Ministry of Education and Science of Ukraine

ODESA NATIONAL UNIVERSITY OF TECHNOLOGY

International Competition of
Student Scientific Works

BLACK SEA SCIENCE 2023

PROCEEDINGS

ODESA, ONUT 2023

Ministry of Education and Science of Ukraine

Odesa National University of Technology

International Competition of Student Scientific Works

BLACK SEA SCIENCE 2023

Proceedings

Odesa, ONUT
2023

METHODOLOGICAL BASIS FOR ASSESSING THE INTEGRATED SECURITY OF THE ENTERPRISE

Authors: Ihor Riznyk, Yevhen Hloba
Advisor: Iryna Fedotova
Kharkiv National Automobile and Highway University (Ukraine)

Abstract. *The paper considers the main types and methods of assessing the level of integrated security of the enterprise. The main purpose of the study is to develop methodological foundations for assessing the level of integrated security of the motor transport enterprise (MTE). The methodical basis for assessing the level of integrated security of the enterprise, which, unlike the existing ones, is based on the assessment of the safety of the basic subsystems of the enterprise (in accordance with the resource and functional components) using the generalized desirability function and integral assessment. The scale of interpretation of the integral level of integrated security of the enterprise is developed. This methodology takes into account the influence of a complex of internal and external factors, and allows to determine the overall level of integrated security of the enterprise, problem areas of production and economic activity of enterprises that require management decisions. The results of the study can be used by domestic enterprises in the process of ensuring the required level of their security.*

Keywords: *security, integrated security, environmental safety, economic safety, evaluation, desirability function.*

I. INTRODUCTION

Intensive change of environmental factors, which causes instability of economic conditions of market participants, creates threats to their security. This situation forces enterprises to adapt to the operating conditions more quickly, requires the ability to find and implement ways to ensure stable development based on the identification, neutralization and prevention of threats. In Ukraine, full-scale hostilities led to heavy losses due to the destruction and damage of transport infrastructure, industrial and transport enterprises, etc. This has put a large number of motor transport enterprises (MTE) in Ukraine on the verge of survival. The current state of the Ukrainian economy necessitates radical changes in the security of domestic enterprises. The essence of these transformations is the implementation of a set of measures that will ensure the management of integrated security of the enterprise adequate to the conditions of its functioning in a modern competitive environment.

Despite the large number of scientific studies in the field of management and assessment of integrated security of the enterprise (ISE), approaches to defining the essence, principles, identifying factors of influence and assessing the level of integrated security of the enterprise are scattered. Therefore, there is a need to study the theoretical and methodological foundations of determining the level of integrated security of the enterprise, management of integrated security of the enterprise and substantiation of ways of their implementation, the application of which will ensure the stable development of enterprises. In this regard, the question arises about the proper

assessment of the state of security of road transport enterprises and the development of appropriate methods for its effective management. Therefore, the issue of assessing the level of integrated safety of motor transport enterprises (MTE) under the condition of environmental protection is quite relevant.

II. LITERATURE ANALYSIS

At the present stage of development of the concept of integrated security of the enterprise, considerable attention is paid to the methods of its assessment at the enterprise level, although a single comprehensive methodological approach to assessment and analysis has not yet been developed. An important element of the security management system of an economic entity is the study of modern methods and tools for assessing its level, as well as their further improvement.

Regarding the methods of safety assessment, each of the researchers formed their own vision of the need for their application in the study. At the same time, approaches to the assessment of individual components of ISE (financial and economic, physical, environmental, informational, political and legal, etc.) Let us consider the most common approaches to assessing these components of ISE.

The main approaches to quantitative assessment of the level of financial and economic security of the enterprise are summarized in Table 1.

Table 1 - The main approaches to quantitative assessment of the level of financial and economic security of the enterprise

Approach	Authors	Characteristics of the approach
1	2	3
Resource and functional	S. Pokropyvnyi, D. Kovalov, I. Pletnikova, S. Illiashenko, O. Karpenko	Provides for the definition of financial and economic security by assessing the effectiveness of the use of financial and other resources
Indicator	H. Kozachenko, V. Shlemko, M. Bermant, I. Russman, B. Koretskyi, Pochechun O.I.	It consists in establishing the level of financial and economic security as a result of comparing the actual performance of the enterprise with indicators that are the threshold values of these indicators and correspond to a certain level of security
Integral	Rzaieva T.H., Bondar H.A., Reta M.V., Ivanova A.O., Portnova H.O., Antonenko V.M.	It is based on the determination of a certain number of indicators characterizing financial stability, solvency, liquidity, return on assets, business activity, market value and investment attractiveness of the enterprise, etc. The integral value is proposed to be measured relative to normal and critical values
Point estimation	F. Yevdokimov, O. Mizina, O. Borodina	The determination of the safety level is based on the limit values of indicators and their rating. If the value of the indicator is higher than the normative, it is assigned the first class; below the normative, but above the critical - the second; below the critical - the third. The rating of the indicator is determined depending on the purpose of the study and the importance of the indicator for the chosen direction of the study

1	2	3
Program-targeted	A. Tkachenko, O. Reznikov	Based on the integration of indicators that determine the level of financial and economic security based on the methods of expert assessments
Approach based on the theory of economic risks	Klopov I. O.	Identification of various threats to the enterprise and calculation of damage, which is compared with the amount of profit, income and property
Accounting	I. V. Piriatinska	Provides for the use of criteria calculated on the basis of information from accounting and management accounting, is the possibility of using actual information about the economic activities of the enterprise in the calculations
Economic and mathematical modeling	I. V. Piriatinska, S. Kapitula, O.V. Fedosova, O.O. Molodid, S.A. Terenchuk	Based on the functional dependence of the financial level of economic security of the enterprise on the relevant performance indicators of the enterprise

Compiled on the basis of sources [1-20]

Among the above methods and techniques for assessing the integrated security of the enterprise, the authors do not have a single opinion and a single methodological approach that takes into account all security subsystems at the enterprise. Since there are different models for interpreting the essence of integrated security of the enterprise, there is also no unified approach to determining the indicators of security assessment. Therefore, it is necessary to develop a methodological approach to assess the security of each subsystem of the enterprise. Assessment of the enterprise security level involves the analysis of various aspects of its activities, according to the previously identified subsystems.

