

# ARTIFICIAL INTELLECTUALIZATION IN THE ASSESSMENT SYSTEM OF THE SAFE DEVELOPMENT OF ECONOMIC ENTITIES

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## ABSTRACT

The processes of artificial intellectualized development of economic systems form an applied toolkit for ensuring effective security development, which determines the need for a well-founded methodological basis for assessing the security development of business entities, which properly takes into account the specific influence of factors of the intellectualized development in the conditions of the dynamic development of artificial intelligence technologies. The purpose of the article is to justify the methodical approach of assessing the security development of economic entities in the conditions of artificial intellectualization by the method of stochastic factor analysis of the main components. The legality and expediency of applying the methodical approach to assessing the security development of economic entities in the conditions of artificial intellectualization due to stochastic factor analysis, the tools of which are the method of principal components, rotation of Varimax components, and Bartlett's method, have been proven. The verification of the proposed methodical approach to assessing the safety development of economic entities in the conditions of artificial intellectualization by the method of stochastic factor analysis of the main components was carried out on the example of PJSC "Southern Mining and Processing Plant". A qualitative analysis of the distribution of analytical parameters as a result of a stochastic factor analysis of the safe development of economic entities was carried out using the example of PJSC "Southern Mining and Processing Plant" in the conditions of artificial intellectualization. The practical significance of the proposed methodical approach lies in the possibility of evaluating the processes of artificial intellectualization in the system of the safe development of an economic entity, to single out the components of artificial intellectualization of the safe development with the corresponding indicators of importance, to more comprehensively assess current security challenges and the objective need for the implementation of artificial intellectualization as a factor of accelerated growth on the basis of which to develop the basic requirements of strategic development.

**Keywords:** *Artificial Intellectualization, Artificial Intelligence, Security Development, Security, Intellectualization Of Economic Development, Intellectual Resource, Enterprise, Economic Entities, Socio-Economic System.*

## 1. INTRODUCTION

The structural transformation of the dominant paradigmatic formation remains a relevant track in the development of modern socio-economic systems, manifesting itself in the completion of the corresponding transition to post-industrial forms of

organization of economic relations. The fundamental basis of post-industrialism is the systemic processes of intellectualization of economic development, which are characterized by the predominance of intangible components as primary drivers of qualitative modernization of production and management activities and consistent provision of

intensive growth. It should be noted that the specified process in modern conditions acquires a qualitative change under the influence of the emergence and active polyfunctional diffusion of artificial intelligence technologies into current structural forms of building economic systems, regardless of their branch orientation. This situation is natural, taking into account the focus of intellectualized development on the elimination of practices involving human resources in production and/or management operations devoid of a cognitive and analytical component. At the same time, artificial intelligence technologies, on the one hand, make it possible to reduce the time parameters of processing large arrays of information, and on the other hand, contribute to the optimization of the work process in relation to homogeneous, in terms of the implementation procedure, analytical tasks.

The following resource-functional elements are the structural basis of artificial intellectualization as one of the dominant trends of socio-economic development today:

- an intellectual resource, which is represented by a set of factors that determine the cognitive potential of an individual, his ability to produce effective technological and management solutions, is characterized by universal utilitarianism and the absence of quantitative restrictions, provided that favorable parameters of its applied application are formed;

- the technological resource is intended for the qualitative modernization of the technical potential of economic actors with the aim, on the one hand, of mobilizing the resource for the growth of efficiency parameters, and on the other hand, avoiding unproductive costs of low-intellectual-intensive operations;

- the information resource forms a set of descriptive characteristics of quantitative parameters of the functioning of specific economic systems or the dynamics of the external environment, thereby acting as a supporting element of the management decision-making system;

- knowledge potential and innovations that act as the drivers of the intellectualized development of economic systems, in which knowledge represents empirical information about the mechanisms of action and the specifics of the implementation of individual processes and phenomena, being converted into a specific innovative product, which in turn serves as a source of increased economic efficiency in various forms;

- creativity and inclusive development determine the necessary composition of parameters for the cultivation of a favorable environment for the

generation of innovative solutions and the maximization of the individual intellectual potential of individuals, regardless of their mental and/or physical characteristics.

