JEL: C59; H56; O31

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https://doi.org/10.60022/sis.2.(01).5

MODELLING A COMPREHENSIVE ASSESSMENT OF THE LEVEL OF INNOVATION SECURITY

Abstract. *The assessment of the level of innovation security is an important task to ensure socio-economic or innovative development and support scientific and technological progress. At the same time, in the modern scientific world, there are not enough methods that allow carrying out an accurate diagnosis of innovation security. It is relevant to consider in such diagnostics the system of external and internal factors that stimulate, or on the contrary, hinder innovative development. An important issue is to improve the tools, methods and stages of such an assessment, taking into account the present.*

The study used a system of methods and tools that allowed solving the problems of the article: mathematical modelling, correlation and regression analysis, modified principal component, Holt's adaptive model, abstraction, synthesis, deduction and induction. The database used for modelling the integrated assessment of innovation security is an official statistical sources, which reflect the results of innovation activity.

It has been proved that innovation activity plays an important role both in the effective functioning of individual sectors of the economy and in the social development of the country as a whole. Consequently, such activity requires constant monitoring and evaluation. The methodology of diagnostics of the level of innovation security and its forecast is proposed.

The obtained levels of innovation security, as well as the forecast, indicate the increased need to form a new type of state policy, which will completely restart innovation activity. The proposed methodology will be useful for the interested market players, which is important to diagnose the current state of innovation activity in time, as well as to develop a policy for innovative development of the country for the future.

Keywords: *innovation, security, socio-economic development, scientific and technological works, globalisation, state budget, gross domestic product.*

1. Introduction

Innovations are the key to the socio-economic development of any country in the world. It is innovations that encourage business entities and the state as a whole to develop. Innovations play a special role in the conditions of globalisation and accelerated competition. It is scientifically proven that countries with high innovative development have highly developed industries, agro- sector and the standard of living of the population in such countries is known to be higher in comparison with innovatively backward economies of other countries. The assessment of the level of innovation security is of high importance, which allows timely identification of threats coming from the external environment. Due to timely diagnostics of the level of innovation security, it is possible to prevent negative consequences for the production of innovations and to develop an effective state innovation policy.

The aim of the article is to determine the methodology for assessing the level of innovation security taking into account today's conditions.

Modelling of complex assessment of the level of innovation security is not a widespread enough topic in scientific sources. The authors paid more attention to the methodology of integrated assessment of the functioning of the state, enterprises, innovative development, economic security etc. In particular, Sukhorukov and Kharazishvili, [1], focused their attention on modelling the assessment of the components of economic security of the state. The study proposed a macroeconomic model for identifying the impact of destabilising factors on the development of the state. Shchurov, [2], at a high scientific level carried out the process of diagnosing the level of economic security of the oil and gas industry. Shchurov, [2], established the level of economic security of the enterprise, identified trend changes at the end of the research period and demonstrated the importance of the dualism of interaction between the enterprise and the state in terms of economic and energy security. The author used modern scientific methods of research-taxonomic analysis and fuzzy set theory Kobeleva and Pererva, [3], proposed a methodological concept of monitoring energy security indicators in the activity of business structures, determined the meaningful sequence of stages of monitoring the financial, production and commercial activities of an industrial enterprise, developed methodological provisions of monitoring of energy security of industrial enterprise using monitoring functions. Prokopenko *et al.,* [4], analysed the influence of state policy on the economic security of machine-building complex, assessed the impact of the state decision on certain elements of the system of public procurement Prozorro, etc. Krupka and Kostetsky, [5], determined the impact of public and private partnerships on strengthening the financial security of economic entities, identified the problems of security support, noted the need to reform the current legislation to simplify the procedure for attracting business entities to participate in public and private partnership projects Shaulskaya and Shcherb, [6], defined the human-centric model of security in the context of preventing risks and conflicts in the social, labour and entrepreneurial spheres, identified the importance of economically safe behaviour of employees in reducing threats to the economic security of the enterprise, detailed the central drivers and threats to economic security at the private level, allowing the formation of an ecosystem for preventing threats of conflicts. Chubaevsky, [7], proposed methods of corporate information security management, generalised scientific approaches to the formation of the mechanism of economic security of the enterprise, defined the scientific basis for the development of the mechanism of formation of corporate information security, the elements of which are objects, subjects, goal, functions and methods. Bartosova *et al.,* [8], proposed non-standard methods for assessing the effectiveness of strategic change management of companies in the system of open innovation. Some modelling tools are appropriate for use in our research. Kopylyuk and Zhuribida, [9], proposed a comprehensive approach to assessing the level of economic security of banks in Ukraine, based on grouping institutions by level of economic security identified threats and dangers accompanying the activities of banks in the context of the state, foreign banking groups and private capital. Kopteva, [10], proposed the author's model for assessing the economic security of business processes of a trading enterprise, allowing thoroughly carrying out calculations and making effective management decisions to ensure the economic security of the enterprise. Yarova, [11], developed a methodology for assessing national security in the context of the principles of sustainable spatial development, proposed indicators of forest security and considered the methodology of forming an algorithm for building a comprehensive rating assessment of national security components.

