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Assessment of Adaptive Management of Economic Security of Enterprises in the Context of Globalization Challenges and Sustainable Development

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ABSTRACT

The relevance of the study is due to the aggravation of changes in external environment that affect economic security of business entities and require the increase in their economic security in the context of globalization challenges and sustainable development. The purpose of the study is to develop principles of assessing adaptive management of economic security of enterprises in the context of globalization challenges and sustainable development. The methodological basis of the research is the structural-functional approach, which makes it possible to consider economic security as a certain system, take into account adaptive behavior of enterprises considering the specifics of their activities, conduct a full and detailed analysis of adaptive management of economic security of enterprises, and ensure the segmentation of economic security by functional areas of its activity, as well as identifying critical security points of the enterprise's functioning. The authors suggested using taxonomic analysis to assess the adaptive management of the enterprises' economic security. The peculiarity of this proposed methodical approach is the establishment of the quality of the influence of analytical features on economic security based on the determination of the Euclidean distance between the standardized values of analytical features and the value of the reference vector and the calculation of the integral indicator of the assessment of the adaptive management of the enterprise' economic security. Approbation of the proposed approach was in relation to the functioning enterprise on the territory of Ukraine, Eurotrading LLC, which carries out production activities. The calculations and taxonomic analysis were based on the actual values of the analytical assessment of the financial, intellectual, personnel and production components of the enterprise's economic security for five years. The results of the application of the proposed methodological approach made it possible to determine the largest root mean square deviation of analytical features, including the duration of accounts payable turnover and the turnover ratio of fixed assets. This made it possible to propose directions of adaptive management to increase the enterprise' economic security in the context of globalization challenges and sustainable development.

1. INTRODUCTION

Modern globalization challenges increasingly actualize the issue of studying security as a whole, as a necessary and most important condition for the existence of heterogeneous entities. The issues related to security of economic entities are becoming more and more relevant in the context of globalization challenges, as they carry both new opportunities and dangers for the development of economic entities. Issues of economic security have a vertical dependence starting from the global level to the level of an individual, since it cannot be achieved, for example, security of an enterprise without security of an individual as an employee and general external security in which the enterprise operates. One of the modern trends in improving the efficiency of economic security of enterprises is adaptive management of economic security, which makes it possible to use various mechanisms and tools of adaptive management to ensure a quick response of the enterprise to the action of external threats, taking into account the principles of ensuring its sustainable development. Adaptive management is considered in two aspects, first, in relation to the adaptation of the enterprise as an economic system to external changes, including those caused by globalization challenges by ensuring economic security of the enterprise. Secondly, ensuring stability of economic security and establishing a dynamic balance between the enterprise as a system and the surrounding environment. The extent to which adaptive management ensures the sustainability of the enterprise's development can be assessed through the state and dynamics of the enterprise's economic security.

The assessment of adaptive management of economic security of the enterprise is a complex and multifaceted process that includes a large number of qualitative and quantitative parameters without the peak state of the enterprise, which ensures its sustainable development and competitiveness in the context of globalization challenges and external threats. Current globalization challenges and sustainable development require the consideration of adaptive management of the enterprises' economic security, taking into account globalization challenges and the spread of sustainable development principles, according to which the functioning of enterprises should be aimed simultaneously at social, economic and environmental components.

The purpose of the study is to justify the methodological principles of assessing the adaptive management of the enterprises' economic security in the context of globalization challenges and sustainable development. To achieve the goal, the following tasks were outlined and solved:

- proven relevance of scientific research in the issue of substantiation of methodological bases for evaluating adaptive management of economic security of enterprises in the context of globalization challenges and sustainable development;
- use of the structural-functional approach as a basis for evaluating adaptive management of economic security of the enterprise is substantiated;
- necessity of using the taxonomic analysis as a toolkit of economic-mathematical modeling, which allows taking into account the multi-component nature and diversity of the analyzed parameters, are proven;
- a methodical approach to the assessment of adaptive management of economic security of the enterprise was tested.

2. LITERATURE REVIEW

Current studies of the problems of adaptive management of the enterprises' economic security require taking into account a significant number of both qualitative and quantitative parameters of the state of enterprise security in order to ensure sustainable development and take into account the current challenges of globalization. The analysis and systematization of existing scientific research on the mentioned issue makes it possible to state that the first article according to the Scopus database appeared in 2002 (Figure 1). The dynamics over the past 10 years looked like this: 2013 - 1 article, 2014 - 3 articles, 2015 - 3 articles, 2016 - 1 article, 2017 - 7 articles, 2018 - 7 articles, 2019 - 3 articles, 2020 - 5 articles, 2021 - 9 articles, 2022 - 8 articles. The countries where research by scientists focused on the problems of managing the enterprises' economic security in the context of sustainable development and the influence of global factors were: China (26 articles), Ukraine (13 articles), Slovakia (5 articles), USA (3 articles).

A study worthy of attention [1], within which a general model of adaptive management was formed, which is based on the application of a deterministic approach to modeling taking risks is taken into account.

The research of Deineha et al. [2], who proposed ways to improve the adaptability of transport logistics management in agricultural enterprises, is of practical importance.

Scientists Teerasoponpong and Sopadang [3] developed a decision support system for adaptive sourcing and inventory management in small and medium-sized enterprises. Within the article, a decision support system based on the use of a modeling and optimization approach by incorporating an artificial neural network and a genetic algorithm to represent the problem and optimize decisions for decision support is proposed.

The article by Wang [4] is devoted to the application of an adaptive algorithm in the management of a paper factory enterprise based on methodological approaches, taking into account complications of the information structure of the micro-level of economy.

The study of Shi et al. [5] is devoted to adaptive management of the self-organization of a complex system of a manufacturing enterprise. Scientists have analyzed the hierarchical structure and characteristics of complex systems of production enterprises, and the adaptive management system developed by them is necessary for self-organization control.