In this case, the processes of the artificial intellectualized development of economic systems form an applied toolkit for ensuring effective security development, thereby expanding and qualitatively enriching the practical field of its application, which is not limited to crisis states of the economic system, on the contrary, allowing to ensure planning and process stability in the functioning of the organization on stages of extended reproduction.

Thus, the above-mentioned aspects determine the need for the formation of a justified methodological basis for assessing the security development of entrepreneurial entities, which properly takes into account the specific influence of factors of intellectualized development in the conditions of the dynamic development of artificial intelligence technologies.

Based on this, the problem of forming methodological components for the implementation of representative forms of artificial intellectualization assessment in the system of ensuring the enterprise economic security in terms of the appropriate indicators composition and means of their analytical structuring arises, which in turn raises the research question of the possibility of a justified distribution among influencing factors on the processes of artificial intellectualization and measurability of quantitative levels of their cumulative impact.

The purpose of the article is to justify the methodical approach of assessing the security development of economic entities in the conditions of artificial intellectualization by the method of stochastic factor analysis of the main components. To achieve the goal, the following tasks were proposed and solved by the authors:

- the relevance and necessity of research into the assessment of the security development of economic entities in the conditions of artificial intellectualization is substantiated;

- the expediency of using the method of stochastic factor analysis, as well as its tools such as the method of principal components, rotation of Varimax components, and Bartlett's method, has been proven;

- verification of the proposed methodical approach to assessing the safety development of business entities in the conditions of artificial intellectualization by the method of stochastic factor analysis of the main components was carried out using the example of PJSC "Southern Mining and Processing Plant";

- a qualitative analysis of the distribution of analytical parameters was carried out as a result of the stochastic factor analysis of the security development of economic entities on the example of PJSC "Southern Mining and Processing Plant" in the conditions of artificial intellectualization.

## 2. LITERATURE REVIEW

The processes of intellectualization of economic development today are characterized by the predominance of intangible components as primary drivers of qualitative modernization of production and management activities and consistent provision of intensive growth of economic entities. A significant role in these processes is played by artificial intelligence technologies, which allow to reduce the time parameters of processing large amounts of information, contribute to the optimization of the labor process, etc. Many scientific studies have been devoted to the features of the application and role of artificial intelligence technologies in the development of enterprises [1-7].

Research [1] examines whether artificial intelligence contributes to the joint prosperity of enterprises in the service sector. The main results of the study show that the use of artificial intelligence in the service sector significantly reduces the labor income of enterprises. The authors of the study found that improving the integration of regional labor markets and the bargaining power of workers could help mitigate the negative impact of AI programs on the share of labor income in the service sector.

Scientists [2] are investigating the role of artificial intelligence in the environmental efficiency of enterprises. Given that businesses aim to implement good environmental practices, the authors' findings not only demonstrate how artificial intelligence is becoming a priority to achieve cleaner production goals, but also serve as a promising basis for developing appropriate policies that aim to achieve environmental responsibility.

The result of scientific work [3] is the confirmation of the hypothesis that value creation, intellectual property and organizational creativity have a positive effect on the fact that enterprises focused on artificial intelligence can be successful according to efficiency criteria. Based on the analysis of the effects of creating the value of intellectual property and organizational creativity in enterprises focused on artificial intelligence, in order to increase the success of such enterprises, according to the authors, they should offer more value to their customers, protect their technologies and increase their innovation potential.

According to the authors [4], the modern business environment has been revolutionized by artificial intelligence, which has undoubtedly affected the operational and competitive strategies of small and medium-sized enterprises. Scholars examine the impact of artificial intelligence on SMEs, examining the benefits, barriers and prospects associated with the adoption of artificial intelligence technology. The authors concluded that SMEs should carefully evaluate the costs and benefits of AI adoption and develop a strategic implementation plan that aligns with their business goals and resources.

Research findings [5], the complexities of multiple data sources, conflicting contracts, residency requirements, and the demand for multiple AI models in trade finance supply chains prevent resource-constrained SMEs from taking advantage of AI. According to scientists, the possibility of using AI could increase the efficiency and predictability of their business.

