

The long-term pressure of the COVID-19 pandemic and hostilities in Ukraine have caused catastrophic consequences in all sectors of life, which negatively affect the overall level of economic security of the state. In these circumstances, the task to adjust the mechanisms for assessing the state of economic security, taking into account existing non-standard challenges, is urgent. The object of this study is the processes of transformation of mechanisms for monitoring the state of economic security of the state under conditions of global instability.

The conceptual foundations for monitoring the state of economic security of the state have been deepened and, taking into account the results of the expert assessment, the directions of its modification have been proposed for practical application. The need to revise the weighting values of indicators of the state of economic security, taking into account the principle of "critical" link, has been determined. The need to update the list of indicators of the state of economic security, taking into account structural changes in the state economy, was emphasized. It is recommended to use the multiplicative form of the integral indicator of the state of economic security instead of the additive one, as well as the method of the reference coefficient instead of the normalization method relative to the scope of variation.

The state of economic security in the context of its structural parts is comprehensively assessed. The existing trends of deterioration of the state of demographic, investment-innovative, macroeconomic subsystems, which should be considered as sources of "weak link", have been registered. The decrease in the level of economic security from 52 % in 2007 to 47 % in 2021 has been proved.

The practical use of the scientific results reported here could contribute to improving the effectiveness of management decisions aimed at strengthening the system of economic security of the state under modern conditions of global instability

Keywords: administrative management, economic security, national security, ensuring economic security, security

DEVELOPMENT OF DIRECTIONS FOR IMPROVING THE MONITORING OF THE STATE ECONOMIC SECURITY UNDER CONDITIONS OF GLOBAL INSTABILITY

Anastasiia Poltorak

Corresponding author

Doctor of Economic Sciences, Associate Professor

Department of Management and Marketing**

E-mail: poltorak@mnau.edu.ua

Yuriy Volosyuk

PhD, Associate Professor

Department of Information Systems and Technologies**

Svitlana Tyshchenko

PhD, Associate Professor

Department of Economic Cybernetics and Mathematical Modeling**

Olha Khrystenko

PhD, Associate Professor*

Volodymyr Rybachuk

PhD, Associate Professor*

*Department of Business Economy**

**Mykolayiv National Agrarian University

Heorhiya Honhadze str., 9, Mykolayiv, Ukraine, 54008

Received date 13.01.2023

Accepted date 16.03.2023

Published date 30.04.2023

How to Cite: Poltorak, A., Volosyuk, Y., Tyshchenko, S., Khrystenko, O., Rybachuk, V. (2023). Development of directions for improving the monitoring of the state economic security under conditions of global instability. *Eastern-European Journal of Enterprise Technologies*, 2 (13 (122)), 17–27. doi: <https://doi.org/10.15587/1729-4061.2023.275834>

1. Introduction

The conditions of global instability are a complex and multidimensional phenomenon that can arise due to geopolitical conflicts, economic crises, social protests, environmental crises. Such conditions cause deterioration of living standards, rising unemployment and poverty, a decrease in the quality of life, and a general decrease in the level of economic security of the state. The conditions of global instability refer to a situation where the world economy or geopolitical situation is in a precarious state, which can lead to a significant decrease in the global level of security and stability.

The conclusion about the existence of global instability can be made in the presence of geopolitical tensions, deep economic crises, environmental crisis, social protests, armed

conflicts, migration flows, threats to global security. Reducing the risk of global instability and developing mechanisms to counteract this phenomenon are important tasks for the international community and individual states. An important part of such measures should be global cooperation and coordination of efforts of international communities to counter global instability and the challenges it poses to the world.

The long-term pressure of the COVID-19 pandemic and full-scale hostilities in Ukraine have caused catastrophic consequences in all sectors of life, which negatively affect the level of economic security of Ukraine and other countries of the world. Economic security of the state is a complex concept that contains a generalization of indicators of many indicators of the security situation in various fields: financial, food, foreign economic, energy, demographic, so-

cial, industrial, investment and innovation, macroeconomic. According to various estimates, Ukraine's GDP in 2022 decreased by 35–50 %, and every second enterprise ceased to function effectively. Based on this, the general system of government is significantly changing, including the mechanisms for ensuring the level of its economic security. In the context of economic globalization, the supply and demand of both food and energy between countries are closely related. The existing conditions of global instability cause the greatest negative consequences for other countries of the world in the field of energy and food security, which are important components of economic security. Since Ukraine is a major exporter of agricultural products, researchers and scientists emphasize that hostilities will exacerbate the already unstable situation with food security in many developing countries. This will cause disruptions in the production and export of agricultural products, accelerating price increases in import-dependent countries.

Under these conditions of global instability, the existing mechanisms for monitoring the state of economic security of the state require adjustments that would take into account the rapid change in the conditions for ensuring economic security and the influence of new factors. The relevance of the chosen scientific problems is justified by the need to transform the mechanisms for monitoring the state of economic security of the state under conditions of global instability. This will contribute to improving the effectiveness of management decisions aimed at strengthening the system of economic security of the state under conditions of global instability.

2. Literature review and problem statement

Our bibliometric analysis using the tools of Vosviewer v.1.6.18 and Google Analytics provided an opportunity to identify research groups of scientists with significant achievements in the field of monitoring the state of economic security at the state level. These works formed the basis for the analysis below.

Paper [1] considers the strategies of debt and investment management under the conditions of the financial crisis. This article discusses a market that is subject to risks in four areas: inflation, investments, income risks, fixed assets, but other components of the state's economic security are overlooked. The authors of study [2] summarized financial security data on more than 150 countries for the period 1960–2014. The study base covers four elements: IMF funding, foreign exchange reserves, regional financing mechanisms, and central bank swap lines. The result are important but require further consideration, taking into account new challenges. The role of the global financial cycle in stimulating international capital flows in emerging economies is considered in [3], but it cannot be confidently guaranteed that the findings can be used by other countries. The authors of article [4] built a model of ontology of financial risks to adapt to the variability, complexity, and relevance of risk in early warning and preliminary control. Study [5] presents proposals for strengthening the financial security of the agricultural sector of the state as the basic system-forming sector. These conclusions need to be revised taking into account changes in external factors affecting the investigated indicators. In [6], the researchers' attention is also focused on improving the work of agricultural enterprises since the level of

their liquidity and profitability is the basis for ensuring the economic security of the state. Due to the fact that under the existing conditions the conditions of functioning of agricultural enterprises are significantly changing, the formed conclusions can be revised and supplemented.