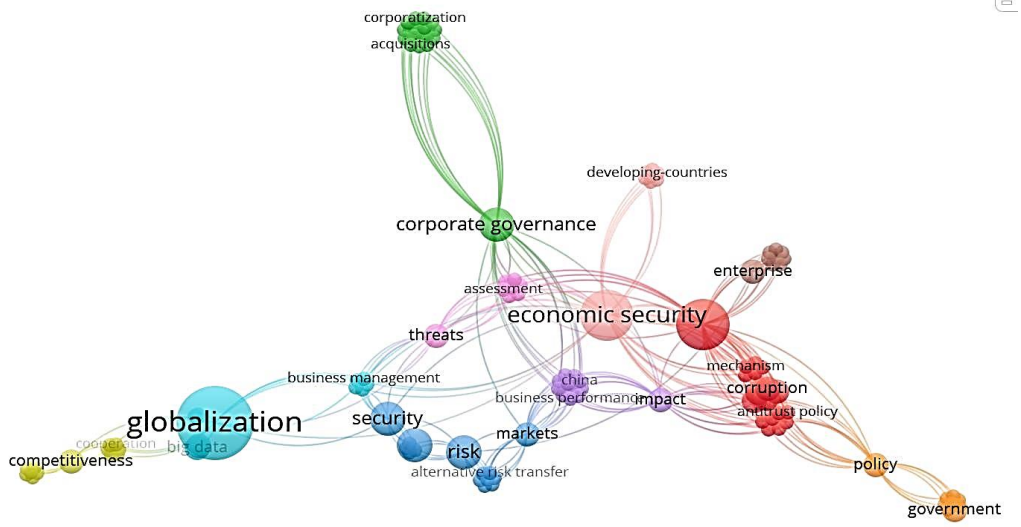

Figure 1. Cartographic analysis of the scientific works results by keywords "management of enterprises' economic security, global challenges, sustainable development", 2002-2022
Source: compiled by the authors based on Scopus database analysis and using VOSviewer tools

Scientists Arboleda et al. [6] developed a toolkit for creating and managing self-adaptive corporate applications, which provides tools and mechanisms for managing self-adaptive enterprise applications.

Many scientific studies of domestic and foreign scientists are devoted to the issue of economic security. Supporting the study Burda et al. [7], it should be noted its practical value in relation to the developed system of adaptive assessment of the financial management of economic security of the enterprise, which takes into account changes in the external and internal environment.

A study of Cherep et al. [8] that assessed the influence of innovative potential of personnel on strengthening economic security of Ukrainian enterprises in the post-war period is practically expedient. We believe that the developed author's proposals can be useful in the development of joint projects to strengthen economic security in various spheres of the activity.

Based on research results of Chubaievskyi et al. [9], a model of the optimization algorithm for the formation of information security of the enterprise in terms of minimizing costs and losses is outlined, which, in our opinion, is extremely relevant in modern conditions.

Worthy of attention are the works of the authors of Kholiavko, et al. [10] and Viknianska et al. 11] devoted to the location of countries in the global scientific and educational space, socio-economic expediency of state management in the context of European integration processes, as well as the development of the author's approach to the economic analysis and management of enterprises in the conditions of the transformation of economic systems.

Within the scope of the article of Lehenchuk et al. [12], a methodology for assessing economic security of industrial enterprises of Ukraine has been developed. The analysis of destructive and stimulating factors of the development of enterprises, as well as the determination of the factors that reduce and increase the level of their economic security, deserve attention.

Research of Samoilenko et al. [13] is relevant today, namely the study of issues of modernization of economic security of the enterprise, taking into account new risks and possibilities of digitalization. The authors outline internal and external negative threats that can be foreseen to ensure effective and stable functioning of the enterprise in the conditions of digitalization and taking into account modern military challenges.

Within the scope of the article by Ovchinnikova et al. [14], the system of criteria aimed at assessing the level of environmental safety of enterprises is described, and also the ways of improving the processes of greening production aimed at improving the environmental situation in the region are developed.

Implementation of the sustainable development concept is becoming more and more relevant in the research of scientists. The result of the authors' research of Popelo et al. [15]; Tulchynska et al. [16]; Boiarynova et al. [17]; Zhavoronok et al. [18] is the determination of the impact of state management of regional development on the formation of inclusive economy, as well as the determination of ways to intensify innovative digital development of regions in the context of sustainable development.

Bresciani et al. [19] prove that innovations, environmental sustainability and economic development are interconnected and collectively contribute to the competitiveness of enterprises. We support the opinion of scientists that the environmental policy has a positive effect on the effectiveness of innovation and demonstrates a positive relationship between development, innovation and environmental sustainability.

We support the research of Marhasova et al. [20], within which the harmony of economic development of the regional economic systems in the context of sustainable development is modeled.

Within the study of Kryvda et al. [21], the harmony of ecological development in the conditions of the the circular economy formation, which today is a relevant and timely direction of research, is analyzed.

Within the framework of article of Raszka et al. [22], the assessment of the development potential of post-industrial territories was carried out from the point of view of the components of sustainable development, namely social, economic and ecological aspects.

We support the research of Lagodiienko et al. [23], which is devoted to the peculiarities of managing foreign economic activities of enterprises in modern conditions of sustainable development, namely the spread of integration processes, structural transformations of the international division of labor, strengthening the role of intellectual property of the state in entering the world economic system.

However, despite a significant number of publications, the issue of evaluating adaptive management of economic security of enterprises in the context of globalization challenges and sustainable development requires further research and analysis.

It should be noted that the conducted research on this topic, which the authors will present in other sections of the publication, made it possible to establish that a lot of attention was paid by researchers to such issues as adaptive management in economic security, sustainable development and global challenges affecting the activity of economic systems of various level, but there are no areas of research combining these topical issues. In this study, the authors justify their proposals from the perspective of globalization challenges and sustainable development regarding the adaptive management of the enterprises' economic security with a simultaneous justification of the methodological foundations of this issue.

3. METHODOLOGY

It should be noted that a diverse set of methodological approaches can be used to assess adaptive management of economic security of enterprises, including the indicator approach of calculations, criteria, methods based on determining the risks of the enterprise's functioning in the conditions of globalization challenges and sustainable development. The variety of approaches gives rise to the variability of the application of calculation methods, including expert, factor, coefficient, graphic, etc. Each of the methods has its advantages and disadvantages, therefore, when choosing a methodical toolkit, it is important to take into account the set goals when evaluating adaptive management of economic security of enterprises.