Paying due respect to the scientific developments of the authors, we note some fragmentation in the consideration of the process of assessing the level of innovation security. In the framework of our study, it will be useful to use the tools, methods and methodologies of the above authors, which can be partially adapted to our study.

2. Materials and Methods

Innovation activity plays an important role both in the development of individual sectors of the economy and in the economic development of the country as a whole. For a comprehensive assessment of the level of innovation security, it is necessary to use a variety of indicators reflecting various aspects of innovation activity. Let us note through $Q = \{q_i\}_{i=1}^{n}$ set of these indicators. For each indicator q_i, it is possible to determine the critical value q_i^{kr} and optimal value q_i^{opt}. The list of characteristics from the set Q is given in Table 1.

To study the dynamics of these indicators we used statistical data for the retrospective period

Table 1

Indicators for assessing the level of innovation security

Indicator	Sense of the indicator	Critical value	Optimal value
q_1	Gross fixed capital formation as a percentage of GDP	18	30
q_2	Percentage of products sold on competitive markets of the country	50	80
q_3	Share of R&D activities in GDP (in per cent)	0,5	3
q_4	Ratio of state budget expenditures on R&D to GDP (in per cent)	0,2	1
q_5	Percentage of enterprises that implemented innovations	5	35
q_6	Share of innovative products sold (in per cent)	3	25
q_7	Number of specialists performing scientific and technical work per thousand employed population	5	22

Source: Combination of indicators proposed by the authors

2010–2020. Let us denote the value of indicator q_i, in the t-th year of the retrospective period through $q_i(t)$. The values of indicators q_i, during the retrospective period are given in Table 2.

During the retrospective period, none of the indicators reached the optimal value. The indicator q_1 of gross fixed capital formation in relation to GDP grew during 2010–2012 and in 2012 exceeded the critical value of 18%. In 2013–2015, there was a decrease in this indicator and in 2016–2018, it increased again, although its value remained less than the critical value. In 2019, the value of this indicator remained almost unchanged and in 2020, it decreased significantly. The highest chain growth rate was achieved in 2016 and the lowest in 2020.

The indicator q_2 of the part of products sold on competitive markets remains below the critical value of 50% throughout the entire retrospective period, although in 2010–2012 it approached its value. The most significant decrease in this indicator occurred in 2015 — by 10% less than the previous year.

The indicator q_3 of the part of performed scientific and scientific-technical works in GDP exceeded the critical value in 2010–2017, but starting from 2017 its value decreased and became less than the critical value in 2019–2020.

The indicator q_4 — ratio of state budget expenditures on scientific and scientific-technical works to GDP has been decreasing since 2013 (except for 2018, when budget expenditures on innovation increased by 2.8 times compared to the previous year). In 2017, 2019 and 2020, the values of this indicator became less critical, and in 2020, they reached the minimum value for the entire period.

The percentage of enterprises that introduced innovations (indicator q_5) during the whole retrospective period significantly exceeded the critical value of 5%, with periods of growth of this indicator alternating with periods of decline.

The share of realised innovative products (indicator q_6) by 2017 had a clearly pronounced downward trend, because of which, starting from 2014, the value of this indicator becomes less than critical. The decrease in this indicator was particularly significant in 2014 and 2017. In the period 2018–2020, this indicator increases, although it does not reach the value of 2014.