III. OBJECT, SUBJECT, AND METHODS OF RESEARCH

The object of research is the integrated security of the enterprise. The subject of research is the system and methods of assessing the integrated security of the enterprise.

Scientific methods used in the research: theoretical generalization and logical analysis in the analysis of modern approaches to assessing the level of integrated security of the enterprise; systematic approach in the formation of the integrated security system of the enterprise and the allocation of its main subsystems. The selection of indicator indicators was carried out using a systematic approach and logical analysis of existing methods for assessing each component of the ISE; methods of the generalized desirability function, expert survey, scoring and integral assessment, calculation and analytical in assessing the level of integrated security of the enterprise.

The purpose of the research is to deepen the theoretical foundations and develop methodological provisions for assessing the level of integrated security of the enterprise.

IV. RESULTS

The main goal of the integrated security of the enterprise is to guarantee its stable and most efficient functioning now, and high development potential in the future.

Since the integrated security of the enterprise is a system, it is a set of structural elements, each of which has its own content, set of criteria and means of ensuring. The development and implementation of a set of measures to ensure the proper condition of these subsystems is the main goal of achieving a high level of integrated security of the enterprise. But there is no single approach to the allocation of the main components of this category. Most authors [1-20] when considering the security of the enterprise define it as economic security and then distinguish other types of security in its composition.

Since the integrated security of the enterprise in the study is understood as the state of security of the activity of the economic entity and all types of resources that provide it, it is advisable to use the resource-functional approach to allocate the constituent elements of the integrated security system of the enterprise. Within the framework of this approach, a thorough study of enterprise resources is carried out. The greatest recognition of the importance of resources in the formation of mechanisms for sustainable development of the enterprise was received by the modern resource-based view (RBV), which considers the transfer of resources and abilities of the enterprise as a critical factor in generating competitive advantages [21]. Taking into account the specifics of the motor transport enterprise, the authors [22] divided resources into three main categories: material, intangible, human. Thus, when forming subsystems of integrated security, it is necessary to focus on the main groups of resources.

Taking into account the resource approach and a set of functional components, the integrated security of the enterprise is proposed to be considered as a set of security subsystems (Figure 1).

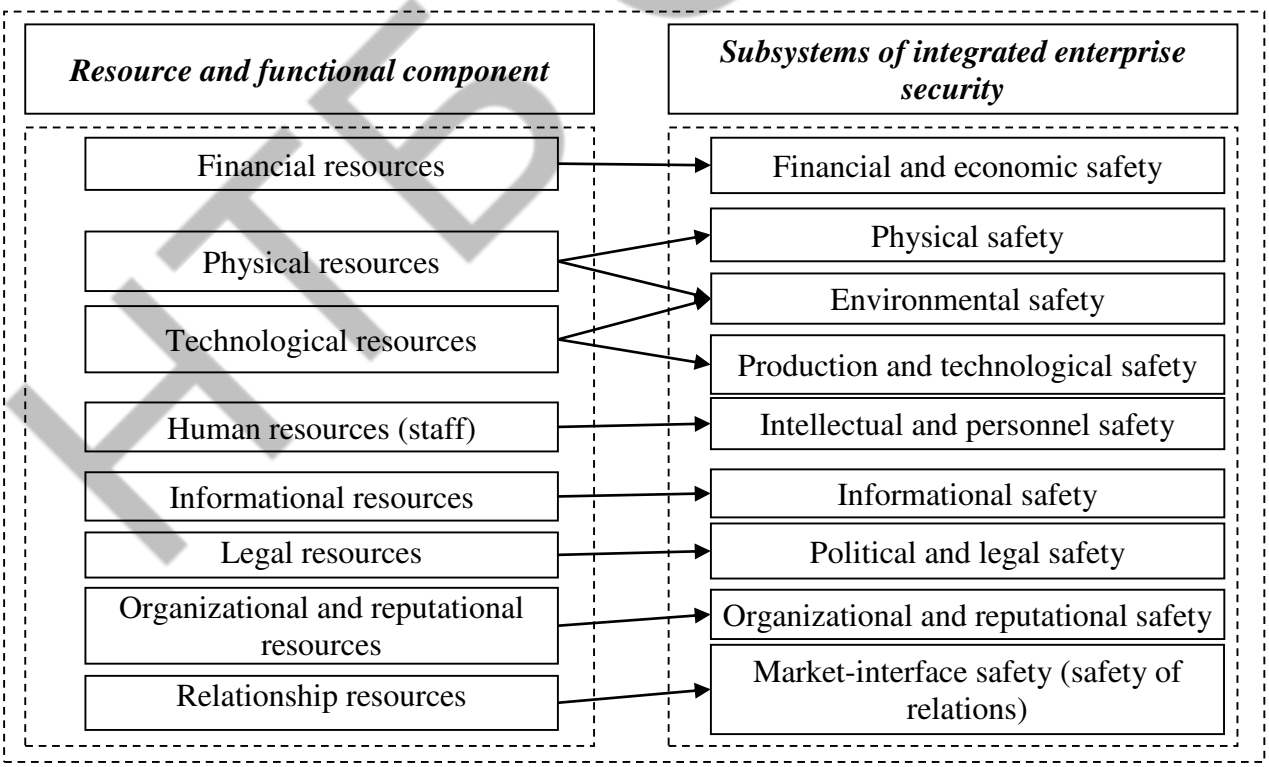

Figure 1 – The essence of the formation of an integrated security system of the motor transport enterprise

For analytical assessment of each of them, it is necessary to determine the range of possible threats (risks) and assess the probability and consequences of their implementation.