Within the article [6], scholars explore the transition to intelligent corporate social responsibility, an advanced approach to CSR that integrates artificial intelligence and new technologies to promote sustainability and efficiency. The authors offer specific means of achieving the country's sustainable development goals while strengthening regional leadership.

According to the results of the study [7], the authors claim that thanks to digitalization over the past few years, small and medium-sized enterprises have significantly increased their efficiency and productivity. The paper proposes a new and secure framework with a standardized process hierarchy for distributed small and medium-sized enterprises using the joint methods of blockchain, Internet of Things, and artificial intelligence with machine learning.

The basis of the study [8] is the forecast of the development of artificial intelligence technology and the impact of the use of AI on companies. The authors aim at defining AI strategies related to broad AI innovation activities and building a strategic decision-making framework for AI strategies for small and medium-sized enterprises in order to improve the practice of strategic decision-making regarding AI strategy in SMEs.

Scientists [9] are convinced that the digital enterprise will actively live and work with the help of the artificial intelligence system. The authors proposed a system that changes the working atmosphere so that the employee abandons his usual tasks. It is envisaged that real-time data will be stored in the cloud to further assist and improve the AI modules by sending new data sets.

Article [10] argues that artificial intelligence is no longer the exclusive domain of large corporations, but is now impacting businesses of all sizes, including small and medium-sized enterprises, as a management tool in the production and communication of critical aspects of business. The authors investigate the degree of implementation of communicative artificial intelligence by small and medium-sized enterprises, identify problems associated with the implementation of industrial AI programs.

Scientists [11] tried to study the measure of behavioral intentions regarding the use of artificial intelligence among managers of small and medium-sized enterprises. As a result of the study, the authors prove that expected performance, social influence, favorable conditions and support from top management have a positive and significant effect on behavioral intentions to use AI among SME managers.

Research paper [12] proves that over the last decade, artificial intelligence has become a key factor in creating and maintaining unique market advantages, and the use of AI is becoming massive and global. The authors are sure that under the influence of the AI spread, companies that use new business models are increasingly competing in the market. The article determines to what extent the use of AI in certain areas of business activity affects their development.

According to the characteristics of the artificial intelligence industry and based on the understanding of the importance of service quality, the authors of the study [13] developed a system for evaluating the service quality of artificial intelligence enterprises. The research findings show that AI businesses must create products for different needs and formulate different marketing strategies according to the characteristics of the users they serve.

Research [14] is of practical importance, in which it is proven that at the current stage of socio-economic development, the use of "artificial intelligence" is becoming increasingly popular in corporate marketing. The authors of the article investigated the peculiarities of the application and trends of artificial intelligence in corporate marketing.

Supporting the papers [15-17], it is appropriate to note that the commercial application of artificial intelligence is indeed changing the internal work, production and operational process of economic entities, and also contributes to the reformation of enterprises. The authors of the articles investigate the impact of artificial intelligence on the business

management of economic entities, evaluate the positive and negative aspects of its use.

However, taking into account the intensive work of scientists in this field, the issue of artificial intellectualization in the system of assessing the security development of business entities is becoming more and more relevant and requires further research and analysis, which manifests itself in the justification of the methodical approach to the assessment of the security development of economic entities in the conditions of artificial intellectualization, as well as its approbation. Based on this, the issues require deeper consideration are:

- substantiation of using method of stochastic factor analysis of the main components for assessing the level of security development of economic entities in the conditions of artificial intellectualization;

- development a system of analytical indicators characterizing the qualitative aspects of the safety factors impact on the processes of artificial intellectualization of business entities;

- carrying out a qualitative distribution of the analytical indicators system into consolidated groups of factors influencing the security components of the economic entities development in the context of artificial intellectualization processes and identification of the quantitative levels of the relevant factors influence.

### 3. METHODOLOGY

The construction and substantiation of the methodology for assessing the safe development of business entities in the conditions of artificial intellectualization requires the involvement of a wide range of descriptive parameters that holistically characterize the existing system of ensuring economic security and development in their multifunctional dimension, at the same time, the principle of complexity should be followed in order to identify the most significant endogenous relationships connections between individual parameters of the system, their qualitative differentiation and quantitative measurability of the level of influence within the studied security issues of the development of economic entities in the conditions of artificial intellectualization.

