			
2018	16.40	12180.10	38.50	36.51	5.16			
2019	15.80	14220.90	37.40	36.43	2.61			
2020	16.80	14406.90	36.30	36.45	0.40			

Fig. 3. Calculation of the coefficients of the GII regression model of Ukraine using the LINEST statistical function

Innovation costs, UAH million (independent variable – x_2)	L	T	Forecast of costs for innovation, UAH million	The absolute error of the innovation expenditure forecast	Regression model (Global Innovation Index)	Global Innovation Index Forecast	Absolute forecast error of the global innovation index
8045.50	8045.50	0.00	–	–	35.58	–	–
14,333.90	8295.84	250.34	8045.50	0.44	35.76	–	–
11,480.60	8663.00	367.16	8546.18	0.26	36.10	–	–
9562.60	9051.36	388.36	9030.16	0.06	35.80	36.61	0.02
7695.90	9370.29	318.94	9439.71	0.23	36.30	36.62	0.01
13,813.70	9853.42	483.13	9689.23	0.30	36.50	36.61	0.00
23,229.50	10,849.82	996.40	10,336.55	0.56	35.70	36.59	0.02
9117.50	11,737.59	887.77	11,846.22	0.30	37.60	36.55	0.03
12,180.10	12,607.63	870.04	12,625.36	0.04	38.50	36.53	0.05
14,220.90	13,507.26	899.63	13,477.67	0.05	37.40	36.49	0.02
14,406.90	14,406.89	899.63	14,406.89	0.00	36.30	36.43	0.00
15,306.52	–	–	Average	0.22	36.40	Average	0.02
			error value				
16,206.15	–	–					
17,105.78	–	–					
18,005.41	–	–					
18,905.05	–	–					

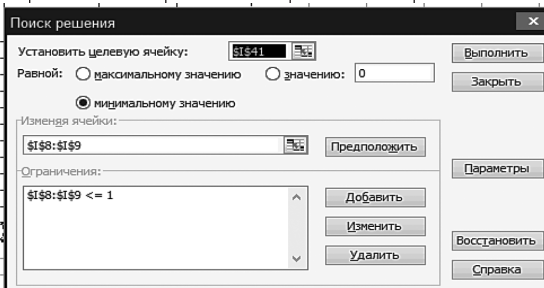


Fig. 4. Forecasting the costs of innovations in Ukraine by Holt's method using the "Search for solutions" program

According to the forecasts, innovation costs will increase (from UAH 15306.52 million to UAH 18905.05 million during 2022–2026).

At the last stage, we present the actual dynamics of the specific weight of innovation-active enterprises in the total number of industrial enterprises, innovation costs and the Global Innovation Index of Ukraine, as well as forecast indicators for the next 5 years based on the results of calculations (Figs. 5–7).

As a result of forecasting (based on actual data of previous periods), we note a slight decline in the GII indicator over the next 5 years (from 36.40 to 36.28), Table 3. The average value of the absolute error of the GII forecast is 2.08 %.

This result, i.e. the decline in the value of the GII indicator, indicates the absence of significant progress in the innovativeness of economic development, which is extremely necessary for Ukraine. As mentioned above, the specific weight of

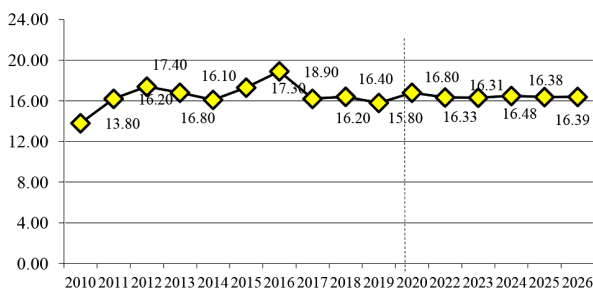


Fig. 5. The specific weight of innovation-active enterprises in the total number of industrial enterprises of Ukraine, % [16]

innovatively active enterprises is low; the amount of funding for innovative activities is insufficient. We believe that under the conditions of preservation of such dynamics regarding innovative activity (and the forecasting results confirmed this), it is unrealistic to expect that innovations will become a powerful locomotive for ensuring economic growth in the coming years.