To assess the integrated safety of the enterprise, the correctness of the methodology for its implementation is important. The methodology is understood as a set of methods, rules and the most appropriate way to perform a certain work.

The purpose of the proposed methodology for assessing the ISE is to calculate and forecast its level, identify and evaluate the factors influencing the level of each component of the integrated security of enterprises, determine strategies for ensuring ISE, taking into account the impact of external and internal factors. In the proposed methodology for assessing the IS of a motor transport enterprise (Figure 2) at the first stage it is necessary to determine the object, subjects, tasks of assessment, components of the ISE, criteria and development of indicators and indicators of assessment.

It is proposed to consider the level of integrated security of the enterprise as the object of assessment, and the heads of the enterprise (their deputies) as the subjects of assessment.

It is advisable to evaluate the ISE on a quarterly basis in order to constantly monitor its activities, increase competitiveness in the market of road transport services or improve the efficiency of the road transport enterprise, etc.

Ensuring the integrated security of an enterprise necessitates the solution of a number of issues, among which the definition of criteria, indicators and indicators for assessing the integrated security of an enterprise is of particular importance. Justification of the criterion for choosing an assessment methodology for enterprises solves the question of how to compare different options for management decisions in order to make the most optimal one.

ISE indicators – are indicators for assessing the level of ISE, which allow to identify pain points in the activities of the MTE, to determine the main directions and the most effective ways to improve the efficiency of the enterprise. Indicators of the ISE level include those that quantitatively reflect the level of threat, have a significant level of sensitivity and, accordingly, the ability to warn of the possibility of danger. In addition, it is advisable to use not a separate indicator, but a system of indicators, with the help of which it becomes possible to determine the level of provision of individual internal components and/or functional components of the ISE, and further - to calculate its integral (generalized) indicator.

The generalized assessment of the level of ISE can be carried out on the basis of comparing the boundary (critical and normal) and actual values of indicator indicators. At the same time, the express assessment of the level of ISE can be carried out on the basis of graphical analysis, which allows to distinguish the zone of normal, critical safety level and pre-crisis zone.

For example, the most common indicators identified by the authors to determine the level of financial security of business entities are presented in Table 2. According to Table 2, we can say that the most common indicators for assessing the financial security of the enterprise are: autonomy ratio, coverage ratio, liquidity ratio and profitability of sales (operating profit margin).