Thus, in accordance with the established requirements for the implementation of the procedure for assessing the security development of entrepreneurial entities in the conditions of artificial intellectualization, the authors proposed the use of the method of factor analysis, which allows, using the mathematical apparatus of analysis, to reduce the

dimension of the array of investigated parameters, grouping the latter within the most influential components, quantitatively having systematized both the influence of specific parameters within the selected components, and the general indicators of the importance of individual components.

Application of the factor analysis tool can be implemented in two possible methodological directions - deterministic and stochastic factor analysis. In the framework of this study, it is proposed to apply stochastic factor analysis, which is explained by the impossibility of establishing stable quantitative ratios of the studied parameters in terms of their influence on the resulting indicator. Based on the fact that the system of internal interrelationships of the studied parameters is indirect, the method of stochastic factor analysis was chosen. The defining characteristic of the application of this method is the probabilistic nature of the study of the system of analyzed internal parameters of the functioning of the business structure, which opens up additional opportunities for the study of the influence of an array of uncontrolled aggregates of factors on the analyzed object, in this case, the safe development of business structures in conditions of artificial intellectualization.

The implementation of the factor analysis tool has several methodological variations of implementation, in particular, within the scope of this study, the method of principal components was applied. The method of principal components allows you to mathematically substantiate the identified set of factors, each of which is a consolidated group of analyzed parameters, which determines the existence of a probabilistic relationship between them.

It should be noted that the proposed technique groups the analyzed parameters into separate factors (main components) based on the presence of a correlation between them, while an important aspect is the absence of a correlation between the identified components. An important analytical element is also the possibility of establishing a quantitative level of the parameter of influence of a separate component on the security development of the enterprise in the conditions of artificial intellectualization. Indicators of accuracy and qualitative representativeness of the built model are determined by the sufficiency of the used analytical parameters that characterize the investigated process or phenomenon.

The key advantages of using the method of stochastic factor analysis by the method of main components in the framework of the analysis of the safe development of economic entities in the conditions of artificial intelligence can be defined as

the possibility of comprehensive systematization of a wide array of quantitative and qualitative parameters of a heterogeneous composition and units of measurement, as well as the establishment of a measurable parameter of the influence of a separate component on the security development of business entities in conditions of artificial intellectualization.

The generalized mathematical representation of the sequence of using the method of stochastic factor analysis by the method of principal components can be displayed in the form of the following formula (1):

$$X \rightarrow Z \rightarrow R(S) \rightarrow \left\{ \begin{array}{l} \Lambda \\ U \rightarrow V \end{array} \right\} \rightarrow A \rightarrow F \quad (1)$$

where  $X$  – the matrix of the initial parameters of the analysis (the size of the matrix is  $m \times n$ );

$m$  – the number of parameters for evaluating the security development of the economic entity in the conditions of artificial intellectualization;

$n$  – number of analyzed periods (years);

$Z$  – a matrix of standardized indicators of analytical parameters, set according to the formula:

$$\frac{x_{ij} - x_j}{\sigma_j} \quad (2)$$

$R$  – the matrix of pairwise correlations

$$r = \frac{1}{n} \cdot Z'Z \quad (3)$$

$\Lambda$  – factor mapping matrix;

$a_{rj}$  – weighting coefficients, components of the matrix of factor mapping;

$\Lambda$  – diagonal matrix of characteristic numbers.

An important element of the implementation of the proposed methodology for conducting a study of the security development of business entities in the conditions of artificial intellectualization is the formation of an array of parameters of the initial data, which is proposed to be carried out according to the principle of complexity both for indicators of security development and parameters reflecting the dynamics of the processes of artificial intellectualization of the economic entity.