Study [7] considers the management of the innovative potential of the enterprise, the construction of an innovative strategy for its development as the basis for ensuring economic security. However, doubts remain about the possibility of using the above recommendations at enterprises of certain organizational and legal forms. The purpose of article [8] is to summarize different points of view on how innovative products and services contribute to the sustainable development of society and ensure economic security. Paper [9] presents the author's view of how innovative enterprises in transition countries function with institutional constraints, increasing their efficiency and ensuring economic security. The authors of work [10] propose to consider a closed-loop economy as a "way of doing business", "a way of thinking" to strengthen economic security. In works [11, 12], the consideration of the components of economic security has begun and a doctrinal model for ensuring the financial security of the state is proposed, the key elements of which should be adjusted taking into account the current economic situation.

Some aspects of external knowledge resources to ensure economic security in developing countries are discussed in [13]. Study [14] draws an important conclusion that global crises and social upheavals are causing a transformation in states that opens up decades of renewal. The authors emphasize that from a regional point of view, these changes have both opportunities and risks. Accordingly, to ensure economic security and collective solution of future problems, the interaction of regional players in science, economics, society, administration, and the environment is required. In [15], the assessment of economic added value created by innovative multinational companies in Poland is carried out, but the question of the possibility of applying the results obtained in other countries remains without the attention of the authors. The assessment of food security in the system of economic security of the state was carried out in work [16], but the existing challenges associated with military aggression against Ukraine require further consideration. The authors of study [17] emphasize that the factor of technological environmental and market regulation affects the level of coherence of the development of the regional system of green innovations and ensuring economic security. In work [18], the authors pay attention to the development of an innovative methodology for the study of systems on the example of the shadow economy as an invariant of the system of economic security of the state, but its other components are left out of the attention of the authors.

Article [19] monitors the state of financial and economic security of Ukraine and compares the main indicators with similar indicators of economically highly developed countries. However, the author of the study paid attention to the analysis of a limited number of macroeconomic indicators (for example, GDP per person), which makes it impossible to draw comprehensive conclusions about the state of financial and economic security of the state.

Work [20] clarifies the role of financial monitoring in ensuring the economic security of the state. However, the directions for improving the effectiveness of monitoring the state of economic security of the state are limited to recommendations in the field of minimizing the risks associated

with counteracting the legalization of proceeds from crime, financing terrorism, and the proliferation of weapons of mass destruction.

Therefore, under the conditions of global instability, it is necessary to make timely changes to the mechanisms for monitoring the economic security of the state. The need to improve these mechanisms continues to be urgent, which will make it possible to obtain more accurate results on the state of economic security of the state in their practical application.

3. The aim and objectives of the study

The aim of this study is theoretical and methodological substantiation of practical approaches to the transformation of mechanisms for monitoring the state of economic security of the state under conditions of global instability. This will make it possible to take into account the peculiarities of the rapid change in the conditions for ensuring the economic security of the state in the process of assessing its condition and, accordingly, to single out effective directions for strengthening the economic security of the state.

To accomplish the aim, the following tasks have been set:

- to summarize the conceptual foundations for monitoring the state of economic security of the state;
- to propose directions for modifying the methodology for assessing the economic security of the state under conditions of global instability;
- to comprehensively assess the state of economic security of the state in the context of its structural parts.

4. The study materials and methods

The object of our study is the processes of transformation of mechanisms for monitoring the condition of economic security of the state under conditions of global instability. The subject of this study is a set of theoretical, methodological, and practical aspects of the transformation of mechanisms for monitoring the condition of economic security of the state under conditions of global instability.

The implementation of the study is based on the idea of improving the mechanisms for monitoring the condition of economic security of the state under conditions of global instability. The basis of this study is the hypothesis that global instability in the state, including caused by military aggression, leads to the need to adjust the existing mechanisms for monitoring the condition of economic security of the state.

Our bibliometric analysis, conducted using the tools of Google Analytics and Vosviewer v.1.6.18, allowed us to systematize research groups with important scientific achievements in the field of monitoring the state of economic security. The use of Vosviewer v.1.6.18 provided an opportunity to build bibliometric networks that summarize scientists and individual scientific publications in the field of the studied topics. These networks were formed on the basis of bibliographic communication and citations, as a result of which the generalized information became the basis of the list of key groups of literary sources of scientists who considered the problem under study.

The theoretical basis of this study was the system of scientific provisions in the fields of economic theory, strengthening economic security at the state level, strategic

management, theories of international relations, and development theory.

To solve the above-mentioned problems, our paper uses system-structural analysis and synthesis – to identify important indicators of the state of each of the economic security subsystems. Aspects of the system-structural nature of economic security arose due to the expediency of finding out how the deviation of the level of each of its subsystems from optimal indicators affects the change in the overall level of security of the economic system of the state.

The method of scientific abstraction, dialectical and historical method are applied in the process of clarifying the essence of the category “monitoring the condition of economic security of the state”. Thus, the study of the processes of economic life provided an opportunity to single out the main features of this economic category, maximally abstracting from secondary categories.

The method of expert assessment is used to clarify the weighting coefficients for certain indicators of the condition of the subsystems of economic security of the state under conditions of global instability. For this analysis, the results of a survey of experts who were selected on the basis of place of work and the presence of a scientific degree were used. Important conditions for the application of this method are a significant level of awareness of the expert with the question under study, the level of erudition, as well as the ability to formulate clear answers. In addition, it was taken into account that the experts who participated in the survey were in no way interested in its results. After determining the numerical characteristic of the importance of each indicator, a “linear convolution” was used (weighted sum method, additive utility function).