The number of professionals performing S&T work per thousand-employed population (indicator q_7) decreased between 2015 and 2019, resulting in a less-than-critical value in 2019.

To determine the interrelationships between the indicators from the set Q, we determine the correlation coefficients $r_{ij} = r\left(q_i, q_j\right)$ between these indicators. These coefficients form a correlation matrix:

$$R = (r_{ij})_{i,j=1}^{7} =$$

$$= \begin{pmatrix} 1,000 & 0,300 & 0,335 & 0,672 & 0,252 & 0,377 & -0,400 \\ 0,300 & 1,000 & 0,798 & 0,674 & 0,498 & 0,899 & -0,316 \\ 0,335 & 0,798 & 1,000 & 0,776 & 0,442 & 0,708 & -0,112 \\ 0,672 & 0,674 & 0,776 & 1,000 & 0,430 & 0,676 & -0,350 \\ 0,252 & 0,498 & 0,442 & 0,430 & 1,000 & 0,338 & 0,201 \\ 0,377 & 0,899 & 0,708 & 0,676 & 0,338 & 1,000 & -0,521 \\ -0,400 & -0,316 & -0,112 & -0,350 & 0,201 & -0,521 & 1,000 \end{pmatrix}$$

Table 2

Dynamics of innovation security indicators

Indicator	Years										
	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
q_1	16,98	17,42	19,54	17,63	14,00	13,50	15,20	15,76	17,65	17,61	13,37
q_2	48,30	49,80	49,20	45,70	47,50	42,70	43,40	41,90	40,73	39,56	42,00
q_3	0,82	0,73	0,75	0,77	0,66	0,67	0,70	0,60	0,55	0,48	0,45
q_4	0,34	0,29	0,33	0,33	0,26	0,21	0,20	0,15	0,29	0,19	0,09
q_5	13,90	16,20	17,40	16,80	16,10	15,20	16,60	14,30	15,60	13,80	14,90
q_6	3,80	3,80	3,30	3,30	2,50	1,40	1,30	0,70	0,80	1,30	1,90
q_7	3,70	5,40	5,20	4,90	4,90	7,45	6,02	5,84	5,39	4,78	4,95

Source: calculated by the authors using https://www.ukrstat.gov.ua/

The significance of the obtained correlation coefficients is checked by the Student's criterion. The correlation coefficient is considered significant if the actual value of this criterion obtained by the formula:

$$t_{факт}(i,j) = \sqrt{\frac{r_{ij}^2}{1-r_{ij}^2}(T-2)} \quad (1)$$

where T is the duration of the retrospective period (T = 11), exceeds the tabulated value $t(\alpha,k)$ which corresponds to the confidence probability α and the number of degrees of freedom $k = T - 2$. Taking the value of confidence probability $\alpha = 0{,}95$, we obtain that $t(\alpha,k) = 2{,}362$. Inequality $t_{actual}(i,j) > t(\alpha,k)$ is fulfilled when the correlation coefficient $r_{ij} > 0{,}602$.

Thus the correlation coefficients r_{14} = 0,672, r_{23} = 0,798, r_{24} = 0,674, r_{26} = 0,899, r_{34} = 0,766, r_{36} = 0,788 and r_{46} = 0,676. Consequently, the indicators of the ratio of state budget expenditures on scientific and scientific-technical works to GDP, the percentage of products sold in the competitive markets of the country, the share of performed scientific and scientific-technical works in GDP and the share of sold innovative products are significantly correlated with each other, in addition, the indicator of the ratio of state budget expenditures on scientific and scientific-technical works to GDP is correlated with the indicator of gross fixed capital formation as a percentage of GDP. The indicators of the percentage of enterprises that introduced innovations and the number of specialists performing scientific and technical work per thousand-employed population do not correlate with other indicators of the set Q.

3. Results and Discussion

Let us define an integral assessment of innovation security, which includes all indicators q_i, and reflects the existing relationships between them. To obtain such an assessment, let us transform these indicators in such a way that their values refer to the interval [0,1].