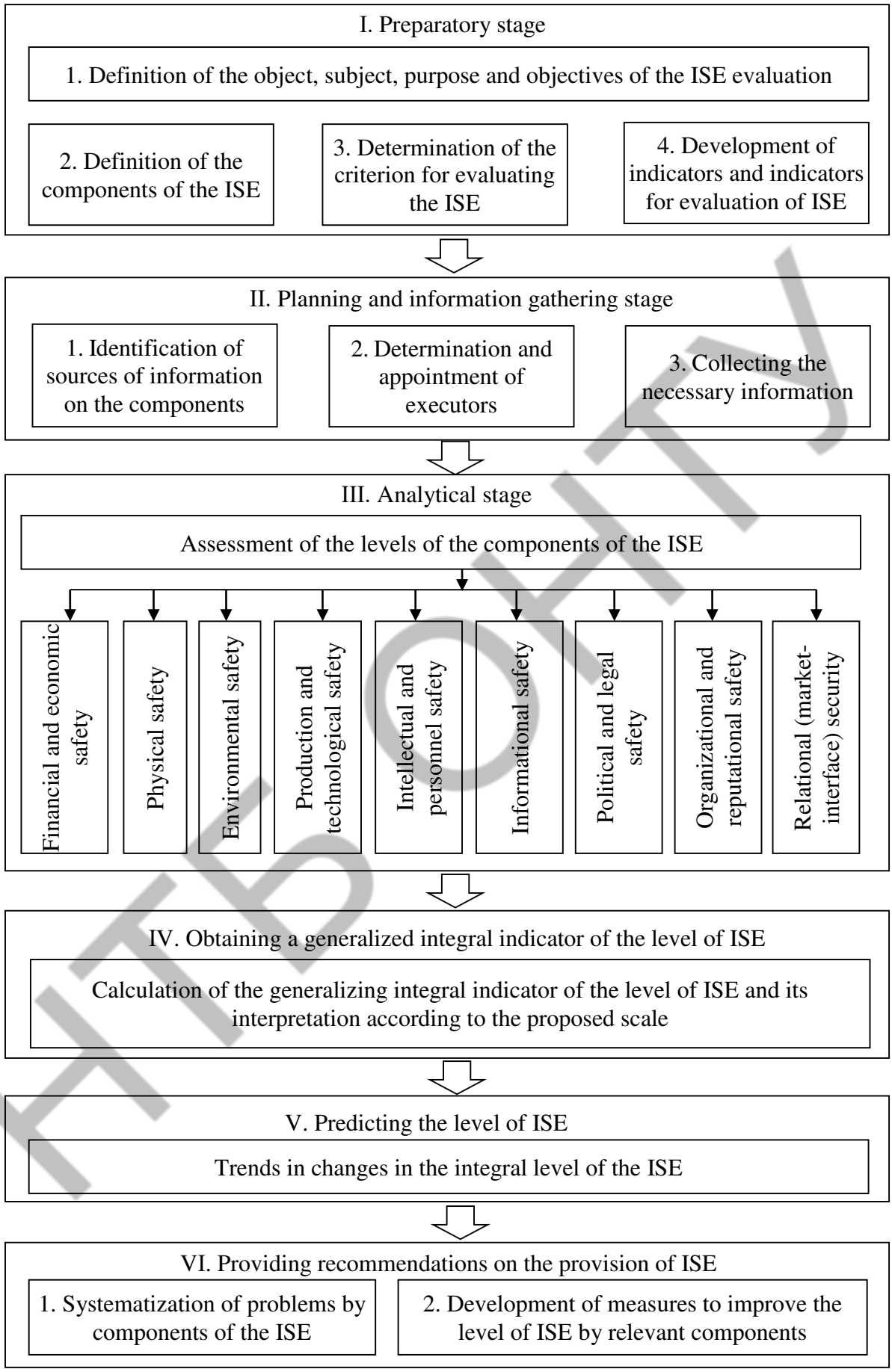

Figure 2 - Development of a methodological approach to the evaluation ISE of the MTE

Table 2 - Rationale for the choice of indicators for assessing the financial and economic component of the ISE

Indicators	Researchers							Total
	Vyshnivska B.	Horiacheva K.S.	Papekhyn R. S.	Mykhailenko V.M. , Arefiev V.O.	Arefieva O.V., Kuzenko T.B.	Oleksiv I., Podolchak N.	Kaplan R., Norton D.	
Level of accounts payable and receivable			+	+				2
Financial leverage ratio			+					1
The amount of equity and working capital		+						1
Break-even point	+							1
Profitability			+					1
Coefficient of autonomy			+		+	+		3
Coverage ratio			+		+	+		3
Maneuverability coefficient					+	+		2
Volume of loans and borrowings		+	+					2
Volume of investments		+						1
Liquidity indicator						+	+	2
Indicator of financial independence							+	1
Financial risk indicator							+	1
Turnover of current assets							+	1
Turnover of non-current assets							+	1
Profitability of assets			+				+	2
Profitability of products					+		+	2
Profitability of sales		+				+	+	3
Financial dependence ratio				+				1
Mobility coefficient				+				1
Equity maneuverability ratio				+				1
Long-term investment structure ratio				+				1
Coefficient of autonomy of sources of stock formation				+				1
Total	1	4	7	6	4	5	8	

Compiled on the basis of sources [1-20]

The creation and implementation of the indicators of the ISE has a preventive function in preventing the transition of the enterprise to a threatening state of the IS. These indicators allow timely detection of signs of significant deviations from the normal state of the IS (scale of IS).

Similarly, the indicators of each component of the ISE are selected. Based on the study of existing approaches and methods for assessing security, it is proposed to use two groups of indicators: an integral indicator - to assess the level of integrated security of the enterprise; partial indicators - for in-depth analysis of various security subsystems and identification of reserves. It is proposed to evaluate the level of ISE using nine groups of indicators for each component of the integrated security of the MTE (Table 3).

Table 3 - Indicators of ISE evaluation

Component of the ISE	Indicators
1. Financial and economic safety	1) Coefficient of autonomy; 2) Coverage ratio; 3) Liquidity ratio; 4) Profitability of sales (operating profit margin)
2. Physical safety	1) Coefficient of protection of the enterprise from illegal penetration; 2) Coefficient of physical protection of employees; 3) Coefficient of moral protection of employees
3. Environmental safety	1) Indicator of the level of compliance with emission (discharge, waste) requirements; 2) Indicator of the level of compliance with sanitary and hygienic working conditions; 3) Share of funds recovered for compensation of damage caused by violation of environmental legislation
4. Production and technological safety	1) Share of the company's products that meet the current requirements; 2) Share of RS and technological equipment that meets world analogues (current requirements); 3) Share of products of enterprises that are protected by patents; 4) Material intensity of products; 5) Capital equipment of labor; 6) Depreciation rate of fixed assets (disincentive)
5. Intellectual and personnel safety	1) Turnover rate of highly qualified workers (disincentive); 2) Share of engineering, technical and scientific workers; 3) Indicator of inventive (rationalization) activity; 4) Indicator of educational level; 5) Share of downtime in the working time fund (destimulator)
6. Information security	1) Coefficient of completeness, accuracy and timeliness of information; 2) Indicator of software and hardware security of information; 3) Share of costs for information security; 4) The level of information reliability of the staff; 5) Information security system reliability indicator
7. Political and legal security	1) Share of losses of the enterprise due to violation of legal norms; 2) The state of business documentation
8. Organizational and reputational security	1) The level of consumer perception of the company's image; 2) The level of business reputation
9. Relational (market-interface) security	1) The level of safety by external factors; 2) The level of safety by internal factors

Compiled on the basis of sources [1-20]

The generalized assessment of the level of ISE can be carried out on the basis of comparison of the boundary (critical and normal) and actual values of indicators. At the same time, an express assessment of the level of BSC can be carried out on the basis of graphical analysis, which allows to distinguish the zone of normal, critical safety level and pre-crisis zone. The normalized values calculated on the basis of the normative (limit) values of the initial indicators can be used as indicators of the ISE. Critical values of the initial indicators are determined from the condition of the minimum permissible safety level, overcoming which would mean the transition to the hazardous zone. In this case, indicators corresponding to the maximum value of the best indicators are called stimulants, and indicators corresponding to the minimum - destimulants.