To normalize indicators of the state of economic security, the normalization method was used – relative to the scope of variation. To determine the boundary values of a certain range of characteristic values of indicators of the state of economic security, methods were used: macroeconomic models, nonlinear dynamics, functional dependences, stochastic, methods of expert assessments, heuristic, legislative approach.

The abstract-logical method is used at all successive stages of transformation of mechanisms for monitoring the condition of economic security of the state under conditions of global instability. Through the application of the abstract-logical method, the essence of the economic category “monitoring of the state of economic security of the state” was formulated, the main hypothesis was put forward, and generalizations and conclusions were formed.

5. Results of transformation of mechanisms for monitoring the condition of economic security of the state under conditions of global instability

5.1. The results of the generalization of the conceptual foundations of monitoring the condition of economic security of the state

The main approved methodology for monitoring the condition of economic security of the state is presented in [21]. The document has an informational, explanatory, and recommendatory nature, respectively, it is not considered mandatory.

This methodology defines a list of indicators of the condition of economic security at the state level, ranges of values that are considered optimal, satisfactory and unsatisfactory,

dangerous and critical. These data are used in the process of applying the mechanism for determining the integral indicator of the level of economic security at the state level and its components.

Comprehensive monitoring of the condition of economic security of the state contributes to the identification of possible threats and further management decisions aimed at strengthening the security situation in the economic sector. In addition, the methodology is designed to monitor individual components of economic security in order to analyze, prevent, and neutralize real and potential threats in the economic sector of the state.

The economic security of the state is characterized by a set of nine indicators, which is advisable to highlight in the form of a vector $\vec{ES}_j = \{x_{1j}, x_{2j}, x_{3j}, x_{4j}, x_{5j}, x_{6j}, x_{7j}, x_{8j}, x_{9j}\}$.

To monitor the condition of economic security of the state, it is necessary to assess the status of its constituent elements (integral indices), based on the results of the analysis of the values of indicators selected according to the principles of information accessibility, reliability, and representativeness. Some of the indicators are statistical data on different sectors of the economy while the other part is the results obtained using the method of expert assessment.

A thorough analysis of the indicators of the condition of economic security of the state provides grounds to conclude about the degree of influence of internal and external threats on this complex system and the creation of favorable ones for its balanced development. In addition, the results of this analysis signal not only the condition of economic security subsystems but also the specifics of the appropriate level of management (households, business entities, sectors of the economy, regions, and the state as a whole).

All indicators of the condition of economic security at the state level are multidirectional and have different dimensions, therefore, after direct calculation, the results obtained should be brought to information unidirectionality and a single dimension of interpretations. This process occurs through the normalization of indicators, namely their transfer to the range of [0,1] – into dimensionless values. This is necessary, firstly, to ensure a common understanding of the results obtained and the possibility of comparing them, and secondly, due to the fact that the components of the vector must be dimensionless quantities. Normalization can occur by various methods, which are mainly based on comparing the calculated values of indicators with constant indicators (optimal, threshold, minimum or maximum levels).

In the Methodology [21], to normalize indicators of the condition of economic security, it is recommended to apply the normalization method – relative to the scope of variation (1):

$$S: y_{ij} = \frac{x_{ij} - x_{\min}}{x_{\max} - x_{\min}}; \quad D: y_{ij} = \frac{x_{\max} - x_{ij}}{x_{\max} - x_{\min}}, \quad (1)$$

where S is the indicator-stimulant;

D – indicator-destimulant;

y_{ij} – dimensionless value of the i -th indicator of the condition of economic security in j period;

x_{\max}, x_{\min} – limit values of the i -th indicator of the condition of economic security in a specific range of characteristic values.

To determine the limit values of a certain range of characteristic values of indicators of the condition of economic security, methods are used: macroeconomic models; nonlinear dynamics; functional dependences; stochastic; methods of expert assessments; heuristic; legislative approach, and others.

For each of the indicators, weighting coefficients are also determined – a numerical characteristic of its importance in comparison with other indicators in the process of calculating subindexes of the condition of economic security. Thus, with the help of weighting coefficients, dimensionless values of indicators are summarized in the integral value of subindexes.

Most often, the numerical characteristic of the importance of a particular indicator is determined using rather subjective methods of expert assessments (for example, the method of pairwise comparisons). This can significantly reduce the effectiveness of monitoring the condition of economic security of the state under conditions of global instability. Thus, the numerical characteristics of the importance of a certain indicator should be systematically revised under conditions of global instability, critical changes in the economic situation, and structural changes in the national economy. This will make it possible to take into account the current condition of the economic system of the state and timely adjust the weighting factors, taking into account the influence of new factors.

After determining the numerical characteristic of the importance of each indicator, a “linear convolution” is applied through the use of the weighted sum method, an additive utility function (2):

$$ES_j = \sum_{i=1}^n a_i y_{ij},$$

where

$$\sum_{i=1}^n a_i = 1, \text{ and } a_i \geq 1, \quad (2)$$

where ES_j is the level of economic security at the state level in the period j ;

a_i – numerical characteristic of the importance of the i -th indicator of the condition of economic security.

Thus, the generalization of the conceptual foundations for monitoring the condition of economic security of the state made it possible, among other things, to systematize the existing shortcomings of the basic methodology, which should be taken into account under the conditions of global instability of the state’s economic system.

5. 2. Results of the modification of the methodology for assessing the economic security of the state under conditions of global instability

The following are contradictory aspects of the process of monitoring the condition of economic security of the state in the face of global instability for practical application:

1. The expanded list of indicators of the condition of economic security complicates the process of monitoring the security situation and can be used as a base only for calculating the annual integral indicator. The implementation of operational analysis is almost impossible due to the approved frequency of publication of most of the proposed indicators and the specifics of the indicators used.