Let's mark through q_i^{min} and q_i^{max} respectively the minimum and maximum elements of the set $\{q_i(t)\}_{t=1}^{T} \cup \{q_i^{kr}, q_i^{opt}\}$. Integral evaluation $G(t)$ of innovation activity in the t-th year of the retrospective period is determined by the formula:

$$G(t) = \sum_{i=1}^{7} \alpha_i \frac{q_i(t) - q_i^{min}}{q_i^{max} - q_i^{min}} \quad (2)$$

where α_i weight coefficients of indicators. These coefficients are determined by the modified principal component method, which makes it possible to take into account significant correlations between the indicators included in the integral assessment.

To determine the weighting coefficients we make a covariance matrix $K = (k_{ij})$, whose elements are the covariance coefficients k_{ij} between indicators g_i and g_j the values of which are determined by the formulas:

$$g_i(t) = \frac{q_i(t) - q_i^{min}}{q_i^{max} - q_i^{min}} \quad (3)$$

$$g_j(t) = \frac{q_j(t) - q_j^{min}}{q_j^{max} - q_j^{min}} \quad (4)$$

The covariance matrix K has the following form:

$$K = \begin{pmatrix} 0{,}0134 & 0{,}0030 & 0{,}0017 & 0{,}0067 & 0{,}0011 & 0{,}0020 & -0{,}0023 \\ 0{,}0030 & 0{,}0073 & 0{,}0031 & 0{,}0050 & 0{,}0016 & 0{,}0036 & -0{,}0013 \\ 0{,}0017 & 0{,}0031 & 0{,}0020 & 0{,}0030 & 0{,}0008 & 0{,}0015 & -0{,}0002 \\ 0{,}0067 & 0{,}0050 & 0{,}0030 & 0{,}0074 & 0{,}0014 & 0{,}0027 & -0{,}0014 \\ 0{,}0011 & 0{,}0016 & 0{,}0008 & 0{,}0014 & 0{,}0015 & 0{,}0006 & 0{,}0004 \\ 0{,}0020 & 0{,}0036 & 0{,}0015 & 0{,}0027 & 0{,}0006 & 0{,}0022 & -0{,}0012 \\ -0{,}0023 & -0{,}0013 & -0{,}0002 & -0{,}0014 & 0{,}0004 & -0{,}0012 & 0{,}0024 \end{pmatrix}$$

When applying the modified principal component method, the weight coefficients α_i in the integral estimation are taken equal to the squares of the component of the eigenvector of this matrix, which corresponds to the maximum eigenvalue of this matrix.

To determine the eigenvalues of the matrix K we solve the equation:

$$\det(K - \lambda E) = 0$$

where E is a unit matrix of the seventh order, and $\det(K - \lambda E)$ — determinant of the matrix $K - \lambda E$.

The maximum root of this equation is λ_{max} = 0,0227. This root is 63% of the sum of all roots of the equation. Consequently, the integral score obtained by the modified principal component method reflects with sufficient accuracy the influence of all the indicators involved in its creation. To determine the eigenvector W corresponding to the eigenvalue λ_{max}, we find a non-zero solution of the equation

$$KW = \lambda_{max} W .$$

The defined components w_i of the eigenvector W and the corresponding weighting coefficients α_i in the integral innovation score are summarised in Table 3.

Consequently, the integral assessment of innovation activity is as follows:

$$G = 0{,}4169g_1 + 0{,}1718g_2 + 0{,}0461g_3 + 0{,}2754g_4 + \\ + 0{,}0128g_5 + 0{,}0545g_6 + 0{,}0224g_7$$

Table 3

Components of the eigenvector W and weighting coefficients of the integral assessment of innovation activity

i	w_i	Coefficient α_i
1	0,6457	0,4169
2	0,4145	0,1718
3	0,2147	0,0461
4	0,5248	0,2754
5	0,1133	0,0128
6	0,2335	0,0545
7	0,1495	0,0224

Source: proposed by the authors

Table 4

Integral assessments of innovation security

Year	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Score	0,221	0,225	0,287	0,224	0,116	0,068	0,110	0,098	0,182	0,144	0,019

Source: calculated by the authors

Using the relationship between indicators g_i and q_i it is possible to express the integral score of G through indicators q_i:

$$G = 0,0251q_1 + 0,0042q_2 + 0,0181q_3 + 0,3018q_4 + \\ +0,0004q_5 + 0,0022q_6 + 0,0012q_7 - 0,5458$$

The integral estimates obtained using this equality are presented in Table 4.