Thus, this methodical approach will make it possible to quantitatively and qualitatively evaluate the system of interrelationships of key indicators of security development and artificial intellectualization, differentiating them according to the corresponding methodically justified groups. Based on this, in the process of carrying out the procedure of stochastic factor analysis using the method of principal components in order to assess

the safe development of economic entities in the conditions of artificial intellectualization, it is proposed to use the following indicators of the dynamics of the processes of artificial intellectualization and security development of the enterprise under study:

- profitability of assets (V1);
- return on equity (V2);
- profitability of sold products (V3);
- the growth rate of the volumes of sold products (V4);
- coefficient of preparation for new professions (V5);
- qualification improvement factor (V6);
- the rate of growth of costs for technological innovations in the field of artificial intelligence (V7);
- rate of growth of costs for informatization (V8);
- rate of growth of software costs (in particular, artificial intelligence) (V9);
- share of the implemented new technological processes (including artificial intelligence technologies) (V10);
- share of innovation costs in production costs (V11);
- savings in production costs as a result of the introduction of innovations in the field of artificial intelligence by 1 US dollar investment spending (V12).

Thus, the researched array of analytical parameters for assessing the security development of economic entities in the conditions of artificial intellectualization by the method of stochastic factor analysis of the main components is represented by 12 indicators.

On the basis of the formed array of initial parameters for assessing the level of security development of economic entities in the conditions of artificial intellectualization by the method of stochastic factor analysis by the method of principal components, successive calculations are implemented according to formula (1). In particular, one of the steps is the construction of a matrix of characteristic numbers -  $\Lambda$ , which is constructed according to formula (4):

$$\Lambda = \begin{pmatrix} \lambda_1 & 0 & 0 & \dots & 0 \\ 0 & \lambda_2 & 0 & \dots & 0 \\ 0 & 0 & \lambda_3 & \dots & 0 \\ 0 & 0 & 0 & \dots & \lambda_m \end{pmatrix} \quad (4)$$

The value of  $\lambda_m$  indicators is calculated by solving the following equation shown in formula (5)

$$|R - \lambda E| = 0 \quad (5)$$

where  $\lambda_j$  – characteristic variation (dispersion indicator of the identified principal component).

The final matrix of the values of the obtained main components is formed based on the application of one of the formulas (6-8):

$$F = A^{-1}Z' \quad (6)$$

$$F = \Lambda^{-1}A'Z' \quad (7)$$

$$F = \Lambda^{-1/2}V'Z' \quad (8)$$

де  $V$  – matrix of standardized characteristic vectors.

It should be added that the implementation of the above-described analytical procedures for assessing the safe development of business entities in the conditions of artificial intelligence by the method of stochastic factor analysis of the main components has several variations of the applied submethods. In the framework of this study, it is proposed to use the Varimax component rotation method, as well as the Bartlett method.

The choice of the Varimax component rotation method is related to the possibility of obtaining the minimum number of analyzed variables with a high level of factor loading, while maintaining the orthogonality of the studied components.

The Bartlett's method, in turn, is designed to ensure the reliability and representativeness of the formed evaluation model. In addition, we note that within the framework of the proposed methodical approach, the maximum number of computational iterations until convergence is 25.

The final presentation of the obtained results of the assessment of the safe development of business entities in the conditions of artificial intellectualization by the method of stochastic factor analysis of the main components occurs by constructing a graph of normalized simple stress, a graph of components in rotated space, a matrix of rotated components (allows to establish the influence of a specific parameter within the selected component), as well as indicators of the full explained variance, which reflect the quantitative level of influence of each of the identified components on the studied phenomenon. In addition, it is proposed to carry out a qualitative analysis of the presented differentiated set of analytical parameters of the security development of economic entities in the conditions of artificial intellectualization with the provision of an appropriate analytical characteristic for each of the identified security components.

#### 4. RESULTS

The testing of the methodical approach proposed in this article to the assessment of the security development of business entities in the conditions of the activation of artificial intellectualization processes was implemented on the example of PJSC PJSC "Southern Mining and Processing Plant", at the same time, in the research process, specialized software was used for computing operations, in particular IBM SPSS Statistics (calculation of the

results of stochastic factor analysis by the method of principal components).