The authors suggest using a structural-functional approach to assess adaptive management of economic security of enterprises. This is due to the following advantages of the structural-functional approach:

Firstly, it makes it possible to consider economic security as a certain system that has subsystems, and is subject to the basic

principles of the system approach, among which the sum of the resulting feature of the system is greater than the sum of its individual components, the possibility of considering each subsystem as a separate system of a different order, etc.;

Secondly, the possibility of ensuring the segmentation of economic security by functional spheres of its activity, which makes it possible to single out the most influential factors of adaptive management, which ensures economic security as a whole in the context of global challenges and sustainability of development;

Thirdly, to take into account adaptive behavior of enterprises, taking into account the specifics of their activity and the specific features of a specific functional component;

Fourthly, the possibility of carrying out a full, detailed analysis of adaptive management of economic security of enterprises due to a multi-faceted consideration of the main functional directions of the enterprise and the possibility of detailing certain components or the economic system as a whole, if necessary;

Fifthly, it provides identification of critical security points of the enterprise's functioning and the direction of adaptive management tools to strengthen economic security of the enterprise in the context of globalization challenges and sustainable development.

Thus, taking into account the justification of the structural-functional approach for evaluating adaptive management of economic security of enterprises in the context of globalization challenges and sustainable development, the authors suggest using taxonomic analysis as a tool of the economic-mathematical analysis.

The structural-functional approach, as well as the taxonomic analysis method, are not new methods, but their application in relation to the substantiation of the methodological principles of evaluating the adaptive management of the enterprises' economic security in the context of globalization challenges and sustainable development has not been used.

A taxonomic analysis of the assessment of adaptive management of economic security of enterprises in the context of globalization challenges and sustainable development is proposed to be carried out in the following sequence (Figure 2).

Firstly, in accordance with the structural-functional approach of identifying analytical features of adaptive management of economic security of the enterprise, which will later be included in the calculation model, which is built on the basis of observation matrices, which has the following form:

$$X = \begin{bmatrix} x_{11} & x_{1j} & x_{1m} \\ x_{i1} & x_{ij} & x_{1m} \\ x_{n1} & x_{nj} & x_{nm} \end{bmatrix}, \quad (1)$$

where, x_{ij} – the value of the jth analytical feature of adaptive management of the enterprise's economic security for the ith time period;

x_{nm} – m-th number of analytical signs of the assessment of the level of adaptive management of economic security for n-th number of studied periods.

According to the structural-functional approach, the grouping of analytical features into financial, intellectual-personnel, production components is proposed.

Secondly, among the isolated analytical signs of establishing the quality of their influence on economic security in the form of a stimulant, which directly positively affects the level of economic security of the enterprise, and a stimulant, which, on the contrary, has a negative effect.

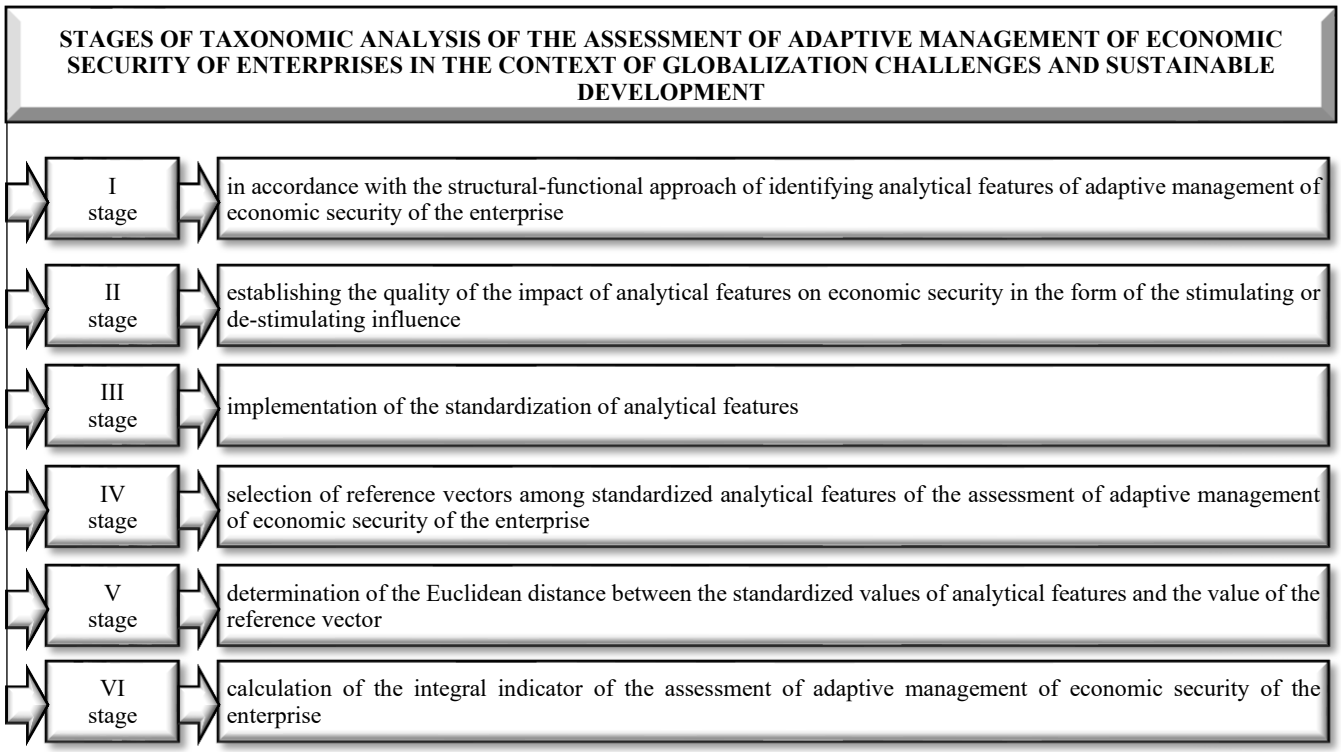

Figure 2. Stages of the taxonomic analysis of the assessment of adaptive management of economic security of enterprises in the context of globalization challenges and sustainable development

Source: suggested by the authors

Thirdly, implementation of the standardization of analytical features for their unification and further calculations of matrix parameters. Standardization is carried out using the following formula:

$$y_{ij} = \frac{x_{ij} - \overline{x}_j}{\sigma_j}, \quad (2)$$

where, y_{ij} – the standardized value of the analytical characteristic of the assessment of adaptive management of economic security of the enterprise;

$x_{ij} - \overline{x}_j$ – respectively, the value and the arithmetic mean value of the j-th analytical feature of the assessment of adaptive management of economic security of the enterprise;

σ_j – root mean square deviation of the j-th analytical feature of the evaluation of adaptive management of economic security of the enterprise.