For example, the assessment of the level of security by the group of indicators of financial and economic security is made by the formula:

$$d_{fes.i} = \begin{cases} 1, & if \ \ X_i^a \geq X_i^n, \\ \frac{X_i^a}{X_i^n}, & \text{if} \ \ X_i^a < X_i^n, \end{cases} \quad (1)$$

where X_i^a, X_i^n – respectively, the actual and normative (limit, maximum of the studied group) values of the indicator.

Indicators and methods of their calculation are proposed for each group of indicators for the assessment of ISE, as well as stimulators and destimulators are defined.

After calculating the value of all indicators, they are reduced to a single integral indicator by the formula:

$$\Pi i = \sum_{i=1}^{n}(1 - \delta i) \cdot Bi, \quad (2)$$

where n — number of indicators;

B_i — specific weight i-th indicator;

δ_i — relative assessment of the i-th indicator, which is calculated as (X_i/X_{max}), if a higher value of the indicator is more desirable (stimulants), or (X_{max}/X_i), if a lower value of the indicator is preferable (destimulants);

X_i — value of the i-th indicator;

X_{max} — the highest value of the indicator or coefficient for the entire analyzed period (or among comparable enterprises);

X_{min} — the lowest value of the indicator or coefficient for the entire analyzed period (or among comparable enterprises).

The second stage of assessing the level of integrated security of the enterprise is planning and collecting information, identifying performers and directly processing information about the results of the enterprise for several years. In order to assess the level of ISE, it is necessary to analyze the activity of the enterprise during a certain period, to consider the obtained indicators in dynamics, which will allow to make more complete and accurate conclusions.

The third stage is to assess the levels of each component of the integrated security of the enterprise based on the generalized desirability function. Based on statistical averages and expert opinions, the so-called "threshold" values of each component are used for the assessment indicators, which makes it possible to determine the overall level of the enterprise's IS.

The fourth stage is the assessment of the integrated security of the enterprise based on the integrated assessment to identify the overall level of integrated security of the enterprise. The closer the ratio is to one, the lower the level of ISE. It is proposed to identify certain levels of ISE for the qualitative interpretation of quantitative indicators using the Harrington's interpretation scale [23] (Table 4). This scale allows formalizing the procedure for identifying the probability and interpreting the results obtained as a result of applying the developed model for assessing the ISE.

The fifth stage is forecasting the level of the enterprise's IS and identifying trends of its change in the direction of increase, preservation or decrease.

The sixth stage is the provision of recommendations to ensure an adequate level of integrated security of the road transport enterprise: systematization of the problems of the enterprise, determination of strategies for further development of the enterprise, providing proposals for the application of organizational and economic measures to ensure the integrated security of the enterprise, taking into account the impact of external and internal factors in an unstable market environment.

Table 4 - Key to interpretation of the integral level of the ISE

Value of integral level ISE	Characteristics of the ISE level
0,00 – 0,25	The highest possible level of integrated security of the enterprise, corresponding to the state of equilibrium.
0,26 – 0,50	The average level of integrated security of the enterprise. The enterprise is functioning normally, but there are certain problems related to the inefficient organization of the main activity, which generate the possibility of a threat to integrated security in the future.
0,51 – 0,75	Low level of integrated security of the enterprise. Negative trends in indicators characterizing the financial and economic spectrum of the enterprise are increasing. There are processes that indicate an increase in threats in the relevant areas of integrated security of the enterprise.
0,76 – 1,00	Crisis state of safety at the enterprise. There are chronic violations of functioning parameters by all assessment criteria.

By forming an integrated security management mechanism, enterprises will be able to meet the requirements of sustainable development and viability.

Testing of the proposed methodological approach to assessing the level of IPA was carried out on the private joint-stock company data «Kharkiv MTE-16355». Here are more detailed calculations for one subsystem of the IPPC - the subsystem of environmental safety. First, let's calculate the level of compliance with emissions (discharges, waste) requirements. To assess the environmental safety of the MTE by the main types of negative impact on the environment (emissions, discharges, waste), the generalized desirability function [23] is calculated by the formula of the geometric mean weighted set of real numbers ($d_1 ... d_n$) with weight ($\alpha_1 ... \alpha_n$; $\beta_1 ... \beta_n$) and is defined as:

$$D = \sqrt[k]{\prod_{i=1}^{n}(d_i^{\alpha})^{\beta}} = \sqrt[k]{d_1^{\alpha\beta} \cdot d_2^{\alpha\beta} \cdot d_3^{\alpha\beta} \dots \cdot d_n^{\alpha\beta}}, \quad (3)$$

where n - number of indicators;

d_i - private desirability function;

α і β – weighting coefficients.

$$K = \sum_{i=1}^{n} \alpha_i \cdot \beta_i. \quad (4)$$

The following interpretation of the weighting coefficients is proposed:

α_i - is the coefficient that takes into account the hazard class of the i-th pollutant;

β_i - coefficient that takes into account the excess of the average measured value of the indicator concentration over the standard. The generalized desirability function is the geometric mean of the private desirability functions (d_i), and if at least one of d_i is zero, then D = 0. There is some excess of waste to surface water and solid waste production.

Next, let us consider in more detail the calculation of the compliance assessment of waste emissions from auxiliary processes of the MTE (Table 5).