In addition, it should be noted that the forecast values were calculated on the basis of actual data and trends of innovative development before the 2022 war in Ukraine. Today, Russia is bombing industrial and civil infrastructure facilities, some business entities have stopped or reduced the scope of their activities. The fall in GDP can already be predicted by up to 50 % in 2022. Inevitable losses for Ukraine are the lives of killed people; the deepening of the demographic problem is expected due to the non-return to Ukraine of the share of Ukrainians who were forced to go abroad. The consequences of the war in Ukraine are already felt in various countries of the world (due to threats to security, including energy, food, inflation, etc.). Therefore, the key is to end the absurd war, Russia's criminal actions in Ukraine as soon as possible, preserve the territorial integrity and sovereignty of Ukraine, and realize the possibilities of civilized development of both Ukraine and other countries of the world.

In order to strengthen Ukraine's competitive position, and increase the level of national innovation, taking into account the fact that the economies of other countries do not stop in their development, it is necessary to significantly intensify innovative activity in Ukraine.

There are prospects for the innovative development of Ukraine (including through the realization of its own powerful potential). Also today, plans for the reconstruction of Ukraine, the "Marshall Plan for Ukraine" are being discussed and

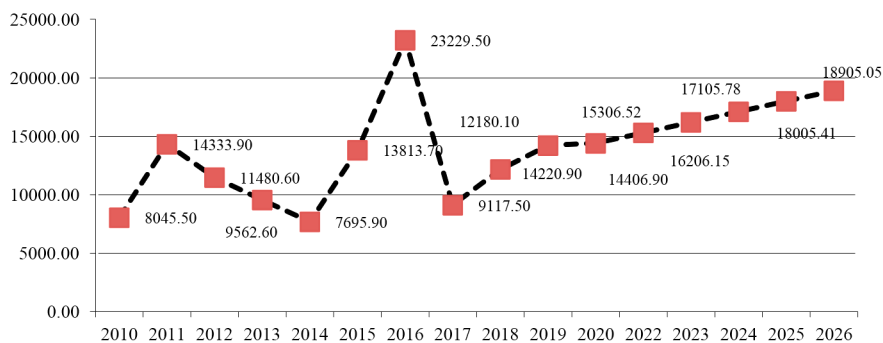


Fig. 6. Financing of innovative activities in Ukraine, UAH million [16]

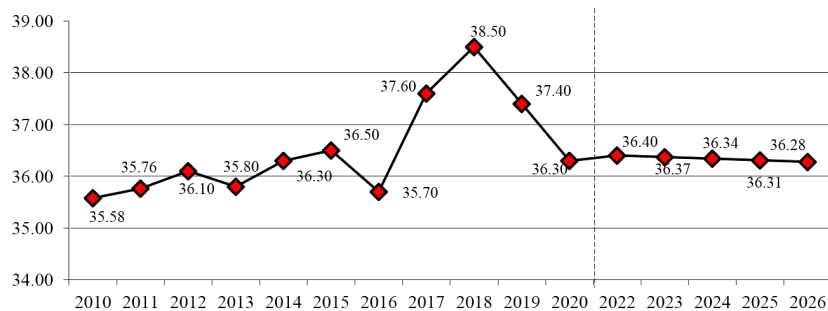


Fig. 7. The value of the Global Innovation Index for Ukraine [10, 14]

Table 3

Global Innovation Index ranking until 2026 [10, 14]