The dynamics of the integral assessment of innovation security is reflected in Figure 1.

To obtain forecast values of indicators q_i for 2023–2024, we use different forecasting models, the choice of which is determined by the peculiarities of the dynamics of these indicators in the retrospective period.

For forecasting indicators q_1, q_2, q_3, q_5 and q_7 we use Holt's adaptive model.

In Holt's model, the adaptation process is ensured by using the smoothing coefficient of the dynamic series γ and the smoothing coefficient of the trend δ. The values of these coefficients are chosen empirically to ensure the highest forecast accuracy.

When using the Holt model to predict the indicator q_i, at each year of the retrospective period, the values of $a_i(t)$ of the exponential-smoothed series and the value of $b_i(t)$ of the trend.

At $t = 1$, the value $a_i(1)$ of the exponentially smoothed series is taken to be equal to the value of the indicator q_i in the first year of the retrospective period, and the value $b_i(1)$ of the trend is taken to be equal to 0.

For other values of t, we calculate these values by recurrence formulas:

$$a_i(t) = \gamma q_i(t) + (1-\gamma)(a_i(t-1) + b_i(t-1)) \quad (5)$$

$$b_i(t) = \delta(a_i(t) - a_i(t-1)) + (1-\delta)b_i(t-1) \quad (6)$$

Forecast values of indicators q_i for j years are determined from the equality:

$$q_i(T+j) = a_i(T) + jb_i(T) \quad (7)$$

where T is the number of years in the retrospective period. Forecast accuracy is assessed using the absolute error Δ_i and relative error ε_i, which are calculated for each year of the retrospective period using the following formulas:

$$\Delta_i(t) = q_i(t) - a_i(t) - b_i(t) \text{ and } \varepsilon_i(t) = \frac{\Delta_i^2(t)}{q_i^2} \quad (8)$$

Forecast accuracy is estimated by the value ν_i, determined from the equality:

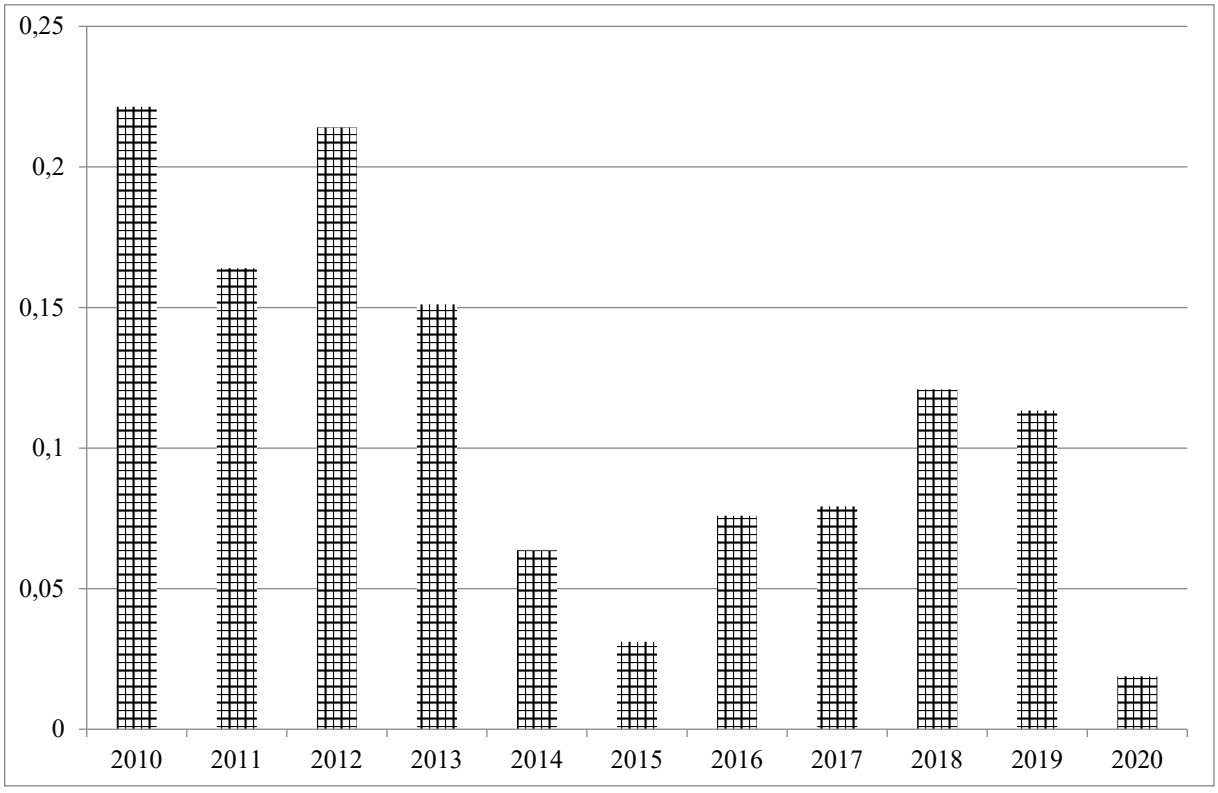

Figure 1. Dynamics of the integral assessment of innovation security

Source: calculated by the authors

$$\nu_i = 1 - \frac{\sum_{t=2}^{T} \varepsilon_i(t)}{T-1} \quad (9)$$

In predicting the values of indicators q_1, q_2, q_3, q_5 and q_7, the prediction accuracies were 97,95%, 99,73%, 99,27%, 98,97% and 96,46% respectively.

To forecast the values of indicators q_4, and q_6 we use the exponential levelling model. This model includes the parameter θ, which determines the advantage of newer values of the indicator in obtaining forecasts. This parameter belongs to the segment [0.2; 0.6], its value is chosen empirically. When forecasting the indicator q_4 we have chosen the value $\theta = 0.5$, and when forecasting the indicator q_6 — the value $\theta = 0.28$. To approximate the value of the predicted indicator, we use a second-order polynomial:

$$\varphi(t) = \eta_0 + \eta_1 t + \eta_2 \frac{t^2}{2!} \quad (10)$$

the coefficients of which we determine by the method of least squares.

Further, for all values of t, corresponding to the years of the retrospective period, we determine the elements of $q_i^1(t)$, $q_i^2(t)$, $q_i^3(t)$ of the aligned series. At $t = 1$ we use the formulas:

$$\begin{cases} q_i^1 = \eta_0 - \frac{1-\theta}{\theta}\eta_1 + \frac{(1-\theta)(2-\theta)}{2\theta^2}\eta_2 \\ q_i^2 = \eta_0 - \frac{2(1-\theta)}{\theta}\eta_1 + \frac{2(1-\theta)(3-2\theta)}{2\theta^2}\eta_2 \\ q_i^3 = \eta_0 - \frac{3(1-\theta)}{\theta}\eta_1 + \frac{3(1-\theta)(4-3\theta)}{2\theta^2}\eta_2 \end{cases} \quad (11)$$

For values $t > 1$ quantities $q_i^1(t)$, $q_i^2(t)$, $q_i^3(t)$ are denoted by recurrence formulas:

$$\begin{cases} q_i^1(t) = (1-\theta)q_i^1(t-1) + \theta q_i(t) \\ q_i^2(t) = (1-\theta)q_i^2(t-1) + \theta q_i^1(t) \\ q_i^3(t) = (1-\theta)q_i^3(t-1) + \theta q_i^2(t) \end{cases}. \quad (12)$$

In this case, the values of η_0, η_1 and η_2 also change according to the formulas:

$$\begin{cases} \eta_0 = 3q_i^1(t) - 3q_i^2(t) + q_i^3(t) \\ \eta_1 = \frac{\theta}{2(1-\theta)^2}[(6-5\theta)q_i^1(t) - 2(5-4\theta)q_i^2(t) + (4-3\theta)q_i^3(t) \\ \eta_2 = \frac{\theta^2}{(1-\theta)^2}(q_i^1(t) - 2q_i^2(t) + q_i^3(t) \end{cases} \quad (13)$$

The values of η_0, η_1 and η_2 obtained at $t = T$ are used to determine the forecasted value of the q_i indicator:

$$q_i(T+j) = \eta_0 + \eta_1 j + \eta_2 \frac{j^2}{2!} \quad (14)$$

The determined forecast values of q_i indicators for 2023–2024 are shown in Table 5.