In the process of carrying out the research, the collection of analytical data from the accounting and statistical reporting of the company under study was carried out, a sequential calculation of predefined analytical parameters of the study was carried out, and an appropriate array of initial data was built for stochastic factor analysis using the method of principal components, which is presented below in the Table 1.

*Table 1: The initial array of data for carrying out stochastic factor analysis by the method of main components of PJSC "Southern Mining and Processing Plant".*

Indicator	V	2017	2018	2019	2020	2021
Return on assets, %	V1	-2,842	0,678	6,372	12,781	14,502
Return on equity, %	V2	-2,964	36,874	7,947	17,247	18,358
Profitability of sold products, %	V3	-33,785	25,241	4,844	8,975	6,683
The growth rate of the volumes of sold products %	V4	0,743	74,402	233,086	104,229	121,330
The coefficient of preparation for new professions	V5	0,003	0,074	0,112	0,109	0,116
Coefficient of professional development	V6	0	0,026	0,034	0,033	0,035
The rate of growth of costs for technological innovations in the field of artificial intelligence	V7	0	37,211	41,751	61,105	50,854
Growth rate of informatization costs, %	V8	0	44,686	124,251	175,700	39,173
Growth rate of spending on software (in particular, artificial intelligence), %	V9	0	4,878	9,605	23,403	20,177
The share of implemented new technological processes (including artificial intelligence technologies), %	V10	0	0,016	0,051	0,078	1,023
The share of innovation costs in production costs, %	V11	0	0,027	0,091	1,025	0,195
Savings in production costs as a result of the introduction of innovations in the field of artificial intelligence by 1 dollar US investment costs	V12	0	0,059	0,081	0,896	0,104

Source: created by the authors based on the data of PJSC "Southern Mining and Processing Plant"

Based on the calculations carried out in accordance with the predetermined methodology of stochastic cluster analysis using the method of principal components, 4 main groups of factors were distinguished, the corresponding results are presented in the Table 2.

Table 2: Full explained dispersion of analytical parameters for assessing the level of the safe development of PJSC "Southern Mining and Processing Plant" in the conditions of artificial intellectualization.

Factor	Initial eigenvalues			Sums of squares of extraction loads			Sums of squares of rotation loads		
	Together	Dispersions, %	Cumulative, %	Together	Dispersions, %	Cumulative, %	Together	Dispersions, %	Cumulative, %
1	7,157	59,642	59,642	7,157	59,642	59,642	3,905	32,543	32,543
2	2,153	17,943	77,585	2,153	17,943	77,585	3,148	26,231	58,774
3	1,517	12,644	90,229	1,517	12,644	90,229	2,534	21,119	79,893
4	1,173	9,771	100,000	1,173	9,771	100,000	2,413	20,107	100,000

Source: calculated by the authors based on the data of PJSC "Southern Mining and Processing Plant"

Thus, as a result of carrying out stochastic factor analysis using the method of principal components, 4 aggregated factors of influence on the safe development of the economic entity in the conditions of artificial intellectualization were singled out, while it was established that the level of influence of

the first factor is 59.642%, the second - 17.943%, the third - 12.644%, the fourth - 9.771%.

Graphs of simple normalized stress and the component of stochastic factor analysis of the security development of business entities in the conditions of artificial intellectualization are presented in Fig. 1.

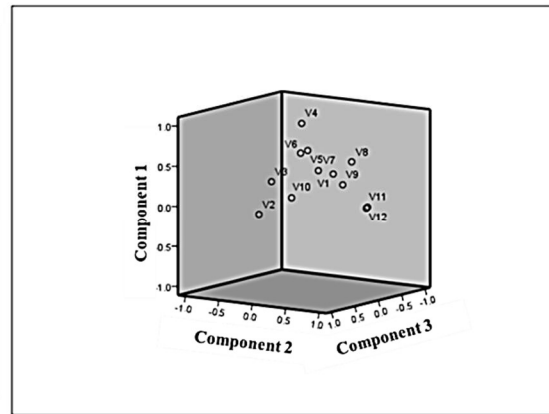
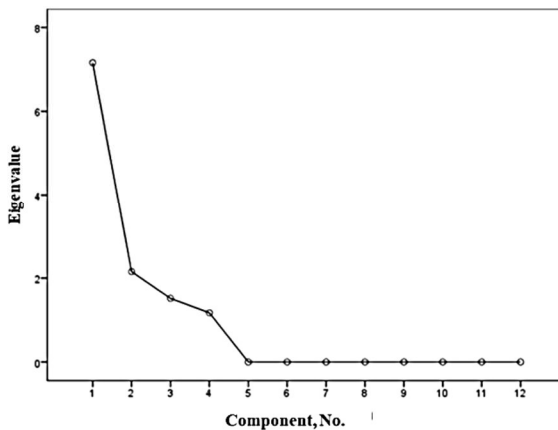