Country	2016	2017	2018	2019	2020	2021	2022	GII rating	2023	GII rating	2024	GII rating	2025	GII rating	2026	GII rating	Average forecast for the GII rating for 2022–2026
Germany	85.5	83.9	82.5	87.3	88.2	57.3	60.0	9	54.9	10	49.9	13	44.8	16	39.7	19	12
South Korea	91.3	89.0	89.3	87.4	88.2	59.3	67.6	2	62.9	3	58.2	4	53.5	3	48.8	6	3
Singapore	84.5	83.2	83.1	84.5	87.0	57.8	67.9	1	64.5	1	61.0	2	57.6	1	54.1	1	1
Switzerland	84.9	83.6	82.3	85.5	85.7	65.5	67.1	3	63.5	2	60.0	3	56.5	2	53.0	2	2
Sweden	85.2	83.9	84.7	84.2	85.5	63.1	64.5	4	60.4	4	56.3	5	52.1	6	47.9	8	5
Israel	79.8	81.2	80.6	84.8	85.0	53.4	57.5	13	52.6	13	47.8	17	42.9	21	38.1	21	16
Finland	83.8	83.3	81.5	85.6	84.0	58.4	60.9	8	56.3	9	51.6	10	46.9	10	42.3	13	9
Denmark	81.4	81.9	81.3	81.7	83.2	57.3	59.3	10	54.7	11	50.1	12	45.5	14	40.9	16	11
USA	82.8	81.4	80.4	83.2	83.2	61.3	62.9	5	59.1	5	55.2	8	51.3	7	47.4	9	7
France	80.4	81.0	80.8	81.7	82.7	55.0	57.6	12	52.8	12	47.9	16	43.2	20	38.4	20	15
Austria	78.5	80.5	79.1	80.9	82.4	50.9	54.0	18	48.8	20	43.6	25	38.3	27	33.1	28	24
Japan	85.1	82.6	81.9	81.9	82.3	54.5	55.5	14	49.8	19	44.1	24	38.4	26	32.7	31	22
Netherlands	74.9	75.2	75.0	79.5	81.2	58.6	61.8	6	58.9	6	56.0	6	53.2	4	50.3	3	4
Belgium	76.2	77.2	77.1	80.4	79.9	49.2	53.1	20	48.1	23	43.2	26	38.2	28	33.2	27	26
China	72.1	68.9	73.4	78.4	78.8	54.8	59.3	11	56.6	8	53.9	9	51.2	8	48.5	7	8
Ireland	76.7	74.9	77.9	80.1	78.7	50.7	54.6	15	49.9	18	45.3	22	40.7	24	36.1	24	20
Norway	77.1	76.9	76.7	77.8	76.9	50.4	52.8	21	47.8	24	42.8	27	37.9	29	32.9	29	27
Great Britain	74.9	74.5	74.5	75.9	76.0	59.8	61.4	7	58.6	7	55.8	7	53.1	5	50.3	4	6
Italy	67.9	65.6	68.9	72.9	75.8	45.7	49.9	26	46.2	27	42.4	28	38.7	25	34.9	25	28
Australia	73.4	73.3	74.3	75.4	74.1	48.3	51.3	24	46.6	26	41.9	29	37.3	31	32.7	30	29
Canada	73.4	71.6	67.9	73.6	73.1	53.1	54.2	16	50.6	16	47.0	18	43.4	19	39.8	18	17
Cyprus	46.3	46.4	47.0	52.5	51.6	46.7	47.4	28	46.9	25	46.4	19	45.9	13	45.4	10	18
Iceland	65.9	65.3	67.1	68.4	71.6	51.8	54.2	17	51.7	15	49.2	14	46.7	12	44.2	12	13

Czech Republic	64.3	66.7	63.5	68.1	70.0	49.0	51.4	23	48.5	21	45.6	21	42.8	22	39.9	17	21
New Zealand	72.1	71.6	67.4	68.1	68.1	47.5	47.2	29	42.5	30	37.7	32	32.9	37	28.2	36	32
Luxembourg	61	59.2	60.7	66.37	65.4	49	52.3	22	50.4	17	48.6	15	46.8	11	44.9	11	14
Spain	66.8	62.5	63.1	64.5	65.1	45.4	46.1	30	42.3	31	38.6	30	34.8	34	31.0	33	31
Portugal	65.1	60.6	61.4	62.8	65.1	44.2	44.9	31	41.2	32	37.5	33	33.9	36	30.2	34	33
Estonia	62.3	59.8	58.8	61.8	62.8	49.9	50.4	25	48.3	22	46.2	20	44.1	18	41.9	14	19
Malta	55.7	54.1	54.3	55.4	53.5	47.1	47.5	27	45.9	28	44.3	23	42.6	23	41.0	15	23
Hong Kong	60.5	57.5	57.1	58.9	61.7	53.7	53.4	19	52.3	14	51.3	11	50.2	9	49.1	5	10
Ukraine	35.7	37.6	38.5	37.4	36.3	35.6	36.4	46	36.4	41	36.4	34	36.3	32	36.3	23	34
Thailand	50.7	47.1	47.8	57.8	60.4	37.2	40.6	39	38.4	35	36.2	35	34.0	35	31.8	32	35
Hungary	64.7	63.2	64.4	63.1	68.2	42.7	43.9	32	39.8	34	35.7	36	31.6	39	27.5	37	36
Slovakia	57.7	57.2	56.9	58.0	59.4	40.2	41.6	36	38.3	36	34.9	37	31.6	38	28.3	35	37
Malaysia	69.2	66.9	64.8	67.6	68.3	41.9	43.1	33	38.1	37	33.1	39	28.1	41	23.1	42	38
Latvia	57.5	54.4	53.6	55.5	62.0	39.9	40.1	41	36.8	39	33.4	38	30.1	40	26.8	38	39
Turkey	60.9	57.1	60.3	62.9	63.8	38.3	40.7	38	36.5	40	32.2	41	27.9	42	23.7	40	40

formed, which is the subject of more detailed coverage in the framework of the next study.