2. The recommendatory nature of the methodological approach actually devalues the results of the analysis obtained in the process of its application. Adjustment of the national security strategy and strategy for ensuring its components occurs without necessarily taking into account the results of the analysis of the condition of economic security.

3. The state of the shadow economy in the process of determining the condition of economic security of the state

is almost not taken into account. Thus, the indicator of the volume of withdrawn capital is calculated using a simplified method, solely on the basis of data from national accounts. Given the shadowing of the economy and its significant impact on the level of economic security of the state, this disadvantage is significant.

4. The corruption component, as well as the level of shadowing of the state's economy, is not taken into account in the process of calculating the condition of economic security. The level of perception of corruption significantly affects the condition of economic security of the state, respectively, this aspect should be presented among the indicators that signal the condition of economic security of the state.

5. The above list of indicators excludes the possibility of their use as a basis for comparing the condition of economic security of the regions.

One of the key points of tectology is the statement that the stability of the system depends on the stability of its weakest link. Therefore, it is appropriate to conclude that in the process of monitoring the condition of economic security it is necessary, firstly, to systematically analyze the indicators of its subsystems, internal and external threats. Secondly, it is important to draw a conclusion about their synergistic influence on the level of economic security of the state. Thirdly, it is imperative to identify indicators, the values of which signal the criticality of the dynamics of the development of certain components of economic security, the negative trends of which can have a significant impact on the development of other subsystems.

Thus, high-quality monitoring of indicators of the condition of economic security and identification of the weakest points in its subsystems will make it possible to form strategic directions for strengthening the economic security of the state. These directions will be the minimum priority actions that will lead to the planned result. The use of this principle, which is more appropriate to perceive as a guide in highlighting important threats to the condition of economic security and directions for its strengthening, allows us to conclude that the measures of influence on the expected result are unevenly contributed.

Along with the principle of "weak link", it is appropriate to take into account the principle of «strong link», which contains statements about improving the efficiency of systems through the use of strengths. It is also appropriate to apply the principle of "critical" link, that is, the selection of the characteristics of the economic security system, which has a decisive influence on its level. Thus, the critical link can be both weak and strong, the main thing is that its influence should be more significant than others.

The purpose of the expert assessment in the form of a standardized interview was to summarize information on trends in the development of certain areas of the state's economy, to identify external and internal threats to its security, to clarify the hierarchy of influences, as well as regulatory measures. The information formed as a result of the analysis of the obtained data made it possible to summarize proposals for improving the methodology for assessing the condition of economic security of Ukraine and its components.

Based on the identified contradictory aspects of the process of monitoring the condition of economic security and the existing conditions of global instability, the directions of transformation of the methodology for monitoring the condition of economic security of the state for its practical application are proposed, including:

1. Compliance with the condition of timely revision of the values of weighting coefficients, which numerically characterize the importance of a particular indicator in comparison with other indicators of the condition of economic security. This recommendation should be taken into account by taking into account the principle of a critical link, that is, the selection of indicators of the condition of economic security, the value of which has a decisive influence on its level.

2. In the process of determining the weighting factors of indicators, the replacement of subjective expert assessments in favor of objective methods (the method of the main components; game methods; modeling methods). The application of the method of expert assessments, taking into account certain limitations and features, provides results that, however, cannot be considered completely objective.

3. Systematic updating of the list of indicators of the condition of economic security, taking into account the principle of "critical" link, structural changes in the state economy and the existing conditions of global instability. The methodology [21] notes that the revision of a set of indicators of the condition of economic security, as well as the intervals of their values, should occur if necessary, but at least 1 time in 5 years. At the moment, no changes have been made to the methodology of 2013. Accordingly, the set of changes in the national economy requires certain adjustments in the established methodology.

The system of indicators of economic security cannot be sustainable, it must be changed and supplemented both in terms of the set of indicators and in relation to their threshold values and weighting coefficients. The system of indicators of economic security should be based on the principles of complexity, adequacy, consistency, continuity, hierarchical and unambiguous.

In the process of assessing the state of debt security in the system of economic security, it is additionally advisable to analyze the following indicators:

- the ratio of the volume of payments for debt servicing to the income of the state budget (now this indicator is considered in the subsystem of budget security);
- the ratio of external debt to annual exports;
- the ratio of the cost of debt servicing to annual exports and GDP;
- the share of short-term public debt in its total amount;
- the ratio of international reserves to short-term public debt.

It is also proposed to consider as an indicator of the state of debt security in the system of economic security of the state an indicator of the long-term sovereign credit rating of the state rating by the agency Standard & Poor's. Given that the proposed indicator is a stimulant, respectively, its ranges of values and compliance with their normalized indicators are as follows:

- optimal range: AAA – 1.0; AA+ – 0.92; AA – 0.87; A – 0.82;
- satisfactory range: A+ – 0.8; A – 0.7; A– – 0.62;
- unsatisfactory range: BBB+ – 0.6; BBB – 0.5; BBB – 0.42;
- dangerous range: BB+ – 0.4; BB – 0.37; BB– – 0.33; B+ – 0.30; B – 0.25; B– – 0.22;
- critical range: CCC+ – 0.2; CCC – 0.17; CCC– – 0.15; CC – 0.10; C – 0.05; D – 0.

4. Given the nonlinearity of economic processes, the use of a multiplicative form of the integral indicator of the condition of economic security (3) instead of the additive form:

$$ES_j = \prod_{i=1}^n y_{ij}^{a_i},$$

where

$$\sum_{i=1}^n a_i = 1, \text{ and } a_i \geq 1. \tag{3}$$

The use of a multiplicative form of an integral indicator of the condition of economic security avoids compensating for the value of the integral indicator for individual indicators at the expense of others.