Figure 1: Graphs of simple normalized stress and component of stochastic factor analysis of the safe development of PJSC "Southern Mining and Processing Plant" in conditions of artificial intellectualization

Source: built according to the results of the author's calculations

The presented graphic visualization of the obtained results confirms the presence of 4 main components, at the same time, the calculated factor load values are concentrated mainly within the first component of the economic security of the enterprise under study.

analytical parameters in a quantitative dimension. Based on this, we will consider the indicators of the distribution of the parameters for evaluating the economic security of the enterprise in the conditions of intellectualization between the defined security components (Table 3).

Next, we propose to evaluate the peculiarities of the relationship and existing correlations within the identified components between the corresponding



Table 3: The matrix of the returned components of the assessment of the safety development of PJSC "Southern Mining and Processing Plant" in the conditions of artificial intellectualization

Variables	Component			
	1	2	3	4
V1	,529	,430	,132	,719
V2	,024	,001	,998	,059
V3	42	,406	,899	,084
V4	,009	,995	,064	,082
V5	,332	,739	,396	,432
V6	,297	,718	,498	,386
V7	,564	,528	,501	,390
V8	,779	,600	,095	-,157
V9	,698	,318	,170	,619
V10	-,144	,055	,061	,986
V11	,992	,054	,059	,101
V12	,995	,045	,090	,008

Source: constructed by the authors

Presented in the Table 3 the data of the matrix of the returned components of the assessment of the security development of economic entities on the example of PJSC "Southern Mining and Processing Plant" in the conditions of artificial intellectualization show that within the first component, the highest level of correlation is observed between variables V11, V12, at the same time, this the relationship is positive, that is, the presence of dynamics to increase these indicators will contribute to the strengthening of the economic security of the enterprise under study.

Examining similar indicators in relation to the second component, it should be noted that the maximum positive correlations occur for variables V4 and V5.

Within the third component of the assessment of the level of the safe development of business entities in the conditions of artificial intellectualization, high indicators of positive correlation were established with respect to variables V2 and V4.

The fourth component of the stochastic factor analysis is characterized by a high level of positive correlations within the component relative to the V10 variable.

It should be noted that the obtained results of the component-wise differentiation of the analyzed parameters proved that the chosen system of indicators as a whole demonstrates a positive correlation, that is, the quantitative growth of the relevant indicators in the long run will lead to a more effective and safe development of the studied economic entity in the conditions of artificial intellectualization.

After carrying out a qualitative analysis of the distribution of analytical parameters as a result of a stochastic factor analysis of the security development of economic entities on the example of PJSC "Southern Mining and Processing Plant" in the conditions of artificial intellectualization, each of the components was assigned an appropriate name that most fully reflects the content load of the analytical parameters that are included to its composition, namely:

1st component – the innovative safety component of artificial intelligence processes,

2nd component – the personnel security component of artificial intellectualization processes,

3d component – the component of financial security of artificial intellectualization processes,

4th component – component of industrial safety of artificial intelligence processes.

The results of a qualitative analysis of the distribution of analytical parameters as a result of a stochastic factor analysis of the security development of business entities on the example of PJSC "Southern Mining and Processing Plant" in the conditions of artificial intellectualization are presented in Table 4.