Conclusions. The state and dynamics of innovativeness of the economy of Ukraine in the system of indicators of innovativeness of other countries of the world are analyzed. According to the Global Innovation Index rating, Ukraine is in the group of countries with an income level below the average. Almost all the countries with the best (highest) results in the Global Innovation Index rating belong to the group of countries with a high level of income, which confirms the key aspect of innovation in ensuring the economic development of the countries of the world.

The stimulating effect of globalization processes on the spread of innovations, as well as the limitation of access to innovations (“dumping” of second-order technologies in developing countries) in order to maintain competitive positions by economically developed countries of the world, is noted. The forecast of the Global Innovation Index is determined using a regression model of the dependence of this indicator on the specific weight of innovation-active enterprises in the total number of industrial enterprises and innovation costs. The results of forecasting the innovativeness of the economic development of Ukraine showed a slight downward trend according to the forecast values of the calculated index. Such results are determined by the insufficient level of innovative activity in Ukraine and the higher innovative activity of the economically developed countries of the world. Therefore, in order to increase the level of innovativeness of the national economy, to strengthen Ukraine’s competitive position, it is necessary to significantly intensify innovative activity in Ukraine, to ensure higher rates of innovation implementation compared to other countries of the world.

Today, Ukraine chooses territorial integrity and sovereignty at a high price, as well as the prospects of its innovative development, which can be realized through the effective use of its own powerful potential, as well as by implementing the “Marshall Plan for Ukraine”, which is currently being discussed at various levels.

References.

1. Vyshnivska, B. V. (2016). Innovative development of Ukraine. *Naukovyi Visnyk Natsionalnoho Universytetu Bioresursiv i Pryrodokorystuvannya Ukrainy. Seriya: Ekonomika, ahraryni menedzhment, biznes*, 244, 183-191.
2. Zhang, H., Veltri, A., Calvo-Amodio, J., & Haapala, K. (2020). Making the business case for sustainable manufacturing in small and medium-sized manufacturing enterprises: A systems decision making

approach. *Journal of Cleaner Production*, 287. <https://doi.org/10.1016/j.jclepro.2020.125038>.