5. Application of the method of reference coefficient (4) instead of the method of normalization relative to the scope of variation (1):

$$S: y_{ij} = \frac{x_{ij}}{k}, \quad k \geq x_{\max}; \quad D: y_{ij} = \frac{k}{x_{ij}}, \quad k \leq x_{\min}. \tag{4}$$

The method of normalization relative to the scope of variation does not fully characterize the variation of the trait. This is explained by the fact that this method does not take into account the frequencies and all values of the trait under study and are intermediate between the limits in a certain range of characteristic values. Accordingly, the range of variation depends on the threshold values of the range, but these values may not be typical enough, which will lead to a narrowing of the scope of practical application of the indicator of the scope of variation.

6. The use of a methodical approach to the express analysis of the condition of economic security, which is based on an abbreviated list of indicators of economic security, will make it possible to simplify the process of monitoring the state of security.

5. 3. Results of assessing the condition of economic security of the state in the context of its structural parts

Taking into account the fact that the integral value of the state’s economic security contains generalized indices for its 9 subsystems, the dynamics of the state of indicators of the state’s energy security as a critical subsystem for 2015–2021 were analyzed (Table 1).

Throughout the entire study period 2015–2021, the value of the indicator “The share of own sources in the balance of fuel and energy resources of the state” corresponds to the range of values [60; 70], which is considered an unsatisfactory range of values. The level of import dependence on the dominant resource in the total supply of primary energy during 2020–2021 corresponds to the range of optimal values. Depreciation of the main production assets of enterprises of the fuel and energy complex for 2018–2021 exceeds 60 %, which indicates compliance with the critical level and is considered as one of the weakest links in this subsystem of economic security of the state. A similar situation was recorded with the indicator “The ratio of investments in enterprises of the fuel and energy complex to GDP”. The value of the indicator “Coal reserves”, which as of the end of 2021 corresponds to only 0.4 months of consumption, is also critical. The share of losses during transportation and distribution in energy consumption varies in the range of [3.5; 4.2], although 2 % is the maximum value of the critical level, that is, the recorded values indicate extremely dangerous values of the indicator.

The dynamics of the status of indicators of investment and innovation security of the state in the system of its economic security are given in Table 2.

Table 1

Dynamics of the status of indicators of energy security of the state in the system of its economic security

Years/Energy Security Indicator, %						
2015	2016	2017	2018	2019	2020	2021
The share of own sources in the balance of fuel and energy resources of the state, %						
65.0	68.2	60.7	63.5	61.0	64.4	64.4*
The level of import dependence on the dominant resource in the total supply of primary energy, %						
48.8	34.2	43.8	32.8	42.3	22.5	29.9
The share of fuel imports from one country (company) in the total volume of its imports, %						
34.1	24.5	28.5	32.9	33.3	31.4	24.0
Depreciation of fixed production assets of enterprises of the fuel and energy complex, %						
82.6	62.1	57.0	73.7	68.9	69.9	68.0
The ratio of investments in enterprises of the fuel and energy complex to GDP, %						
1.20	1.30	0.97	0.98	1.42	0.86	0.90
Natural gas reserves, months of consumption						
4.90	4.00	5.20	5.20	8.10	8.70	5.60
Coal reserves, months of consumption						
1.70	0.90	0.90	0.80	1.30	0.80	0.40
The share of renewable sources in the primary energy supply						
3.00	3.90	4.40	4.60	4.90	6.60	6.60*
Share of losses during transportation and distribution in energy consumption, %						
3.70	3.70	3.50	3.80	4.10	4.20	4.20*

Source: calculated and summarized by authors according to procedure from [21] and data from [22]. * – the data can be clarified because according to the guidelines for indicators that have a frequency of publication once a year, or are published with a time delay, the last available values can be used

Table 2

Dynamics of the status of indicators of investment and innovation security of the state in the system of its economic security

Years/Indicator of investment and innovation security, %						
2015	2016	2017	2018	2019	2020	2021
Gross accumulation of fixed capital, % of GDP						
13.5	15.5	15.8	17.6	17.6	13.4	12.4
The ratio of the value of newly introduced fixed assets to the volume of capital investments, %						
79.3	56.3	53.0	52.9	70.1	89.7	89.7*
Investment favorability index of the business environment						
48.7	52.0	55.2	56.6	56.8	50.3	50.3*
The ratio of net growth of foreign direct investment to GDP, %						
-0.1	4.10	3.30	3.40	3.40	-0.04	3.44
The ratio of loans granted to non-financial corporations and households for the purchase, construction and reconstruction of real estate (cumulatively) in % of GDP						
2.60	2.60	1.90	2.10	1.60	1.20	0.90
The size of Ukraine's economy, % of world GDP						
0.12	0.12	0.14	0.15	0.18	0.18	0.18*
Share of scientific, research and technical works performed in GDP, %						
0.55	0.48	0.45	0.47	0.43	0.41	0.41*
Internal expenditures on the implementation of research at the expense of the state budget, % of GDP						
0.20	0.16	0.16	0.17	0.17	0.17	0.17*
Number of specialists performing scientific and technical work up to the number of employed population (per 1000 people)						
6.17	4.58	4.24	4.05	3.53	3.68	3.68*
The share of enterprises that introduced innovations in the total number of industrial enterprises, %						
15.2	16.6	14.3	15.6	13.8	14.9	14.9*
The share of innovative products sold in the volume of industry, %						
1.40	1.40	0.70	0.80	1.30	1.90	1.90*
The ratio of exports of royalties, licensed services, computer and information services, scientific and design developments, services in architectural, engineering and other technical industries to GDP, %						
2.40	2.50	2.50	2.70	3.00	3.50	3.70
The proportion of people who reported that they have used Internet services over the past 12 months (household survey)						
49.0	53.0	59.0	63.0	70.0	76.0	80.0

Source: calculated and summarized by authors according to procedure from [21] and data from [22]. * – the data can be clarified, because according to the methodological recommendations for indicators that have a frequency of publication once a year, or are published with a time delay, the last available values can be used

Similarly, the values of indicators for other subsystems of economic security of the state for 2015–2021 are calculated and analyzed. The level of financial security of the state in terms of components is summarized in Table 3.

