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Created for scholars, research workers, postgraduates and students of higher education institutions, as well as for all those interested in the implementation of the Association Agreement.

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Integral Valuation of the System Efficiency of Economic Security of the Enterprise

In the conditions of intensification of modern globalization processes and scientific and technological progress, the negative influence of crisis phenomena on the development of entrepreneurial activity is observed. The modern business environment became a lot more difficult in comparison with previous years, resulting in new threats and risks, in addition to new opportunities. Under these conditions, in order to achieve the desired economic result, it is very important to correctly assess the economic situation for timely detection of possible negative trends and their neutralization. In view of this, increased attention should be paid to assessing the level of their own economic security of enterprises. This confirms the relevance of the choice of methodological approaches to assessing the systemic efficiency of economic security of enterprises in order to ensure their stable functioning under uncertainty. In order to understand the success of any system, a necessary condition is the use of a certain criterion, which demonstrates the degree of its adaptation to the conditions of the external and internal environment. Given the subject of this study - the system of economic security, we believe that such a criterion advisable to choose the systemic efficiency, which involves determining the effectiveness of the functioning of the selected functional components of the system. After all, it is believed that in the sixth technological way, the predominant concept of managing the economic activities of economic actors would be precisely efficiency management, instead of such topical processes as business management, production, market value of the enterprise, etc.

It should be noted that the widespread use of the category of "efficiency" is not based on generally accepted interpretations of tasks, conditions and restrictions on its application. In this regard, there are many thoughts about the nature, characteristics and ways of measuring it in different indicators. Thus, various scientists effectively understand the degree of achievement of the goal, the intensity of the functioning of the system, the level of its organization, the effectiveness or performance of certain business processes, the cost of the company. In addition, in most cases, the assessment of economic efficiency is limited only to the ratio of the expected or obtained result (effect) to the cost of its receipt (most often the cost of operating activities - cost approach, or to all resources used - resource approach) [1,2,3,4]. In this regard, it is important to remember the well-known principle of marginal economic efficiency V. Pareto, which involves determining the effectiveness of the level of organization of the economy, in which society gets the maximum benefit from available resources [5].

Thus, the problem of assessing the effectiveness of various business processes of the company and its sources, has always been one of the most

urgent issues of economic science. The first study of the concept of efficiency is devoted to the work of such prominent scholars as S. Brue, F. Ken, K.Mackonel, D. Ricardo and others. As stated in the paper [6], the theory of efficiency as an independent scientific direction was formed in the 1930s to solve the problems of mass service systems, to evaluate the results of certain processes, to optimize the allocation of resources, to study conflicts, and so on. On this basis, the principles of analysis and synthesis were formed, which subsequently became basic in the system approach. As part of these scientific areas, as well as the complement to the theory of economics and management theory, the theory of efficiency continued to develop.

In violation of the concept of the effectiveness of management, the author M. Klimov in 1981 noted that foreign and domestic scientists are only beginning to seek approaches to the essence, criteria, indicators and efficiency factors. The search for a solution to this problem is aimed at finding a correlation between quantitative and qualitative, objective and subjective indicators. At the same time, some of these indicators can be measured in physical or cost units, and part - to estimate only approximately (moral values, level of satisfaction of needs, etc.) [7]. As I. Gontarev rightly points out "... the variety of environmental parameters and the system itself, the instability of these parameters in time, the presence of a large number of direct and indirect, positive and negative connections in the system does not allow us to find a fairly simple mathematical description that complicates the understanding of the essence such an important category in economics as efficiency " [8].

It should be noted that the feature of modern studies of economic processes is the need to take into account such trends as accelerating the scientific and technological process, the development of innovation and the formation of an information society, which increases the level of intellectualization of production as a result of the emergence of new knowledge, the development of human intelligence, the introduction of new information technologies and telecommunications. It interdepends with social and economic factors of development, which certainly requires taking into account both economic and social indicators during the evaluation of systemic efficiency. After all, in accordance with modern methods of evaluating the efficiency of the operation of enterprises, priority is given to the indicators of the quality of working life, the degree of satisfaction with the work of the staff, their professional qualification level, along with the typical indicators of assessing the financial condition.