Table 5 - Input data for estimating the level of waste from technical service and repair rolling stock

Name of the indicator	X_i	$X_{standard}$	d_i	α	β	α*β
Annual level of waste to surface water bodies per one accounting vehicle, kg						
dry residue	80	76	0,999	1	1,053	1,053
chlorides	16	17	0,998	0,25	0,941	0,235
sulphates	6	4	0,923	1	1,500	1,500
suspensions	1,2	1	0,984	1	1,200	1,200
other	1,8	2	0,994	0,25	0,900	0,225
Annual volume of solid waste removed from the MTE per one accounting vehicle, kg						
dust	110	102,5	0,998	1	1,073	1,073
consumption waste	50	47,5	0,999	1	1,053	1,053
wood waste	28	35	0,976	0,25	0,800	0,200
waste paper	34	35	1,000	0,25	0,971	0,243
brake pads	10,5	10	0,999	1	1,050	1,050
glassblower	16	15	0,998	1	1,067	1,067
rubber (except tires)	4,8	5	0,999	0,25	0,960	0,240
Annual volume of waste transferred by MTE for further processing to other organizations per one accounting vehicle, kg						
ferrous metal scrap	310	342	0,995	0,25	0,906	0,227
sludge from sewage treatment plants	240	279	0,989	0,25	0,860	0,215
car tyres	160	180	0,993	0,25	0,889	0,222
used oils and lubricants	78	81	0,999	0,25	0,963	0,241
scrap of batteries	16	18	0,993	0,25	0,889	0,222

There is some excess of waste to surface water and solid waste production. Table 6 calculates the indicators of waste level assessment from maintenance and repair of rolling stock of MTE.

Table 6 - Assessment of the level of waste from technical service and repair of rolling stock

Name of the indicator	α*β	K	$d_i^{\alpha\beta}$	Assessment level waste
Annual level of waste to surface water bodies per one accounting vehicle, kg				
dry residue	1,053	4,213	0,999	0,967
chlorides	0,235		1,000	
sulphates	1,500		0,887	
suspensions	1,200		0,980	
other	0,225		0,999	
Annual volume of solid waste removed from the MTE per one accounting vehicle, kg				
dust	1,073	4,925	0,997	0,997
consumption waste	1,053		0,999	
wood waste	0,200		0,995	
waste paper	0,243		1,000	
brake pads	1,050		0,999	
glassblower	1,067		0,998	
rubber (except tires)	0,240		1,000	

Annual volume of waste transferred by ATP for further processing to other organizations per one accounting vehicle, kg				
ferrous metal scrap	0,227	1,127	0,999	0,994
sludge from sewage treatment plants	0,215		0,998	
car tyres	0,222		0,998	
used oils and lubricants	0,241		1,000	
scrap of batteries	0,222		0,998	
Total waste		10,265		0,984

According to Table 6, it can be seen that the assessment of the environmental component of the ISE in terms of waste from rolling stock maintenance and repair is at a fairly high level and is equal to 0.984. However, it is still necessary to take into account the level of discharges (waste) from additional services, the quality of treatment facilities, the level of emissions from vehicles, etc. This assessment is made using a rating scale developed according to the relevant Euro 1 - Euro 6 standards. In this case, for MTE all vehicles meet the environmental standards Euro 4-6. In general, the value of this indicator for MTE is the geometric mean of all vehicles. The generalized indicator of the level of compliance with the requirements of emissions (discharges, waste) is 0.56.

Table 7 shows the assessment of sanitary and hygienic working conditions of drivers according to the appropriate scale. Assessment of sanitary and hygienic working conditions of car drivers is carried out according to the developed scale.

Table 7 – Assessment of sanitary and hygienic working conditions of the driver's team

Elements of working conditions	Assessment of working conditions by drivers															
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Air temperature at the workplace, °C	5	5	4	5	5	5	5	4	4	5	5	4	5	4	5	5
Toxic substances	5	4	4	4	4	5	4	4	4	4	4	5	4	4	5	5
Industrial dust	3	3	4	3	4	3	3	3	3	3	4	3	3	5	4	3
Vibration	3	4	4	4	4	5	3	5	3	3	4	4	3	4	4	5
Noise	5	4	3	5	3	4	4	5	3	3	5	3	5	4	3	4
Sum of points	21	20	19	21	20	22	19	21	17	18	22	19	20	21	21	22

$d_{work.cond}$=(21+20+19+21+20+22+19+21+17+18+22+19+20+21+21+22)/(5·6·16) =0,67.

After calculating the level of sanitary and hygienic working conditions of all groups of the company's personnel, this figure was 0,32.

Similarly, the calculation is carried out for all other security components. The results of the assessment of the level of ISE for all components (according to formula 3) for the private joint-stock company «Kharkiv MTE-16355» are shown in Table 8.

According to the study, it was found that MTE-16355 currently has an average level of Coefficient of Performance (0,413), that is, the enterprise is functioning normally, but there are certain problems associated with the inefficient organization of

the main activity, which generate the possibility of a threat to comprehensive security in the future.