Based on the results of the modification of the methodology for assessing the economic security of the state under conditions of global instability, the level of economic security is calculated, integral, and for individual components (Table 4).

The results of the calculation of the integral indicator of economic security of the state for 2007–2021 are highlighted in Fig. 1.

Table 3

The level of financial security by components

Years/Financial security component, %						
2015	2016	2017	2018	2019	2020	2021
Budget security						
59	59	50	56	52	46	48
Debt security						
12	16	19	21	27	24	30
Currency security						
42	50	59	65	65	68	70
Monetary security						
43	48	54	48	39	35	39
Banking security						
17	21	23	38	27	31	25
Security of the out-of-bank financial market						
37	32	31	34	35	31	31
General calculated financial security index						
35	38	40	45	42	40	41

Source: calculated and summarized by authors according to methodology from [21] and data from [22] taking into account the results of modification of the methodology for assessing the economic security of the state under conditions of global instability

Table 4

The level of economic security: integral and in terms of individual components, %

Years/Economic Security Component						
2015	2016	2017	2018	2019	2020	2021
Production safety						
47	56	59	58	57	54	51
Demographic security						
43	46	41	41	39	40	37
Energy security						
45	58	54	53	49	48	48*
Foreign economic security						
37	40	36	36	40	41	42
Investment and innovation security						
35	30	30	31	31	31	31*
Macroeconomic security						
31	36	37	40	45	44	41
Food security						
92	92	91	90	89	86	88
Social security						
55	54	59	59	60	62	62*
Financial security						
35	38	40	45	42	40	41
Integral indicator of the level of economic security						
44	47	48	49	49	48	47*

Source: calculated and summarized by authors according to methodology from [21] and data from [22], taking into account the results of modification of the methodology for assessing the economic security of the state under conditions of global instability. * – the data can be clarified because according to the methodological recommendations for indicators that have a frequency of publication once a year, or are published with a time delay, the last available values can be used

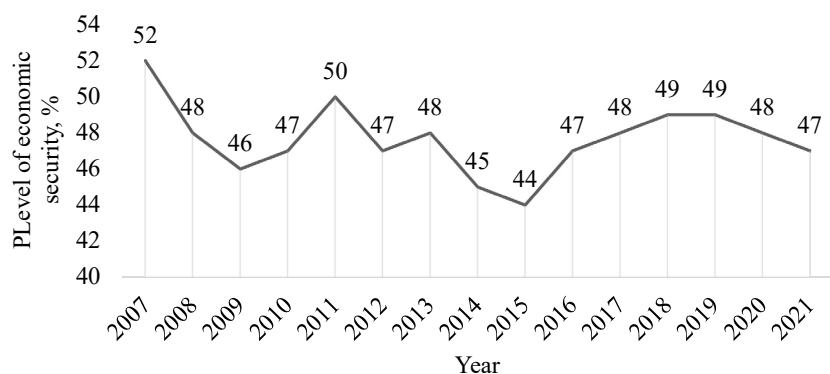


Fig. 1. Dynamics of the integral indicator of the level of economic security of the state

Thus, the results of the calculated integral level of economic security show that during 2018–2021 the level of economic security of the state tends to decrease.

6. Discussion of results of the transformation of mechanisms for monitoring the condition of economic security of the state under conditions of global instability

The basic methodology for assessing the condition of economic security of the state is of a recommendatory nature, in addition, it is extremely difficult to apply it to monitor the condition of economic security of individual

regions. Among the main shortcomings is also highlighted the presence of problems with the implementation of operational assessment since most of the indicators are quite specific. The use of the additive form of calculation of the integral indicator of economic security and the subjectivity of the process of determining the weight of each of the indicators also form additional shortcomings in the process of monitoring the condition of economic security of the state.

Directions for improving the methodology for assessing the economic security of the state are proposed, including:

- use of an express approach to the analysis of the condition of economic security of the state, which is based on an abbreviated list of indicators of economic security and simplifies the process of timely monitoring of the security situation;
- systematic revision of the weighting factors of indicators of the condition of economic security and the corresponding expansion of the list of methods on the basis of which they are determined, by reducing the use of subjective expert assessments in favor of more objective methods;
- updating the list of indicators of economic security of the state, taking into account structural changes in the state economy;
- use of the multiplicative form of the integral index of economic security instead of the additive form (3);
- application of the method of reference coefficient (4) instead of the method of normalization relative to the scope of variation (1);
- expansion of the methodology for normalization indicators of economic security of the state through the establishment of methods based on the use of the reference coefficient or limit values of certain indicators in a certain period of research. Such methods of normalization should vary depending on the specifics of the indicator and the peculiarities of structural changes in the state’s economy.

Our results of the study on the transformation of mechanisms for monitoring the condition of economic security of the state under conditions of global instability indicate the need to continue scientific research in this area.

In a thorough work [1], debt and investment management strategies in the financial crisis are considered, and the authors of study [2] summarized financial security data on 150 countries for the period of 1960–2014. Continuing the research of the authors of [1, 2], the condition of financial security of the state as an important component of its economic security was assessed (Table 3). An important result of this monitoring is the conclusion about the existing trends in the deterioration of the budget, monetary and security of

the non-bank financial market for the period 2015–2021. Thus, it is these subsystems of financial security that should be considered as sources of “weak link” in the field of ensuring the financial security of the state.

In [7], the conclusions concerning the construction of an innovative strategy for its development as the basis for ensuring economic security are obtained, and work [8] considers how innovative products and services contribute to the sustainable development of society and ensure economic security. The logical continuation of the research [7, 8] was the results of monitoring the state of indicators of investment and innovation security of the state in the system of its economic security (Table 2). It was found out that the share of scientific work performed in GDP decreased from 0.55 % in 2015 to 0.41 % in 2021, which corresponds to the range of absolutely dangerous values of the condition of economic security of the state. A similar situation was recorded in relation to the dynamics of the values of the indicator “The ratio of expenses for scientific, research and technical work at the expense of the state budget”. Its significance during 2015–2021 is in the range of [0.16; 0.20], which indicates a critical state of development of this link in the system of ensuring the economic security of the state. In addition, it was found out that in 2015 there were more than 6 people per 1000 people who performed scientific and technical work while according to the results of 2021, this number decreased to 3 people. Our conclusions confirm and continue the results of research [17, 18], which began consideration of the factor of technological regulation and its impact on the level of economic security.