Fourthly, the identification of reference vectors among the standardized analytical features of the assessment of adaptive management of economic security of the enterprise, which, depending on the stimulating or de-stimulating influence, are represented by a maximum or a minimum, respectively:

$$y_{oj} = \begin{cases} \max\limits_i y_{ik}, \text{ provided the stimulating effect of the analytical feature}, \\ \min\limits_i y_{ik}, \text{ provided the disincentive effect of the analytical feature} \end{cases} \quad (3)$$

where, y_{oj} – the reference vector of the standardized analytical feature of the assessment of adaptive management of economic security of the enterprise;

y_{ik} – the maximum (for stimulators) and minimum (for de-stimulators) value of the reference vector of the standardized analytical features of the assessment of adaptive management of economic security of the enterprise.

Fifthly, the determination of the Euclidean distance between the standardized values of analytical features and the value of the reference vector, which is calculated using the formula:

$$d_{i0} = \sqrt{\sum_{j=1}^{n} \left(y_{ij} - y_{oj} \right)^2}, \quad (4)$$

where, d_{i0} – the distance between y_{ij} and the values of the formed reference vector for evaluating adaptive management of economic security of the enterprise.

Sixthly, the calculation of the integral indicator of the assessment of adaptive management of economic security of the enterprise, which makes it possible to quantitatively determine the degree of deviation of the existing level of economic security from the reference level. For this, you need to make calculations:

– the average value of the deviations of the analytical features of the assessment of adaptive management of economic security of the enterprise from the reference vector using the formula:

$$M(d_{i0}) = \overline{d_0} = \frac{1}{m} \sum_{j=1}^{m} d_{i0}, \quad (5)$$

where, $M(d_{i0})$ – the average level of deviations of the analytical features of the assessment of adaptive management of economic security of the enterprise from the reference vector;

– the root-mean-square deviation of the distances of the vectors of individual periods from the reference vector of the assessment of adaptive management of economic security of the enterprise according to the formula:

$$\sigma_0 = \sqrt{\frac{1}{m} \sum_{i=1}^{m} \left(d_{i0} - \overline{d_0} \right)^2}, \quad (6)$$

where, σ_0 – root mean square deviation d_{i0} of the distances of the vectors of individual periods from the reference vector of the evaluation of adaptive management of economic security of the enterprise;

– the maximum value of the deviation from the reference vector of the assessment of adaptive management of economic security of the enterprise using the formula:

$$d_0 = \overline{d_0} + 3 \cdot \sigma_0, \quad (7)$$

where, d_0 – the maximum value of the deviation from the reference vector of the evaluation of adaptive management of economic security of the enterprise thanks to the use of the formula $3 \cdot \sigma_0$.

Calculations of the average value of the deviations of the analytical features from the reference vector, the root mean square deviation of the distances of the vectors of individual periods from the reference vector, and the maximum value of the deviation from the reference vector of the assessment of adaptive management of economic security of the enterprise makes it possible to determine the value of the integral indicator of the assessment of adaptive management of economic security of the enterprise, namely:

$$I_i = 1 - I_i^*, \quad (8)$$

where, I_i – indicator of the level of the assessment of adaptive management of economic security of enterprises in the context of globalization challenges and sustainable development;

I_i^* – intermediate value of the indicator of the level of the assessment of adaptive management of economic security of the enterprise, which is according to the formula:

$$I_i^* = \frac{d_{i0}}{d_0}, \quad (9)$$

Thus, carrying out the outlined stages makes it possible to evaluate adaptive management of economic security of enterprises in the context of globalization challenges and sustainable development using the structural-functional approach and the tools of taxonomic analysis.

4. RESULTS

In order to test the proposed approach of assessing adaptive management of economic security of enterprises in the context of globalization challenges and sustainable development, the authors chose an enterprise operating in the territory of Ukraine, Eurotrading LLC. Table 1 presents the actual values of the analytical assessment of financial, intellectual, personnel and production components of economic security for 2017-2021, as well as standardized values for their further use in taxonomic analysis. The actual values of the analytical signs of economic security of Eurotrading LLC are presented in the form of generally accepted coefficients, which were calculated on the basis of the company's data on its financial statements for 2017-2021.

Table 1. Actual and standardized values of analytical signs of economic security of Eurotrading LLC for 2017-2021

Analytical signs	Actual value of analytical features					Standardized values of analytical features				
	Year									
	2017	2018	2019	2020	2021	2017	2018	2019	2020	2021
Financial component of economic security										
Coefficient of financial stability	0,519	0,491	0,136	0,421	0,442	0,864	0,652	-1,954	0,143	0,295
Equity maneuverability ratio	0,306	0,374	0,423	0,483	0,342	-1,295	-0,197	0,613	1,585	-0,706
Current liquidity ratio	1,334	1,362	1,076	1,355	1,277	0,502	0,774	-1,937	0,704	-0,043
Coefficient of provision with own working capital	0,245	0,262	0,062	0,258	0,211	0,512	0,729	-1,961	0,675	0,045
Turnover ratio of working stocks	31,204	29,602	26,579	27,370	21,708	1,221	0,721	-0,223	0,024	-1,743
Duration of accounts payable turnover	15,726	17,708	84,724	88,051	39,083	-1,067	-1,003	1,140	1,247	-0,319
Rate of return on assets	0,016	0,018	0,008	0,008	-0,123	0,566	0,614	0,415	0,418	-2,014
Intellectual and personnel component of economic security										
Staff turnover rate	0,102	0,108	0,097	0,147	0,150	-0,827	-0,549	-1,063	1,141	1,298
Ratio of growth rates of labor productivity and wages	0,963	0,756	1,045	1,111	0,680	0,313	-0,939	0,818	1,214	-1,406
Coefficient of the ratio of the average monthly salary of the organization's employees to the average level of the industry in the region (motivation coefficient)	0,881	0,895	0,938	0,955	0,984	-1,324	-0,943	0,195	0,668	1,405
Coefficient of physical aging of personnel	0,112	0,118	0,082	0,074	0,095	0,948	1,305	-0,832	-1,341	-0,080
Share of newcomers who have been working for more than 1 year, from the number of those admitted within 2 years	0,662	0,786	0,657	0,178	0,202	0,653	1,144	0,633	-1,264	-1,169
Funding of employees, thousand UAH/person	8,603	7,816	7,242	6,986	7,536	1,750	0,325	-0,716	-1,178	-0,183
Production component of economic security										
Depreciation rate	0,255	0,304	0,347	0,395	0,426	-1,488	-0,680	0,028	0,811	1,328
Rate of renewal of fixed assets	0,007	0,000	0,017	0,020	0,000	-0,229	-1,059	1,018	1,329	-1,059
Coefficient of disposal of fixed assets	0,051	0,049	0,049	0,056	0,031	0,360	0,261	0,261	1,050	-1,932