3. Dykha, M. V., Tanasiienko, N. P., & Kolisnyk, G. M. (2017). Ensuring of labor productivity growth in the context of investment and innovation activity intensification. *Problems and Perspectives in Management*, 15(4), 197-208. [https://doi.org/10.21511/ppm.15\(4-1\).2017.04](https://doi.org/10.21511/ppm.15(4-1).2017.04).
4. Alekseenko, V., Seredina, N., & Kosaynova, V. (2019). Integrated Assessment of Leading Strategic Sustainability for Integrated Business Structures. In *Sustainable Leadership for Entrepreneurs and Academics*, (pp. 201-212). Springer, Cham. https://doi.org/10.1007/978-3-030-15495-0_21.
5. Brockova, K., Rossokha, V., Chaban, V., Zos-Kior, M., Hnatenko, I., & Rubezhanska, V. (2021). Economic mechanism of optimizing the innovation investment program of the development of agro-industrial production. *Management Theory and Studies for Rural Business and Infrastructure Development*, 43(1), 129-135. <https://doi.org/10.15544/mts.2021.11>.
6. Krulický, T., Horák, J., & Skulcova, K. (2021). Business valuation in times of crisis. *SHS Web of Conferences*, 91. <https://doi.org/10.1051/shsconf/20219101039>.
7. Hrypynska, N. V., Dykha, M. V., Korkuna, N. M., & Tsehehlyk, H. H. (2020). Applying Dynamic Programming Method to Solving the Problem of Optimal Allocation of Funds between Projects. *Journal of Automation and Information Sciences*, 52(1), 56-64. <https://doi.org/10.1615/JAutomatInfScien.v52.i1.60>.
8. Pedchenko, N., Strilec, V., Kolisnyk, G. M., Dykha, M. V., & Frolov, S. (2018). Business angels as an alternative to financial support at the early stages of small businesses’ life cycle. *Investment Management and Financial Innovations*, 15(1), 166-179. [https://doi.org/10.21511/imfi.15\(1\).2018.15](https://doi.org/10.21511/imfi.15(1).2018.15).
9. Zos-Kior, M., Kuksa, I., Samoilyk, I., & Storoška, M. (2017). Methodology for assessing the countries’ globalization development. *Economic Annals-XXI*, (11-12), 4-8. <https://doi.org/10.21003/ea.V168-01>.
10. *Global Innovation Index* (n.d.). Retrieved from <https://www.globalinnovationindex.org>.
11. *Internal Market, Industry, Entrepreneurship and SMEs*. (n.d.). Retrieved from http://ec.europa.eu/growth/industry/innovation/facts-figures/scoreboards_en.
12. *Global Competitiveness Index* (n.d.). Retrieved from <https://countryeconomy.com/government/global-competitiveness-index>.
13. *Knowledge for Development Community* (n.d.). Retrieved from <https://www.worldbank.org/en/news/feature/2016/10/20/knowledge-for-development-community>.
14. *THE GLOBAL INNOVATION INDEX 2020* (n.d.). Retrieved from https://www.wipo.int/edocs/pubdocs/en/wipo_pub_gii_2020-chapter1.pdf.
15. Brou, D., & Ruta, M. (2011). Economic integration, political integration or both? *Journal of the European Economic Association*, 9(6), 1143-1167.

16. State Statistics Service of Ukraine (n.d.). Retrieved from <http://ukrstat.gov.ua/>.

17. Hovorukha, V. B., & Tkachova, O.K. (2017). Mathematical methods and forecasting models in foreign economic activities. *Pytannia prykladnoi matematyky i matematychnoho modeliuvannia*, 17, 54–61.

Прогнозування інноваційності економічного розвитку України у глобальному вимірі

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Мета. Аналіз стану й тенденцій інноваційного розвитку країн світу, визначення місця України на міжнародній арені та прогноз її інноваційності.

Методика. Методичну основу склали загальнонаукові теоретичні методи: узагальнення, пояснення, групування; статистичний (для комплексного оцінювання стану й тенденцій інноваційної діяльності економік країн світу та України); методи аналізу й синтезу, економіко-математичні методи прогнозування, методи абстрагування й візуалізації (для наочної демонстрації фактичних даних і отриманих результатів дослідження).

Результати. Проаналізовано рівень інноваційності економік світу; позиції України у рейтингу Глобального

індексу інновацій (ГІІ). Відзначено позитивний/стимулюючий вплив глобалізаційних процесів на поширення інновацій, а також дискримінаційні методи інноваційного розвитку («скидання» технологій другого порядку до країн, що розвиваються). Визначено прогноз ГІІ за допомогою регресійної моделі залежності цього показника від питомої ваги інноваційно-активних підприємств у загальній кількості промислових підприємств і витрат на інновації. Результати прогнозування показали незначну спадну динаміку значення ГІІ України. Аргументовано, що для підвищення рівня інноваційності національної економіки, посилення конкурентних позицій України та враховуючи, що економіки інших країн не зупиняються у своєму розвитку, необхідно суттєво активізувати інноваційну діяльність в Україні.

Наукова новизна. Запропоновано науково-методичний підхід щодо прогнозування інноваційності економічного розвитку залежно від питомої ваги інноваційно-активних підприємств у загальній кількості промислових підприємств і витрат на інновації. З'являється можливість здійснювати прогнозно-планові розрахунки розвитку обраного об'єкта прогнозування, досліджувати поведінку макроекономічної системи в контексті інноваційності її розвитку, вносити корективи до системи стратегічного управління на рівні держави з метою стимулювання інноваційних процесів і впливу на результати інноваційного розвитку України у глобальному вимірі.

Практична значимість. Запропонований науково-методичний підхід дає можливість оцінити тенденції рівня інноваційності розвитку на перспективу та стає інформативним підґрунтям для розробки системи заходів щодо активізації інноваційної діяльності.

Ключові слова: економічний розвиток, інновації, Глобальний індекс інновацій, рейтинг, прогнозування

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