Interesting scientific results in the field of the studied topics were obtained by the authors of article [14], in which the attention of scientists is directed to the impact of global crises and social upheavals, including the level of economic security of the state. The authors emphasize that the collective solution of future problems requires the interaction of regional players in science, economics, society, administration, and the environment. In the study, monitoring of the condition of economic security (Table 4) was carried out for the period of 2015–2021. Thus, the results of full-scale hostilities on the territory of Ukraine have not yet been reflected in the results of the assessment of the condition of economic security of the state. However, preliminary calculations allow us to make assumptions about the presence of critical negative changes in the indicators of various subsystems of economic security of the state. These changes are caused by military aggression against Ukraine and global economic instability in the state. This is planned to be investigated and confirmed in future scientific studies.

At the same time, there are certain limitations in this study. In particular, in the process of monitoring the condition of economic security of the state under conditions of global instability, it is recommended to apply an express analysis of the condition of economic security of the state with an abbreviated list of indicators. Nevertheless, in a situation of economic stability, it is advisable to apply the classic, most complete set of indicators of the condition of economic security of the state. In this situation, the list of input indicators should be adjusted.

In addition, in this study, indicators of the state of food security of the state as an important component of economic security are calculated and evaluated in accordance

with the methodology from [21]. This fact can be considered as a certain disadvantage of this study since a set of indicators of the state of food security needs to be revised to take into account changes in the external situation. This problem will be discussed in our subsequent publications as it requires deep scientific understanding and thorough consideration.

Non-standard factors influencing the condition of economic security of the state, such as the long-term pressure of the COVID-19 pandemic and full-scale hostilities in Ukraine, are difficult to predict. Therefore, the process of ensuring the economic security of the state should be revised taking into account these factors. This is the direction of future research, which has a powerful potential for scientific work in the future. To a certain extent, the proposed directions of transformation of mechanisms for monitoring the condition of economic security of the state under conditions of global instability are available for practical use by all interested parties.

7. Conclusions

1. During the generalization of the conceptual foundations of monitoring the condition of economic security of the state, the methodology for assessing the condition of economic security of the state was comprehensively considered. It was found that this category contains generalized integral indices of nine subsystems: financial, food, foreign economic, energy, demographic, social, industrial, investment and innovation, macroeconomic. The list of indicators of the condition of economic security at the state level of state was considered, ranges of values that are considered optimal, satisfactory and unsatisfactory, dangerous, and critical. Given that all indicators of the condition of economic security are multidirectional and have different dimensions, after calculating them, the results obtained should be brought to information unidirectionality. This process occurs through their normalization, that is, the conversion to dimensionless values in the range of [0, 1].

The methods by which the following can be carried out are systematized:

- normalization of indicators (normalization method – relative to the scope of variation; method of reference coefficient);
- determination of threshold values of a certain indicator (functional dependences; macroeconomic models; stochastic; nonlinear dynamics; heuristic; legislative approach; methods of expert assessments);
- calculation of weighting coefficients, which numerically describe the importance of a particular indicator in comparison with other indicators (method of expert assessments; method of sensitivity theory; game methods; method of main components; modeling methods);
- methods for calculating the integral indicator of the state of financial security (method of weighted amounts (additive utility function); multiplicative form of the integral indicator).

2. Taking into account the results of the expert assessment, it was proposed for practical application of the direction of modification of the methodology for assessing the economic security of the state under conditions of global instability, among which the main ones are:

- systematic review of the values of the weighting coefficients of indicators of the condition of economic security of the state, taking into account the principle of “critical” link;
- giving preference to objective methods in the process of determining the quantitative values of the weighting coefficients of indicators of the condition of economic security (game methods; method of main components; modeling methods) and gradual reduction of subjective expert assessments in the process of such calculations;
- updating the list of indicators of the condition of economic security, taking into account structural changes in the state economy, the existing conditions of global instability and the principle of “critical” link;
- use of the multiplicative form of the integral index of economic security instead of the additive form;
- application of the method of reference coefficient instead of the method of normalization relative to the scope of variation;
- use of a methodical approach to the express analysis of the condition of economic security of the state, which is based on an abbreviated list of indicators of economic security and will provide an opportunity to simplify the process of monitoring the security situation under conditions of global instability.

3. The condition of economic security of the state in the context of its structural parts is comprehensively assessed, taking into account the directions of modification of the

methodology for assessing the economic security of the state under conditions of global instability proposed for practical use. The existing trends of deterioration of the state of demographic, investment-innovation, macroeconomic subsystem of economic security for the period of 2015–2021 were recorded. Thus, it is these subsystems of economic security (along with food and energy subsystems of global importance) that should be considered as sources of “weak link” in the field of ensuring the economic security of the state.

Conflicts of interest

The authors declare that they have no conflicts of interest in relation to the current study, including financial, personal, authorship, or any other, that could affect the study and the results reported in this paper.

Funding

The study was conducted without financial support.

Data availability

All data are available in the main text of the manuscript.