Source: calculated by the authors on the basis of the enterprise data and proposed methodological toolkit

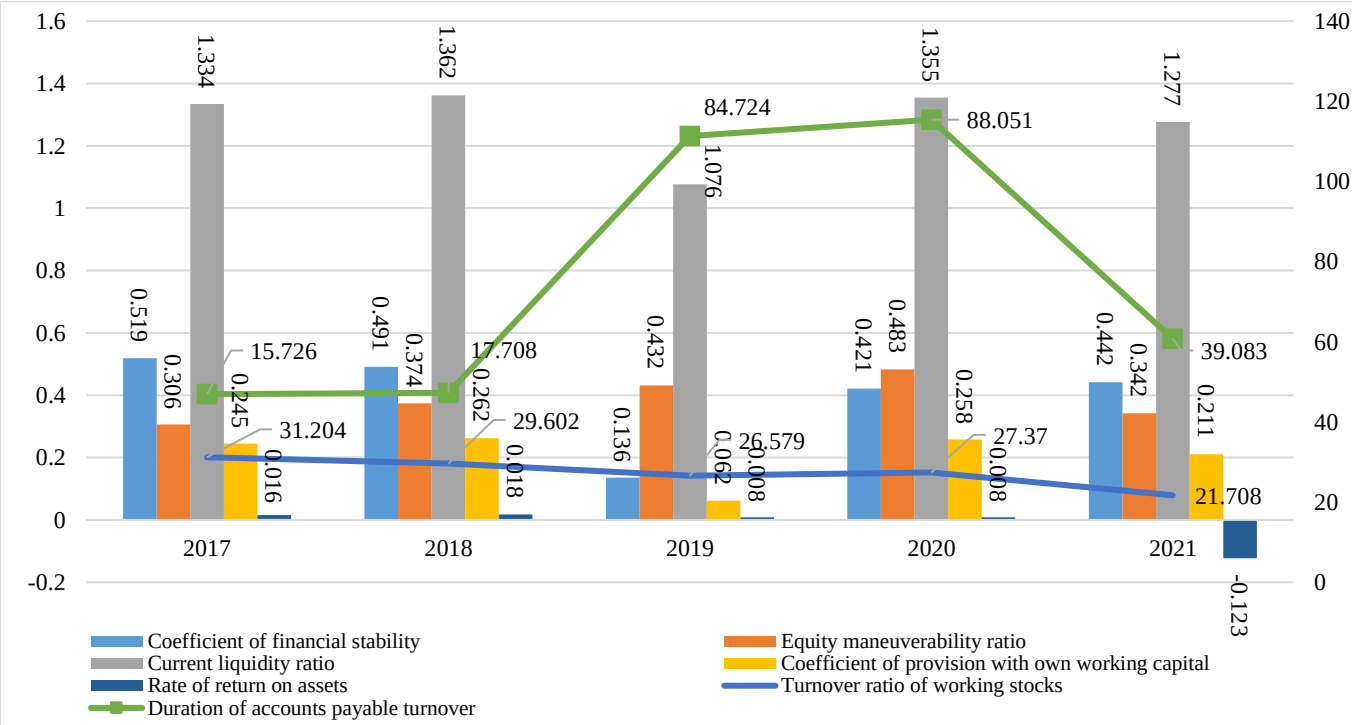

Figure 3. Dynamics of indicators of th assessment of the financial component of economic security of Eurotrading LLC (2017-2021)