In view of the above, the assessment of the system effectiveness of such a multifunctional mechanism as the enterprise's economic security should include a set of partial assessments that will meet its functional constituents. It is worth to note that at the current stage of development important and universal functional components for any enterprise, along with financial security, also have information, personnel and innovation and investment

security. It should be noted that selected subsystems of economic security of the enterprise are different in essence and function, but achieving the appropriate level of security of each of them will contribute to ensuring integral efficiency and achieving the overall goal of sustainable operation of the enterprise in an unstable economic environment. As a result of this, as is precisely stated in [8], the causal relationships of the processes of functioning and development of a unified system provide systemic characteristics, namely, the effects of emergence (new properties of the effect) and symmetricity (additional or supportive effect). In this case, all types of efficiency are interrelated and interdependent, that is, the change of any of them serves as the cause and effect of changing another. For example, innovation-investment efficiency depends on the results of scientific and technological progress and the degree of readiness of the enterprise to introduce innovations, while the effectiveness of innovative achievements is impossible without informational, personnel and financial efficiency.

Consequently, if the assessment of the efficiency of an enterprise's economic security system is based on only one of the subsystems selected (for example, financial as the easiest to measure and analyze based on the use of indicators for assessing the financial position of an enterprise), then the integral system efficiency will be incomplete and imperfect as a result of non-inclusion the effectiveness of other functional subsystems. After all, the complex (integral) efficiency of the system of economic security of the enterprise almost never coincides with the sum of its local effects (efficiency of functional subsystems). In this case, the authors agree with I. Gontarev's view that "the heterogeneity of local effects, their differences in the nature of occurrence and the principles of reproduction complicate the understanding of system efficiency and the formation of a comprehensive assessment. Moreover, it is not always clear how the system will behave in one or another situation, in particular fluctuations in the external environment or innovations in any field of activity. Consequently, systemic efficiency is the higher, the more the overall effect exceeds its partial components (positive synergy)" [8].

Thus, taking into account the foregoing, under the estimation of system efficiency of economic security of an enterprise we will understand the process of determining the levels of safety of its functional components and integral indicator on the basis of a choice of aggregate of indicators that are the most optimal for assessing the information, financial, personnel and innovation and investment security of the enterprise, and also the identification of quantitative and qualitative result (effect). In this case, the components of the system efficiency of economic security of enterprises are: performance, which shows the correspondence of actual results and planned values; rationality, reflecting the relation of the target effect (purpose) to the resources necessary for its achievement; efficiency as the amount of time that is needed to achieve the goal.

It should be noted that the analysis of existing methodological approaches to assessing the level of economic security of an enterprise allows us to state that almost each of them is based on the choice of a set of indicators of the enterprise, the composition of which is ambiguous and insufficiently justified for specific methods. In addition, the above methods of calculating indicators use critical or threshold values, within the magnitude of the deviation of which the necessary condition is the gradation of levels of economic security of the enterprise for its qualitative evaluation. Also, the problem aspect is the availability of the source information base, since for the calculation of most economic and financial indicators, data can be obtained from standard or specialized statistical reporting, but there remains a set of indicators (this applies, for example, resource-functional approach), which computes additional information. Often, the information processed is controversial or duplicated, since it is based on the use of different sources [9]. In addition, some methods of assessing the company's economic security cannot be used in the context of the closed information about competitors and partners, which requires in-depth studies of alternative valuation methods [10]. In this regard, from the point of view of the effectiveness of the practical application, we consider that the most optimal option is to use a method that synthesizes several approaches at once, which will allow you to obtain the most accurate results with minimal deviations from the real state regarding the level of economic security of the enterprise.