Table 8 - Assessment of the level of integrated security of MTE

Component of the ISE	Evaluation indicators	Normalized value of the indicator	Weight of the indicator	Balanced assessment
1	2	3	4	5
Financial and economic safety	Coefficient of autonomy	0,40	0,032	0,013
	Coverage ratio	0,38	0,040	0,015
	Liquidity ratio	0,39	0,045	0,017
	Profitability of sales (operating profit margin)	0,41	0,043	0,018
	Financial and economic component of the ISE	**-**	***0,160***	***0,063***
Physical safety	Coefficient of protection of the enterprise from illegal penetration	0,49	0,035	0,017
	Coefficient of physical protection of employees	0,52	0,028	0,015
	Coefficient of moral protection of employees	0,48	0,017	0,008
	Physical component of the ISE	**-**	***0,080***	***0,040***
Environmental safety	Indicator of the level of compliance with emission (discharge, waste) requirements	0,56	0,059	0,033
	Indicator of the level of compliance with sanitary and hygienic working conditions	0,32	0,054	0,017
	Share of funds recovered for compensation of damage caused by violation of environmental legislation	0,44	0,038	0,017
	Environmental component of the ISE	**-**	***0,150***	***0,067***
Production and technological safety	Share of the company's products that meet the current requirements	0,22	0,022	0,005
	Share of RS and technological equipment that meets world analogues (current requirements)	0,25	0,026	0,007
	Share of products of enterprises that are protected by patents	0,30	0,018	0,005
	Share of products of enterprises that are protected by patents	0,44	0,022	0,010
	Capital equipment of labor	0,56	0,020	0,011
	Depreciation rate of fixed assets (disincentive)	0,52	0,022	0,011
	Production and technological component of ISE	**-**	***0,130***	***0,049***
Intellectual and personnel safety	Turnover rate of highly qualified workers (disincentive)	0,44	0,022	0,010
	Share of engineering, technical and scientific workers	0,61	0,017	0,010
	Indicator of inventive (rationalization) activity	0,28	0,016	0,005
	Indicator of educational level	0,63	0,022	0,014
	Share of downtime in the working time fund (destimulator)	0,56	0,014	0,008
	Intellectual and personnel component of the ISE	**-**	***0,090***	***0,046***
Informational safety	Coefficient of completeness, accuracy and timeliness of information	0,54	0,024	0,013
	Indicator of software and hardware security of information	0,32	0,022	0,007

1	2	3	4	5
Informational safety	Share of costs for information security	0,30	0,021	0,006
	The level of information reliability of the staff	0,39	0,020	0,008
	Information security system reliability indicator	0,35	0,023	0,008
	Information component of the ISE	-	***0,110***	***0,042***
Political and legal safety	Share of losses of the enterprise due to violation of legal norms	0,18	0,039	0,007
	The state of business documentation	0,45	0,041	0,018
	Political and legal component of the ISE	-	***0,080***	***0,025***
Organizational and reputational safety	The level of consumer perception of the company's image	0,52	0,061	0,031
	The level of business reputation	0,44	0,050	0,022
	Organizational and reputational component of the ISE	-	0,110	0,053
Market and interface safety	Security level by external factors	0,29	0,058	0,017
	Security level by internal factors	0,35	0,032	0,011
	Market-interface component of the ISE	-	***0,090***	***0,028***
The overall level of integrated security of the enterprise		-	*1,000*	*0,413*

The most significant negative impact on the ISE is observed in the environmental (0,067), financial and economic (0,063) and organizational and reputational (0,053) components of the ISE. Thus, it is necessary to consider and propose strategies for the development of integrated security of the enterprise by various components and introduce measures to improve it.

V. CONCLUSIONS

The methodological basis for assessing the integrated security of the enterprise for each of its components, based on the methods of the generalized desirability function and integral assessment, has been improved, and a scale for interpreting the integrated level of integrated security of the enterprise has been developed.

Thus, according to the results of the study, the methodological foundations for assessing the level of integrated security of the enterprise were improved, which, unlike the existing ones, is based on the methods of the generalized desirability function and integral assessment, and a scale for interpreting the integrated level of integrated security of the enterprise was developed. This methodology takes into account the influence of a complex of internal and external factors, and allows to determine the overall level of integrated security of the enterprise, problem areas of production and economic activity of enterprises that require management decisions. The results of the study can be used by domestic motor transport enterprises in the process of ensuring the required level of their safety.

VI. REFERENCES

1. Варічева, Р.В. (2016). Методичні підходи до оцінки якості економічної безпеки підприємства: облікове забезпечення. *Вісник Хмельницького національного університету*, 3(1), 88-93.

2. Воропай, В. А. (2013) Аналіз методичних підходів оцінки стану і рівня забезпечення системи економічної безпеки підприємства. *Культура народів Причорномор'я*, 257, 190–195.

3. Д'яконова, І.І., Петренко, Ю.М. (2013). Ресурсно-функціональний підхід у дослідженні фінансової безпеки підприємства та корпоративного управління. *Бізнес Інформ*, 2, 188-193.

4. Дяченко, К.С. (2015). Методичні підходи до оцінки рівня економічної безпеки підприємств будівельної галузі. *Технологічний аудит та резерви виробництва*, 4/5(24), 31–36.

5. Іванова, Н.С. (2020). *Економічна безпека*: навч. посібник. Кривий Ріг: ДонНУЕТ.

6. Капустин, Н. (2018). Экономическая безопасность отрасли и фирмы. *Бізнес Інформ*, 11-12, 44-49.

7. Карпенко, О. (2015). Комплексна оцінка економічної безпеки підприємництва в агропромисловому комплексі. *Економіка*, 1(133), 22–27.

8. Коваленко, Д.І., Ломако, К.В. (2017). Методичні підходи до оцінки рівня фінансово-економічної безпеки підприємства. *Міжнародний науковий журнал "Інтернаука"*, 18(2), 30-33.

9. Козлова, В.Я. (2018). Сучасні методи оцінки економічної безпеки підприємства. *Вісник Приазовського державного технічного університету*, 35, 96–100.

10. Колісніченко, П.Т. (2017). Науково-методичні підходи до оцінки рівня економічної безпеки підприємства. *Інвестиції: практика та досвід*, 16, 38-44.

11. Копитко, М.І. (2015). Комплексне забезпечення економічної безпеки підприємств: науково-методичний підхід. *Управління проектами та розвиток виробництва*, 3, 127-144.