Source: built by the authors based on the results of calculations

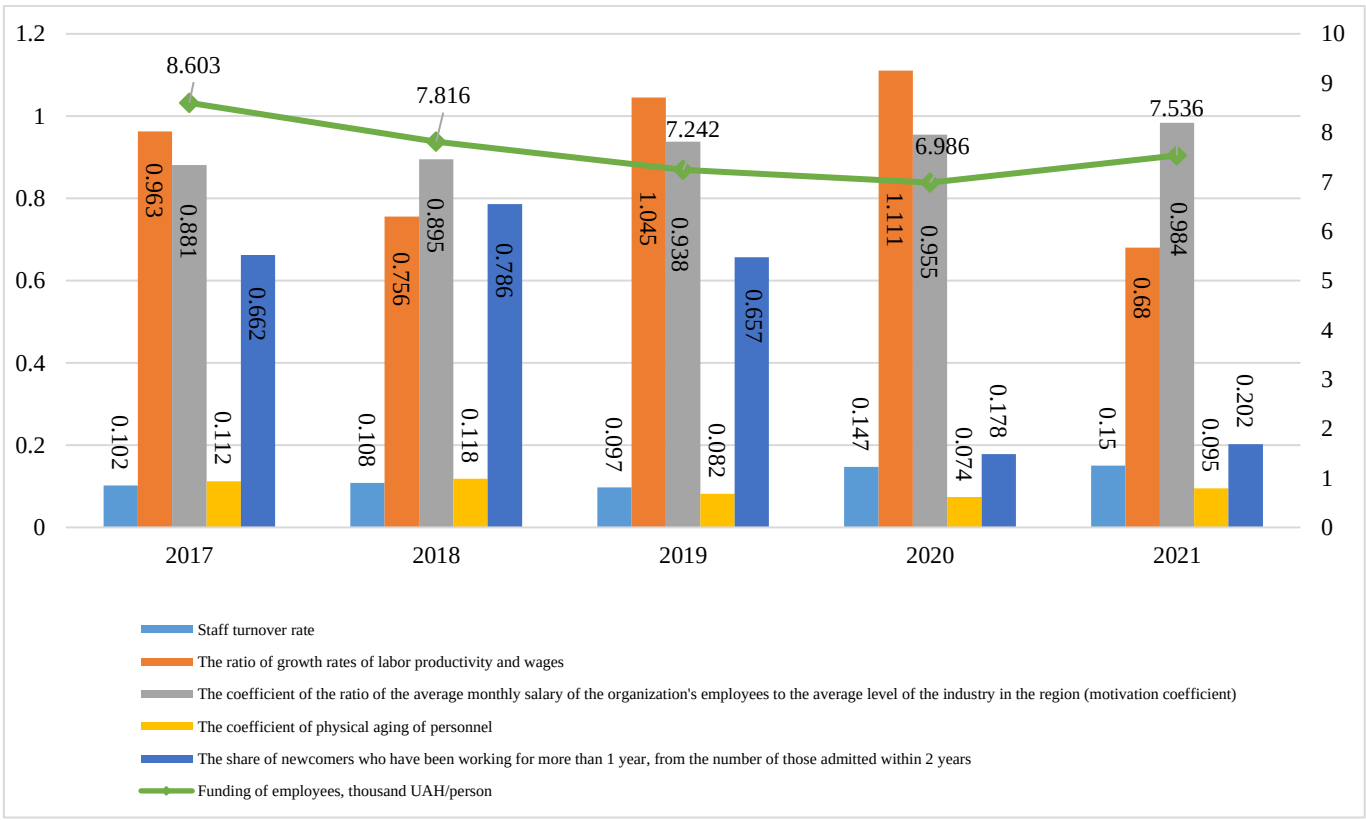

Figure 4. Dynamics of evaluation indicators of the intellectual and personnel component of economic security of Eurotrading LLC (2017-2021)

Source: built by the authors based on the results of calculations

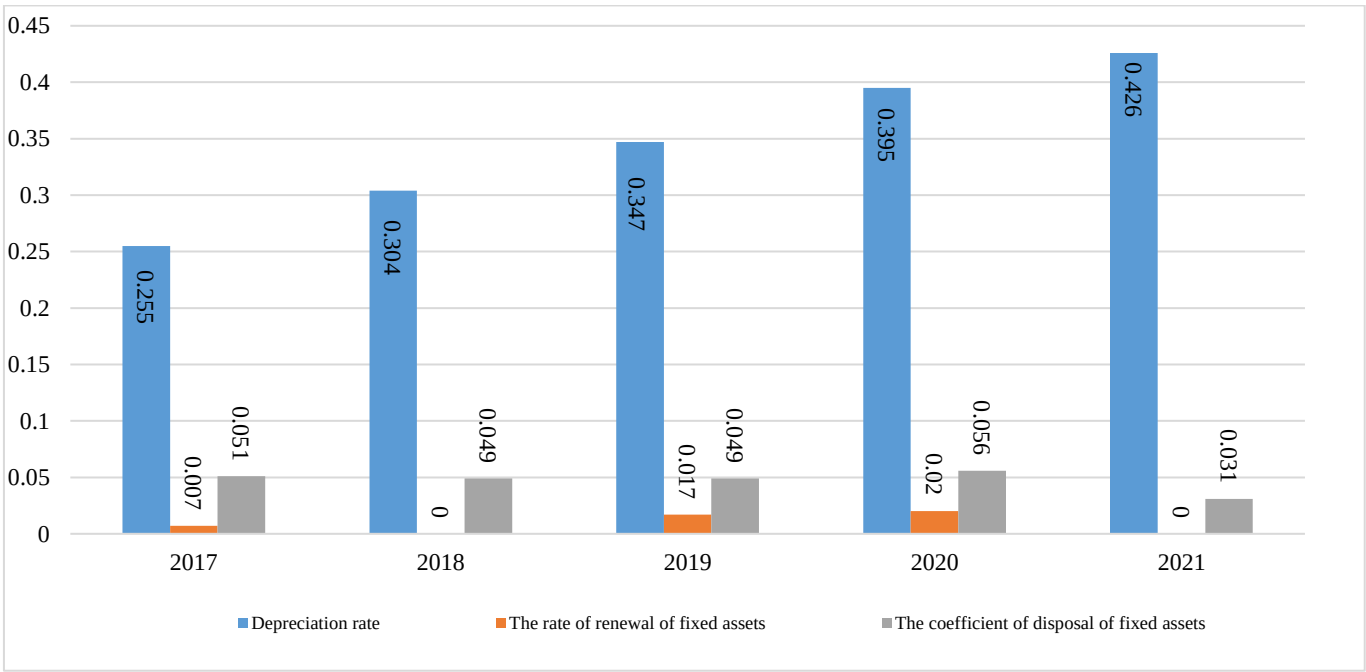

Figure 5. Dynamics of indicators of the assessment of the production component of economic security of Eurotrading LLC (2017-2021)

Source: built by the authors based on the results of calculations

Figures 3-5 presents three components of economic security (the values of the obtained coefficients are plotted on the abscissa axis). There may be more of them, for example, informational, innovative, technological, power, environmental and other components can be distinguished. The financial component of economic security is described by seven analytical features, including the following coefficients, namely: financial stability, maneuverability of own capital, provision of own working capital and others. The intellectual and personnel component of economic security also has seven analytical features, and the production component has three.

Presented in the Table 1 financial component of economic

security characterizes the enterprise's ability to maintain the necessary level of sustainability of the entire enterprise and to maintain a stable structure and dynamics of financial resources.