Consequently, a certain increase in the ratio of state budget expenditures on scientific and scientific-technical works to GDP is forecasted, this indicator is expected to reach the critical value of 0.2. In 2024, the share of realised innovative products is forecast to grow, although the value of this indicator will remain less than the critical. For the rest of the indicators considered, a decrease is forecasted compared to the 2020 level. At the same time, of all these indicators, only the percentage of enterprises implementing innovations will remain above the critical value.

4. Conclusions

Thus, we have determined that innovation activity plays an important role in the effective functioning of individual sectors of the economy, as well as in the social development of the country as a whole. For a comprehensive assessment of the level of innovation security, it is necessary to use many indicators reflecting various aspects of innovation activity. The greatest decrease in innovation security was determined in 2020, and its highest value, respectively, in 2010. The obtained levels of innovation security, as well as its forecast, indicate the increased need for the formation of a new type of public policy, which will completely restart innovation activity.

Table 5

Forecast values of innovation activity indicators

Indicator	Sense of the indicator	Forecast for 2023	Forecast for 2024
q_1	Gross fixed capital formation as a percentage of GDP	12,34	11,68
q_2	Percentage of products sold on competitive markets of the country	40,45	40,17
q_3	Share of completed scientific and technical works in GDP (in per cent)	0,31	0,27
q_4	Ratio of state budget expenditures on R&D to GDP (in per cent)	0,20	0,20
q_5	Percentage of enterprises that implemented innovations	13,39	13,09
q_6	Share of innovative products sold (in per cent)	1,60	2,09
q_7	Number of specialists performing scientific and technical work per thousand employed population	4,72	4,64

Source: calculated by the authors

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Received: 10/10/2023
Accepted: 18/01/2024
Published: 29/03/2024

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https://doi.org/10.60022/sis.2.(01).5

МОДЕЛЮВАННЯ КОМПЛЕКСНОГО ОЦІНЮВАННЯ РІВНЯ ІННОВАЦІЙНОЇ БЕЗПЕКИ

Анотація. *Оцінювання рівня інноваційної безпеки є важливим заданням забезпечення соціально-економічного або інноваційного розвитку та підтримки науково-технічного прогресу. Одночасно у сучасному науковому світі недостатньо методик, які дозволяють провести точну діагностику інноваційної безпеки. Актуальним є врахування в такій діагностиці системи зовнішніх та внутрішніх чинників, які стимулюють або навпаки заважають інноваційному розвитку. Важливим питанням є удосконалення інструментарію, методів та етапів такого оцінювання з урахуванням сьогодення.*

В дослідженні використано система методів та інструментів, які дозволили вирішити задачі статті: математичного моделювання, кореляційно-регресійного аналізу, модифікованої головної компоненти, адаптивна модель Хольта, абстрагування, синтезу, дедукції та індукції. Базою даних, яка використовувалася для моделювання комплексного оцінювання інноваційної безпеки є офіційні статистичні джерела, в яких відображені результати інноваційної діяльності.

Доведено, що інноваційна діяльність відіграє важливу роль як в ефективному функціонуванні окремих галузей економіки, так і в соціальному розвитку країни в цілому. Отже така діяльність вимагає постійного моніторингу та оцінювання. Запропоновано методику діагностики рівня інноваційної безпеки та його прогнозу.

Отримані рівні інноваційної безпеки, а також прогноз засвідчують підвищену необхідність формування державної політики нового типу, яка повністю перезапустить інноваційну діяльність. Запропонована методика буде корисною для зацікавлених суб'єктів ринку, яким важливо вчасно діагностувати поточний стан інноваційної діяльності, а також розробляти політику інноваційного розвитку країни на перспективу.

Ключові слова: *інновації, безпека, соціально-економічний розвиток, науково-технічні роботи, глобалізація, держбюджет, валовий внутрішні продукт.*