A prerequisite is the establishment of a list of requirements that the methodology for assessing the systemic efficiency of an enterprise should comply with, namely: the sectoral affiliation of the enterprise (taking into account the sector specifics of the functioning of the enterprise and the main functional components in the structure of its economic security); information accessibility (use of official statistics, company reports and public expert assessments); representativeness (selection and display of the most significant indicators for each functional subsystem that affect the level of economic security of the enterprise); dynamism (taking into account the cyclic factor in the functioning of the enterprise and its impact on external and internal economic conditions); integral decomposition (the possibility of solving one complex task by its allocation to the required number of more simple and interrelated tasks). Indeed, as it is rightly noted in [8, p. 273], "Efficiency is a multicomponent and complex property, for obtaining the characteristics of which it is necessary to divide (decompose) into more simple properties, to present simple properties through singular (partial) parameters (parameters), to form a complex index of complex property. For the formation of a system-wide efficiency criterion, the collapse of complex indicators into one integral is required."

Taking into account the foregoing, we will present an algorithm for the integrated assessment of the systemic efficiency of the enterprise's economic security, consisting of the implementation of successive stages (Fig. 1).

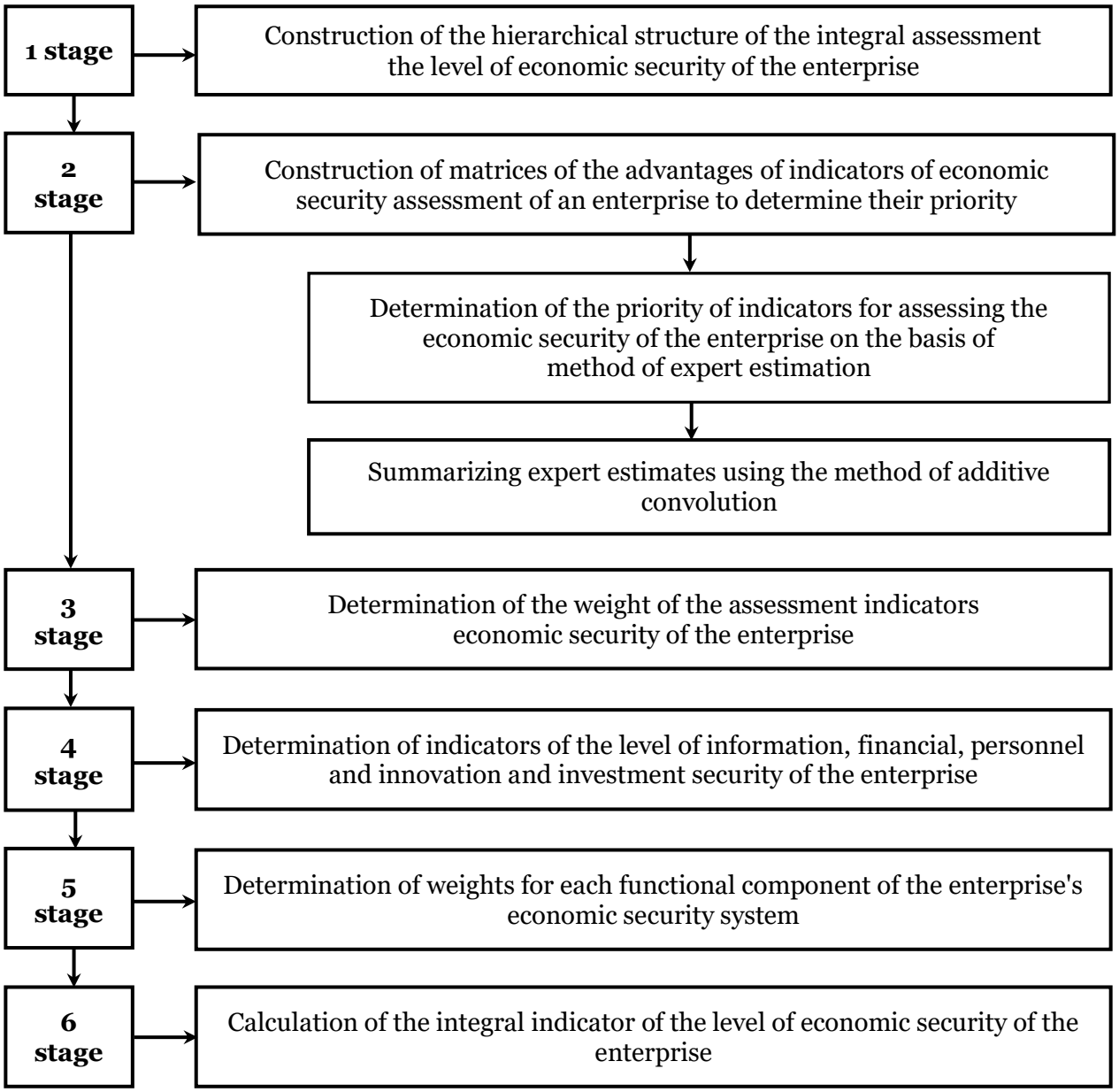

Fig. 1 Algorithm of integral estimation of system efficiency of economic security of the enterprise

Implementation of the first stage consists in the construction of a hierarchical structure of the integrated assessment of the level of economic security of the enterprise by selecting indicators for evaluating its functional subsystems. An overview of the literature on assessing the level of economic security of the enterprise [11,12] shows that in most research studies, the focus is on the study of purely financial indicators that can be calculated using financial statements. However, we believe that financially oriented system of indicators does not fully cover the functioning of the enterprise's economic security system and the analysis of the effectiveness of all its functional components.