12. Лойко, В.В. (2013) Методичні аспекти діагностики рівня економічної безпеки. *Ефективна економіка*, 2. http://www.economy.nayka.com.ua/?op=1&z=1794

13. Меліхова, Т.О. (2018). Узагальнення методичних підходів до оцінки рівня економічної безпеки підприємства з метою вибору оптимальних для діагностування зовнішніх та внутрішніх загроз. Ек*ономіка. Фінанси. Менеджмент: актуальні питання науки і практики*, 2, 38–50.

14. Олійник, Т.І. (2019). Методичні аспекти оцінки економічної безпеки підприємств у ринкових умовах господарювання. *Економіка та держава*, 10, 69–72.

15. Писаренко, Б.А., Проценко, Н.Б. (2013). Діагностика економічної безпеки функціонування промислових підприємств. *Вісник Житомирського державного технологічного університету. Серія: Економічні науки*, 1(63), 302-305.

16. Пірятінська, І. В. (2013). Систематизація підходів до оцінки економічної безпеки будівельних підприємств. *Комунальне господарство міст*: наук.-техн. зб., 106, 266–271.

17. Поляков, П.А. (2018). Аналіз методів оцінки економічної безпеки промислових підприємств. *Науковий огляд*, 50 (7). https://naukajournal.org/index.php/naukajournal/article/view/1613/1690.

18. Федосова, О.В., Молодід, О.О., Теренчук, С.А. (2011). Визначення рівня економічної безпеки будівельного підприємства на основі економетричних моделей. *Управління розвитком складних систем*, 5, 117-119.

19. Філиппова, С.В., Волощук, Л.О., Черкасова, С.О. (2015). *Економічна безпека підприємств реального сектору економіки в умовах вартісно-орієнтованого управління*. [Монографія]. ФОП Бондаренко М.О.

20. Чирва, Ю.Є., Нестеренко, О.М. (2012). Оцінка економічної безпеки цукропереробного підприємства на основі інтегральної моделі. *Бізнес Інформ*, 8, 67–69.

21. Швиданенко, Г.О. (За ред.) (2014). *Управління ресурсами підприємства* [Електронний ресурс]: монографія. Київ: КНЕУ.

22. Шинкаренко, В.Г., Бекетов, Ю.О., Трощій, І.І. (2019). Ресурсний підхід до розробки стратегії окремого виду бізнесу підприємства. *Економіка транспортного комплексу*, 34, 55-73.

23. Castillo, E.D., Montgomery, D.C., McCarville, D.R. (1996). Modified Desirability Functions for Multiple Response Optimization. *Journal of Quality Technology*, 28 (3), 337-345.

CONTEMPORARY ASPECTS OF THE ANALYSIS OF CURRENT ASSETS IN THE ENTERPRISE MANAGEMENT SYSTEM
Authors: Olha Velychko, Hanna Sariieva
Advisors: Nataliia Kuprina, Tatiana Stupnytska
Odesa National University of Technology (Ukraine)……. 245

OPTIMIZATION OF THE MANAGEMENT DECISION-MAKING SYSTEM AT A CONSTRUCTION ENTERPRISE
Author: Roman Spytsya
Advisor: Olena Dolgalova
Donbas National Academy of Civil Engineering and Architecture (Ukraine)…… 262

FORENSIC AS A MODERN METHOD OF FIGHTING CORPORATE FRAUD
Authors: Maksym Shapovalov, Volodymyr Petrov
Advisors: Volodymyr Kraevskyi, Maryna Skoryk
State Tax University (Ukraine)…….. 277

ACCOUNTING FOR INNOVATIVE ACTIVITIES OF ENTERPRISES
Author: Gavrilyuk Zoryana
Advisor: Fatenok-Tkachuk Alla
Lesya Ukrainka Volyn National University (Ukraine)…….. 292

TERRITORIAL COMMUNITIES IN THE PROCESS OF MANAGING THE SUSTAINABLE DEVELOPMENT OF THE REGION
Author: Lyudmila Kyforenko
Advisor: Nataliia Osadchuk
Pavlo Tychyna Uman State Pedagogical University (Ukraine)…….. 307

PROSPECTS FOR THE DEVELOPMENT OF CONTACTLESS PAYMENT IN THE CONDITIONS OF DIGITALIZATION OF THE BANKING SYSTEM
Author: Sofiia Prokopchuk
Advisors Iryna Hrinko
National Technical University of Ukraine “Igor Sikorsky Kyiv Polytechnic Institute” (Ukraine)… 319

HYDROPOWER INDUSTRY OF UKRAINE: CURRENT STATE, PROSPECTS AND FISCAL INSTRUMENTS TO STIMULATE ITS DEVELOPMENT
Author: Pavlo Nahornyi
Advisor: Kateryna Hnedina
Chernihiv Polytechnic National University (Ukraine)…….. 331

3. INFORMATION TECHNOLOGIES, AUTOMATION AND ROBOTICS…….. 345

OPTIMIZING THE TRAJECTORY OF THE QUADCOPTER USING BUILT-IN SENSORS
Author: Zihura Tamila
Advisors: Kryvchenko Anastasiia, Tomachenko Oleksandr
Separated structural subdivision "Odesa Technical Professional College of
Odesa National University of Technology" (Ukraine)…….. 346

RESEARCH OF MECHATRONIC GRIPPER DEVICES ON THE BASIS OF BIONICS WITH EXTENDED FUNCTIONAL CAPABILITIES
Authors: Yurii Yakymchuk, Dmitry Danyuk
Advisor: Mykola Iakymchuk
National University of Food Technologies (Ukraine)…… 357