The results of calculations of the financial component of economic security of Eurotrading LLC testify to persistent negative trends regarding the values of the main financial analytical signs. Yes, there is a rather long time for one turnover of accounts payable in 2019-2020, which is associated with an increase in accounts receivable. Also, the level of the financial stability and profitability of assets is quite low, which, as a result of the losses received in 2021, reached the lowest value during the studied period. The most stable indicator for Eurotrading LLC in the financial component of economic security is the current liquidity ratio. In general, it can be concluded that the financial component of economic security is at a rather low level and requires further measures of adaptive management.

The second component that characterizes economic security of Eurotrading LLC is intellectual and personnel security, which characterizes the enterprise's ability to effectively manage personnel potential and the possibility of increasing intellectual capital. The data presented in the Table 1 make it possible to note that during the studied period, the enterprise had a fairly high staff turnover. The growth of this indicator in 2020 can be explained by the impact of the pandemic, which forced a reduction in the number of jobs at the enterprise due to a reduction in demand for products. The turnover rate is correlated with the rate of new hires with less than two years of experience at the company. The increasing dynamics and reduction of the backlog of wages at the enterprise in relation to the average industry regional value, and positive dynamics of the labor productivity indicator can be considered positive. But, in general, it can be noted that the level of intellectual and personnel security at the enterprise does not have general clear tendencies of increase, it is also affected by the lack of intellectual assets available at the enterprise, which would provide an opportunity to receive additional income and act as an additional incentive for employees.

The third component of economic security of the enterprise is the production component of Eurotrading LLC, which describes current production capabilities without the need for sustainable development of the enterprise, taking into account moral wear and tear of fixed assets, the ability to meet new consumer needs, etc. The obtained calculations testify to the negative dynamics of the growth of wear and tear of fixed assets, and the dynamics of renewal of fixed assets at Eurotrading LLC is also deteriorating, which corresponds to zero values in 2018 and 2021. The indicator of the disposal ratio significantly exceeds the level of renewal of fixed assets and maintains, with the exception of 2021, the value at the level of 0.5. It should also be noted that Eurotrading LLC lacks innovative products and leading equipment, which increases the risk of the company's development in the context of globalization challenges and sustainable development.

Calculations of the values of the analytical features of the assessment of adaptive management of economic security of the enterprise in the context of globalization challenges and sustainable development are presented in the Table 2, which were carried out in accordance with the proposed methodical assessment approach.

It can be noted that from the calculations presented in the Table 2, that of the 16 given analytical evaluations grouped into three components of economic security, such coefficients as: duration of accounts payable turnover, staff turnover, physical aging of staff, wear and tear and disposal of fixed assets are disincentives. Analytical features such as the duration of accounts payable turnover and the turnover ratio of fixed assets have the largest root mean square deviation.

Table 2. Calculations of the values of analytical features of the assessment of adaptive management of economic security of Eurotrading LLC in the context of globalization challenges and sustainable development

Analytical signs	Arithmetic average value of the analytical characteristic (x_{javg})	Root mean square deviation of the analytical characteristic (σ_j)	Reference value of the analytical characteristic	The type of influence is stimulating (+), disincentive (-)
Financial component of economic security				
Coefficient of financial stability	0,402	0,137	0,864	+
Equity maneuverability ratio	0,386	0,062	1,585	+
Current liquidity ratio	1,281	0,107	0,774	+
Coefficient of provision with own working capital	0,207	0,075	0,729	+
Turnover ratio of working stocks	27,293	3,235	1,221	+
Duration of accounts payable turnover	49,058	31,578	-1,067	-
Rate of return on assets	-0,015	0,055	0,614	+
Intellectual and personnel component of economic security				
Coefficient of disposal of fixed assets	0,121	0,023	-1,063	-
Ratio of growth rates of labor productivity and wages	0,911	0,167	1,214	+
Coefficient of the ratio of the average monthly salary of the organization's employees to the average level of the industry in the region (motivation coefficient)	0,930	0,038	1,405	+
Coefficient of physical aging of personnel	0,096	0,017	-1,341	-
Share of newcomers who have been working for more than 1 year, from the number of those admitted within 2 years	0,497	0,255	1,144	+
Funding of employees, thousand UAH/person	7,637	0,558	1,750	+
Production component of economic security				
Depreciation rate	0,345	0,062	-1,488	-
Rate of renewal of fixed assets	0,009	0,008	1,329	+
Coefficient of disposal of fixed assets	0,047	0,008	-1,932	-

Source: calculated by the authors on the basis of the enterprise data and proposed methodological toolkit

Based on the information given in the Table 2 calculations, we determine the average value of the deviations of analytical features from the reference vector, the root mean square deviation of the distances of the vectors of individual periods from the reference vector, and the maximum value of the deviation from the reference vector of the assessment of adaptive management of economic security of the enterprise according to the proposed methodical approach. The results of calculations are given in Table 3.

Table 3. Calculations for determining the integral indicator of the assessment of adaptive management of economic security of the enterprise according to the components of economic security of Eurotrading LLC

Indicators	Financial component of economic security	Intellectual and personnel component of economic security	Production component of economic security
average value of the deviations of analytical features of the assessment of adaptive management of economic security of the enterprise from the reference vector M(d_{i0})	3,521962401	4,01212092	3,661681626
root mean square deviation of the distances of the vectors of individual periods from the reference vector of the assessment of adaptive management of economic security (σ_0)	1,357146118	0,681107388	0,391934914
maximum value of the deviation from the reference vector of the assessment of adaptive management of economic security of the enterprise (d_0)	7,593400754	6,055443084	4,837486367

Source: calculated by the authors on the basis of the enterprise data and proposed methodological toolkit

Table 4. Calculations of evaluation indicators of adaptive management of economic security of Eurotrading LLC, 2017-2021