Hence, the development of an effective system of indicators is a complex methodological problem, since their quantity and quality should be aimed at obtaining balanced information on the state of the security of each functional component of the enterprise's economic security system on the basis of compliance with the actual and normative values of these indicators. In this regard, the choice of indicators for assessing the economic security of enterprises should comply with the following principles:

– complexity - a set of indicators should be sufficient to fully characterize all components of the economic security of the enterprise;

– measurability - the indicators should be realistic to calculate and provide the possibility of obtaining reliable information;

– information simplicity - the calculation of indicators should be based on existing official documents and reporting of the enterprise, the results of expert assessments;

– uniqueness - indicators should not reflect the same characteristics of the subsystems of economic security and functionally dependent on each other;

– normalization - the possibility of bringing the selected indicators to isomorphic form, that is, to the same orientation and units of measurement.

Taking into account these principles and selected functional subsystems of the enterprise, the next step is the choice of indicators for assessing the information, financial, personnel and innovation-investment security, which should be carried out individually for a particular enterprise, taking into account the sectoral affiliation and the specifics of its activities. On the basis of the choice of these indicators, it is possible to construct a hierarchical structure of the integral estimation of the system efficiency of the enterprise's economic security, consisting of the following levels (Fig. 2):

– the first level - an integral indicator of the level of economic security of the enterprise:

$$L_{ESE} = \bigcup (L_{IS},\ L_{FS},\ L_{PS},\ L_{INS}) \tag{1}$$

– the second level – indicators of assessing the levels of economic security of the enterprise by functional subsystems:

– the level of informational security:

$$L_{IS} = \bigcup (K_1,\ K_2,\ K_3 \dots K_n) \tag{2}$$

– the level of financial security:

$$L_{FS} = \bigcup (K_4,\ K_5,\ K_6 \dots K_m) \tag{3}$$

– the level of personnel security:

$$L_{PS} = \cup\ (K_7,\ K_8,\ K_9 \dots\ K_p) \tag{4}$$

– the level of innovation and investment security:

$$L_{INS} = \bigcup\ (K_{10},\ K_{11},\ K_{12} \dots\ K_l) \tag{5}$$

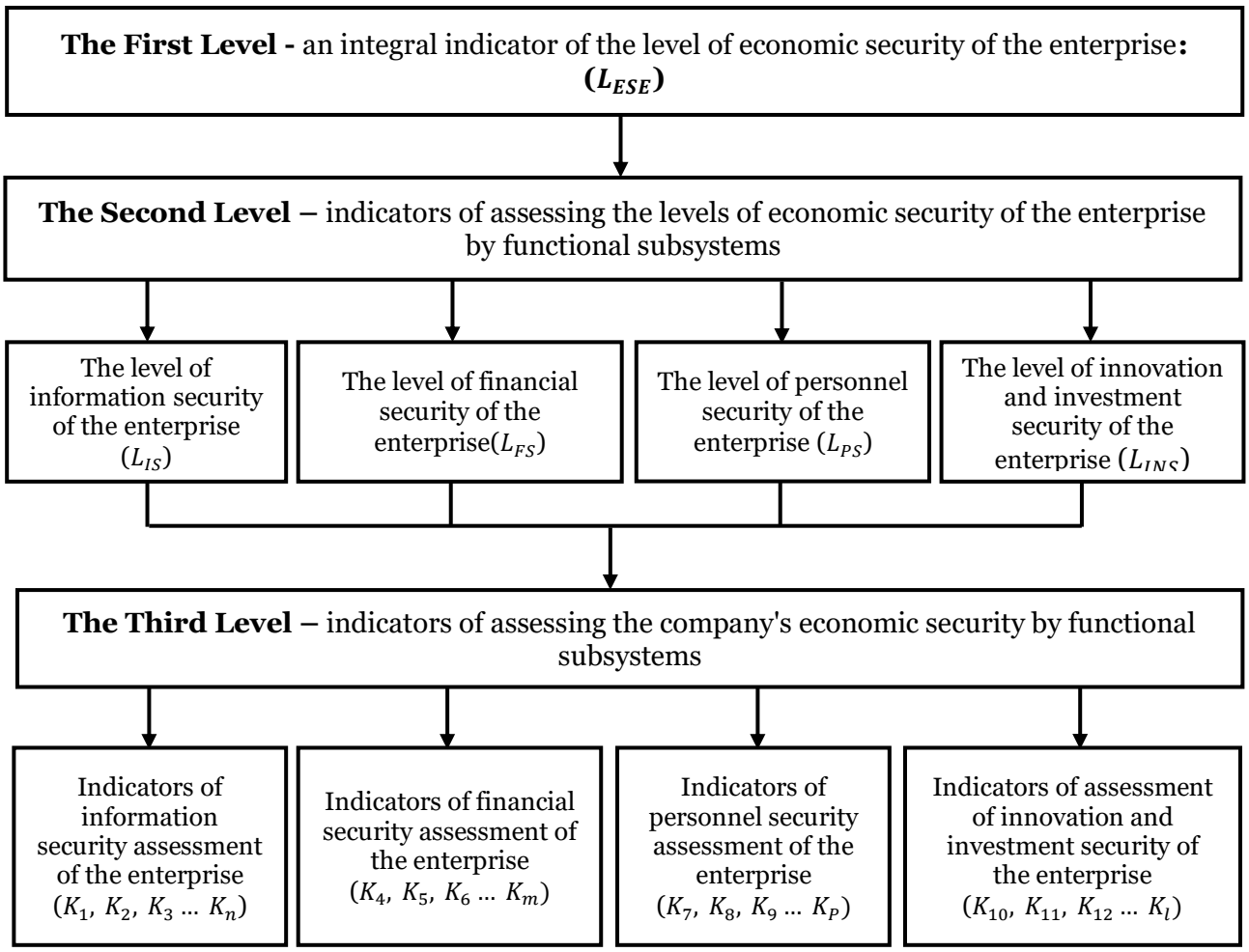

Fig. 2 Hierarchical structure of integral estimation of system efficiency of enterprise economic safety

– the third level – indicators of assessing the company's economic security by functional subsystems.

The second stage involves the construction of matrices of the benefits of indicators of economic security of the enterprise to determine their priority on the basis of pairwise comparisons of indicators. For the purpose of obtaining detailed information on the indicators that are the most priority in the activity of the enterprise and ensuring its economic security, the

application of the method of expert assessments based on a questionnaire survey is a prerequisite. In order to summarize expert assessments, we use the method of additive convolution of indicators based on the theory of "additive value", according to which the value of the whole equals the sum of the values of its components. If the signs of the set have different units of measurement, then additive aggregation requires bringing them to one basis, that is, the previous normalization. The results of pairwise comparisons of the indicators of the systemic efficiency of economic security of enterprises are reflected as elements of the matrix of preferences (Table 1). In this case, the elements located behind the diagonal of the matrix, are equal to units, because they correspond to the comparison of the same indicator. Such a matrix is symmetric, the results of pairwise comparison of indicators relative to its diagonal are inversely proportional. Accordingly, the number and size of the matrix of preferences depends on the hierarchical structure of the integral assessment of the systemic efficiency of economic security of enterprises.