References

1. Nkeki, C. I. (2018). Optimal investment risks and debt management with backup security in a financial crisis. *Journal of Computational and Applied Mathematics*, 338, 129–152. doi: <https://doi.org/10.1016/j.cam.2018.01.032>
2. Scheubel, B., Stracca, L. (2019). What do we know about the global financial safety net? A new comprehensive data set. *Journal of International Money and Finance*, 99, 102058. doi: <https://doi.org/10.1016/j.jimonfin.2019.06.003>
3. Scheubel, B., Stracca, L., Tille, C. (2019). Taming the global financial cycle: What role for the global financial safety net? *Journal of International Money and Finance*, 94, 160–182. doi: <https://doi.org/10.1016/j.jimonfin.2019.01.015>
4. Yang, B. (2020). Construction of logistics financial security risk ontology model based on risk association and machine learning. *Safety Science*, 123, 104437. doi: <https://doi.org/10.1016/j.ssci.2019.08.005>
5. Davydenko, N., Bilyak, Y., Nehoda, Y., Shevchenko, N. (2020). Financial security for the agrarian sector of Ukraine. 21st International Scientific Conference “Economic Science for Rural Development 2020”. *Bioeconomy, Production and Co-Operation in Agriculture, Finance and Taxes, Rural Development and Entrepreneurship*. doi: <https://doi.org/10.22616/esrd.2020.53.007>
6. Yekimov, S., Poltorak, A., Dereza, V., Buriak, I., Purtov, V. (2020). The role and importance of financial results in the effective management of an agricultural enterprise. *E3S Web of Conferences*, 222, 06001. doi: <https://doi.org/10.1051/e3sconf/202022206001>
7. Valitov, S. M., Khakimov, A. Kh. (2015). Innovative Potential as a Framework of Innovative Strategy for Enterprise Development. *Procedia Economics and Finance*, 24, 716–721. doi: [https://doi.org/10.1016/s2212-5671\(15\)00682-6](https://doi.org/10.1016/s2212-5671(15)00682-6)
8. Kantola, J., Liu, Y., Peura, P., de Leeuw, T., Zhang, Y., Naaranoja, M., Segev, A., Huisingh, D. (2017). Innovative products and services for sustainable societal development: Current reality, future potential and challenges. *Journal of Cleaner Production*, 162, S1–S10. doi: <https://doi.org/10.1016/j.jclepro.2017.07.091>
9. Istipliler, B., Bort, S., Woywode, M. (2023). Flowers of adversity: Institutional constraints and innovative SMEs in transition economies. *Journal of Business Research*, 154, 113306. doi: <https://doi.org/10.1016/j.jbusres.2022.113306>
10. Sonnier, E., Grit, A. (2022). A narrative for circular economy in Cities: Conditions for a Mission-Oriented innovative system. *City and Environment Interactions*, 16, 100084. doi: <https://doi.org/10.1016/j.cacint.2022.100084>
11. Poltorak, A., Potryvaeva, N., Kuzoma, V., Volosyuk, Y., Bobrovska, N. (2021). Development of doctrinal model for state financial security management and forecasting its level. *Eastern-European Journal of Enterprise Technologies*, 5 (13 (113)), 26–33. doi: <https://doi.org/10.15587/1729-4061.2021.243056>
12. Poltorak, A., Khrystenko, O., Sukhorukova, A., Moroz, T., Sharin, O. (2022). Development of an integrated approach to assessing the impact of innovative development on the level of financial security of households. *Eastern-European Journal of Enterprise Technologies*, 1 (13 (115)), 103–112. doi: <https://doi.org/10.15587/1729-4061.2022.253062>

13. Donbesuur, F., Hultman, M., Oghazi, P., Boso, N. (2022). External knowledge resources and new venture success in developing economies: Leveraging innovative opportunities and legitimacy strategies. *Technological Forecasting and Social Change*, 185, 122034. doi: <https://doi.org/10.1016/j.techfore.2022.122034>
14. Waidelich, L., Kölmel, B., Bulander, R., Brugger, T. (2022). Approaching a regional innovation ecosystem in the Northern Black Forest for a future-orientated economy and society. *Procedia Computer Science*, 204, 253–260. doi: <https://doi.org/10.1016/j.procs.2022.08.030>
15. Szklarz, P., Klóska, R., Czyżycki, R., Ociepa-Kicińska, E. (2021). Do the innovative MNEs generate an added value in emerging economy? *Procedia Computer Science*, 192, 2180–2189. doi: <https://doi.org/10.1016/j.procs.2021.08.231>
16. Poltorak, A. S. (2015). Assessment of Ukrainian food security state within the system of its economic security. *Actual Problems of Economics*, 11 (173), 120–126. Available at: http://nbuv.gov.ua/UJRN/ape_2015_11_15
17. Ying, L., Li, M., Yang, J. (2021). Agglomeration and driving factors of regional innovation space based on intelligent manufacturing and green economy. *Environmental Technology & Innovation*, 22, 101398. doi: <https://doi.org/10.1016/j.eti.2021.101398>
18. Yegorova-Gudkova, T., Bojko, M., Neustroiev, Y., Khostash, O., Pan, L., Shepitko, H. et al. (2021). Development of an innovative methodology of research of systems on an example of a shadow economy as an invariant of system of economic security of state. *Technology Audit and Production Reserves*, 4 (4 (60)), 41–45. doi: <https://doi.org/10.15587/2706-5448.2021.239035>
19. Popova, A. (2019). Condition monitoring financial and economic security of Ukraine. *Visnik Zaporiz'kogo Nacional'nogo Universitetu. Ekonomichni Nauki*, 1 (41), 132–138. doi: <https://doi.org/10.26661/2414-0287-2019-1-41-23>
20. Kuzminska, O. (2021). The role of financial monitoring as a mechanism to control threats in the field of economic security of Ukraine. *Naukovi Pratsi NDFI*, 4, 106–123. doi: <https://doi.org/10.33763/npndfi2021.04.106>
21. Pro zatverdzhennia Metodychnykh rekomendatsiy shchodo rozrakhunku rivnia ekonomichnoi bezpeky Ukrainy. Nakaz Ministerstva ekonomichnoho rozvytku i torhivli Ukrainy vid 29.10.2013 r. No. 1277. Available at: <https://zakon.rada.gov.ua/rada/show/v1277731-13#Text>
22. Statystychna informatsiya. Derzhavna sluzhba statystyky Ukrainy. Available at: <https://ukrstat.gov.ua/>