Indicators	2017	2018	2019	2020	2021
Financial component of economic security					
the Euclidean distance between the standardized value of the analytical feature and the value of the reference vector (d_{i0})	2,87175	1,84453	5,4655	2,6841	4,744025
intermediate value of the indicator of the assessment level of adaptive management of economic security of the enterprise (I_i^*)	0,37819	0,24291	0,7198	0,3535	0,624756
indicator of the assessment level of adaptive management of economic security of enterprises in the context of globalization challenges and sustainable development **(I_i)**	**0,62181**	**0,75709**	**0,2802**	**0,6465**	**0,375244**
Intellectual and personnel component of economic security					
the Euclidean distance between the standardized value of the analytical feature and the value of the reference vector (d_{i0})	3,681305	4,36897	2,8434	4,4045	4,762385
intermediate value of the indicator of the assessment level of adaptive management of economic security of the enterprise (I_i^*)	0,607933	0,72149	0,4696	0,7274	0,786463
indicator of the assessment level of adaptive management of economic security of enterprises in the context of globalization challenges and sustainable development **(I_i)**	**0,392067**	**0,27851**	**0,5304**	**0,2726**	**0,213537**
Production component of economic security					
the Euclidean distance between the standardized value of the analytical feature and the value of the reference vector (d_{i0})	3,244929	3,73437	3,1722	4,1112	4,045706
intermediate value of the indicator of the assessment level of adaptive management of economic security of the enterprise (I_i^*)	0,670788	0,77196	0,6558	0,8499	0,836324
indicator of the assessment level of adaptive management of economic security of enterprises in the context of globalization challenges and sustainable development **(I_i)**	**0,329212**	**0,22804**	**0,3442**	**0,1501**	**0,163676**

Source: calculated by the authors on the basis of the enterprise data and proposed methodological toolkit

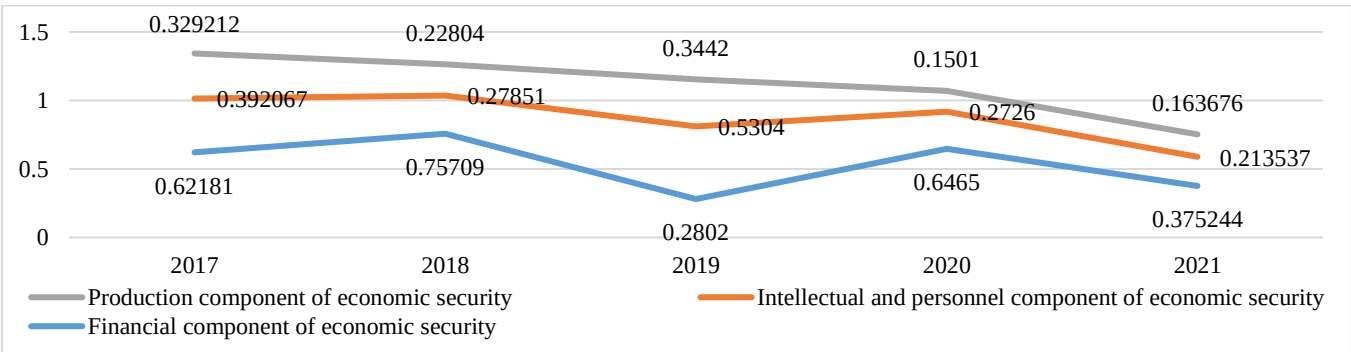

Figure 6. Indicators of adaptive management of economic security of Eurotrading LLC in the context of globalization challenges and sustainable development

Source: built by the authors based on the results of calculations

On the basis of the obtained results, the indicators of adaptive management of economic security of Eurotrading LLC were calculated for each of the components of economic security, the results of the calculations are shown in Table 4.

From the above results of calculations according to the structural-functional approach presented in Figure 6, it can be noted that for all components of economic security in the last studied period, there is a deterioration of the integral indicator of the assessment level of adaptive management of economic security. That is, the presence of threatening dynamics is observed in the non-pecuniary parameters of the functioning of Eurotrading LLC in terms of financial, intellectual-personnel and production components according to the results of the taxonomic analysis. The biggest threats to the activity of Eurotrading LLC are financial problems, including low profitability, financial stability and solvency, as well as high wear and tear of fixed assets and staff turnover. Further aggravation of such problems may necessitate remedial measures, which requires an immediate review of adaptive management measures.

So, the approbation of the proposed methodical approach using the taxonomic analysis of the assessment of adaptive management of economic security of enterprises in the context of globalization challenges and sustainable development on the example of Eurotrading LLC makes it possible to assert that in order to ensure sustainability of economic development, it is necessary to increase the level of economic security of the enterprise. In this direction, within the framework of adaptive management, it is necessary to ensure rapid changes in the conditions of limited information resources regarding more efficient use of resources, introduction of new fixed assets, production of innovative products, increase of labor motivation to reduce staff turnover.

5. CONCLUSIONS

The scientific novelty of the study consists in the improvement of the methodical approach to the assessment of adaptive management of economic security of enterprises in the context of globalization challenges and sustainability of development, which is based on the structural-functional approach, the use of taxonomic analysis as a toolkit of economic-mathematical modeling and allows taking into account the multi-component and diversity of the analyzed parameters, with in order to obtain the most representative and methodically correct result.

The taxonomic analysis of the assessment of adaptive management of economic security of enterprises in the context of globalization challenges and sustainable development is proposed to be carried out in the following sequence: identification of analytical features of adaptive management of economic security of the enterprise; establishing the quality of the impact of analytical features on economic security in the form of a stimulating or de-stimulating effect; implementation of standardization of analytical features; identification of reference vectors among the standardized analytical features of the assessment of adaptive management of economic security of the enterprise; determination of the Euclidean distance between the standardized values of analytical features and the value of the reference vector; calculation of the integral indicator of the assessment of adaptive management of economic security of the enterprise.

The proposed methodology for evaluating the adaptive management of the enterprises' economic security was used in practice in relation to the functioning production enterprise Eurotrading LLC according to the actual values of the analytical features of the assessment of the financial, intellectual, personnel and production components of the enterprises' economic security for five years, which made it possible to determine the most root mean square deviation of analytical features, including the duration of accounts payable turnover and the turnover ratio of fixed assets. The obtained calculations and Euclidean distances made it possible to substantiate the directions of adaptive management to increase the enterprises' economic security in the context of globalization challenges and sustainable development.

The prospect of further research is the development of the adaptive management toolkit in accordance with the obtained results of evaluating its effectiveness in relation to the enterprises' economic security in the context of globalization challenges and sustainable development, taking into account endogenous and exogenous factors of influence on the micro-level economic system.

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