The third stage is to provide indicators of economic safety of weight coefficients - a numerical relative indicator that characterizes the degree of importance or importance of its manifestation of the enterprise. The sum of weight coefficients for all indicators is equal to one.

The calculation of the weight values of the indicators for assessing the systemic efficiency of the enterprise's economic security is carried out on the basis of the formation of their own advantage vector (A_i), which is determined by the formula of the average geometric weighted:

$$A_i = \sqrt[j]{\prod_{i=1}^{j}\left(\frac{A_i}{A_j}\right)} \qquad (6)$$

where A_i – own vector of advantage of the indicator, which is located in the i-th line of the matrix of advantages $(i = \overline{1,n})$;

$1, 2, \ldots, j$ – the numbering of indicators for which the advantage of the i-th indicator is calculated;

$\prod_{i=1}^{n}$ – a sign of the multiplication of the results of the benefits of indicators i and j.

Table 1

The matrix of the advantages of indicators for assessing the system effectiveness of economic security of the enterprise

Indexes	x_1	x_2	**…**	x_i	**…**	x_n
x_1	1	A_1/A_2	…	A_1/A_i	…	A_1/A_n
x_2	A_2/A_1	1	…	A_2/A_i	…	A_2/A_n
…	…	…	1	…	…	…
x_i	A_i/A_1	A_i/A_2	…	1	…	A_i/A_n
…	…	…	…	…	1	…
x_n	A_n/A_1	A_n/A_2	…	A_n/A_i	…	1

where x_1, x_2, x_i, x_n – the comparative indexes;

A_i/A_n – the relative advantage of the i-th index over the n-th index.

Furthere, the weight values of the matrix of advantages according to the following formula are directly determined:

$$w_i = A_i \Big/ \sum_{i=1}^{n} P_i \qquad (7)$$

where w_i – the weight of the indicator in the matrix of preferences, which is located in the *i-th* line $(i = \overline{1,n})$.

Consequently, the execution of this stage allows us to present in the final form the matrix of the advantages of the indicators for assessing the systemic efficiency of the economic security of the enterprise, taking into account their own advantage vector and determining weight coefficients (Table 2).

The fourth stage involves the definition of a generalizing level of information, financial, personnel and innovation and investment security of

the enterprise, which is calculated taking into account the above-mentioned weighting factors. In the formalized form, this stage can be represented as follows:

– indicators of information security assessment of the enterprise:

$$L_{IS} = K_1^{w_1} \cdot K_2^{w_2} \cdot K_3^{w_3} \cdot \ldots \cdot K_n^{w_n} \quad (8)$$

– indicators of financial security assessment of the enterprise:

$$L_{FS} = K_4^{w_4} \cdot K_5^{w_5} \cdot K_6^{w_6} \cdot \ldots \cdot K_m^{w_m} \quad (9)$$

– indicators of personnel security assessment of the enterprise:

$$L_{PS} = K_7^{w_7} \cdot K_8^{w_8} \cdot K_9^{w_9} \cdot \ldots \cdot K_p^{w_p} \quad (10)$$

– indicators of innovation and investment security assessment of the enterprise:

$$L_{INS} = K_{10}^{w_{10}} \cdot K_{11}^{w_{11}} \cdot K_{12}^{w_{12}} \cdot \ldots \cdot K_l^{w_l} \quad (11)$$

The fifth stage of the proposed methodology for evaluating functional performance is identical to the third stage, since it involves determining the weighting coefficients of each functional component for the calculation of the integral index of the assessment of system efficiency of the enterprise's economic security. It should be noted that in addition to the expert estimation method, the graph method and other economic and mathematical methods can be used to determine weight coefficients. However, the use of these methods is complicated by the fact that weighted coefficients of standardized unit indicators are not directly measurable by any of the above methods. In this regard, the application of the expert estimation method is the most feasible and reliable [13].

Consequently, the result of the sixth stage is the obtaining of the final result - the definition of the integral indicator of the assessment of the system efficiency of the enterprise's economic security, taking into account the weight coefficients of the functional subsystems, which in the formalized form has the following form:

$$IL_{ESE} = L^{w_{IS}} \cdot L^{w_{FS}} \cdot L^{w_{PS}} \cdot L^{w_{INS}}, \quad \sum_{i=1}^{4} w_i = 1 \quad (12)$$

where IL_{ESE} – integral index of the level of economic security of the enterprise;

$L^{w_{IS}}$ – level of information security of the enterprise;

$L^{W_{FS}}$ – level of financial security of the enterprise;
$L^{W_{PS}}$ – the level of personnel security of the enterprise;
$L^{W_{INS}}$ – the level of innovation and investment security of the enterprise.

Table 2

The matrix of the advantages of indicators for assessing the systemic efficiency of economic security of an enterprise to determine their weighting factors

Indexes	x_1	x_2	…	x_i	…	x_n	**Own vector of benefits of indexes**	**Weights of indexes**
x_1	1	A_1/A_2	…	A_1/A_i	…	A_1/A_n	A_1	w_1
x_2	A_2/A_1	1	…	A_2/A_i	…	A_2/A_n	A_2	w_2
…	…	…	1	…	…	…	…	…
x_i	A_i/A_1	A_i/A_2	…	1	…	A_i/A_n	A_i	w_i
…	…	…	…	…	1	…	…	…
x_n	A_n/A_1	A_n/A_2	…	A_n/A_i	…	1	A_n	w_n

For the purpose of a constructive process of qualitative assessment of the process, the necessary condition is the gradation of the levels of economic security of the enterprise, which is presented on the basis of the use of normative values of the indicators and the method of expert assessments (table 3).

Thus, the level of risks of an indefinite business environment is a key factor in influencing the level of economic security of modern enterprises. This creates the need to develop risk management methods in the system of economic security of the enterprise, the implementation of which will facilitate the adoption of effective management decisions aimed at minimizing or neutralizing the impact of these risks on the enterprise to achieve the necessary level of its economic security. The proposed methodological approach to assessing the system effectiveness of the company's economic security is unified, objective and complex, since the results of its implementation allow to make sound management decisions regarding the state of functional subsystems and their impact on the overall level of economic security of the enterprise. In addition, an analysis of available methodological approaches to assessing the systemic efficiency of economic security of enterprises, emphasizes the need for their improvement

and development of new methods for obtaining reliable results and deepening the provisions of economic security.

Table 3

Characteristics of the levels of economic security of the enterprise

Levels of economic security of the enterprise	Threshold values of the levels of economic security of the enterprise	Characteristics of the enterprise in accordance with the established level of economic security
High	$0{,}8 < L_{ESE} < 1$	Evidence of the existence of effective risk management methods, which is the result of adaptation to the unstable conditions of the economic environment and minimization of threats to the business activities of the enterprise. This level of economic security ensures the stable operation of the enterprise in an uncertain economic environment.
Medium	$0{,}6 < L_{ESE} \leq 0{,}8$	It is evidenced by the presence of a moderate level of the impact of internal and external risks on economic security as a result of a qualitative risk management process at the enterprise. Under these conditions, the implementation of management measures should be aimed at monitoring possible threats as an effective risk management tool at the enterprise.
Satisfactory	$0{,}3 < L_{ESE} \leq 0{,}6$	It testifies to the presence of the permissible level of the impact of risks on the state of economic security, the probability of obtaining a negative financial result and violation of the sustainable operation of the enterprise. A prerequisite is to improve the risk management methodology at the enterprise in order to minimize the possible destructive effects of the business environment risks.
Low	$0 < L_{ESE} \leq 0{,}3$	It testifies to the significant impact of the risks on the company's economic security as a result of the ineffective process of risk management. Such level of economic security is characterized by a violation of the financial condition of the enterprise and its stable functioning. This requires the introduction of fundamentally new methodological approaches to risk management at the enterprise to achieve tactical and strategic goals.

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