*Table 4: The matrix of the returned components of the assessment of the safety development of PJSC "Southern Mining and Processing Plant" in the conditions of artificial intellectualization*

The name of the component	Analytical parameters	Content
The innovative security component of artificial intelligence processes	The rate of growth of costs for technological innovations in the field of artificial intelligence, the rate of growth of costs for informatization, the rate of growth of costs for software (in particular, artificial intelligence), the share of innovation costs in production costs, savings in production costs as a result of the introduction of innovations in the field of artificial intelligence for 1 dollar US investment costs	This component covers analytical parameters that comprehensively characterize the processes of innovative development, which are closely related to artificial intellectualization, in particular in terms of general technological innovations, costs for software relevant to the needs of artificial intellectualization, and the formation of a common digitized space
The personnel security component of artificial intellectualization processes	The rate of growth of the volumes of sold products, the coefficient of preparation for new professions, the coefficient of qualification improvement	Reflects the dynamics of the main safety indicators in the personnel management system at the enterprise, which manifests itself in the necessary measures for the training of specialists in the field of artificial intellectualization and the corresponding performance indicators in the form of an increase in the volume of sold products
The component of financial security of artificial intellectualization processes	Return on equity (%); profitability of sales (%)	It characterizes the key indicators of security development in the field of financial management, thereby reflecting the correlation between the functional processes of artificial intellectualization and the specific parameters of the financial performance of the business entity
The industrial safety component of artificial intelligence processes	Profitability of assets, share of implemented new technological processes (including artificial intelligence technologies), (%)	Describes the direct connection of the processes of artificial intellectualization in the part of ensuring the sustainable safe development of the production and technical potential of the enterprise, reflecting the direct connection of the indicators of the profitability of the assets of the production enterprise

Source: generated and detailed by the authors

Thus, the methodical approach proposed by the authors to the assessment of artificial intelligence in the system of the safe development of economic entities allows for the qualitative differentiation of a wide array of multifunctional parameters of security development, additionally measuring the level of influence of each of the security components, providing a thorough characterization of intra-component correlation relationships.

## 5. CONCLUSIONS

Therefore, the use of the methodological approach proposed by the authors based on the methodological tools of stochastic factor analysis by the method of principal components in order to improve the system of evaluating the safe development of business entities in the conditions of artificial intellectualization will contribute to:

- to improve the applied tools for strategizing the development of economic structures based on a complex methodology of multi-functional assessment of criteria and measurability of safety parameters of specific areas of enterprise activity;
- to ensure the validity of procedures for prioritization of management directions for the development of organizational entities in the conditions of intellectualization;
- to improve the distribution mechanisms of financing the functional areas of business structures;
- to ensure timely prevention, detection and operational elimination of prospective risks and threats to the stable functioning of enterprises under conditions of increasing variability of the external environment;
- to stimulate the intellectually oriented development of business structures on the basis of determined quantitative indicators of their impact on the current and prospective security configuration of the enterprise.

The proposed methodical approach to assessing the security development of the economic entities in the conditions of artificial intellectualization, in contrast to the available scientific and methodological developments and common practices, involves the use of stochastic factor analysis of the main components, which are supplemented by the methodological toolkit of rotation of the Varimax components, Bartlett's method, as well as the construction graph of normalized simple stress, graph of components in rotated space, matrices of rotated components. This makes it possible to visually display the quantitative level of influence of each of the identified components of artificial intelligence on the security development of the business entity.

The scientific novelty of the conducted research consists in the formation of a comprehensive methodology for evaluating the actual internal processes of artificial intellectualization of economic entities, integrating them as a component of the analysis of the level of the safe development, at the same time, the proposed methodology allows to substantiate the content distribution of the analyzed parameters of artificial intellectualization in their functional manifestations, quantitatively measuring the level of their influence within the studied object, as well as to identify internal correlation relationships within a specific functional security component of the development of artificial intellectualization of the economic entity.

The practical implementation of the methodical approach proposed by the authors consists in:

firstly, the possibilities of qualitative adaptation of a possible set of indicators and volumes of the involved information resource for the evaluation of the processes of artificial intellectualization in the system of security development of the economic entity,

secondly, the technique makes it possible to identify the components of security development with the corresponding indicators of importance based on the quantitative methods of economic and mathematical modeling.

thirdly, the expansion of the methodological toolkit for the implementation of strategic development planning processes, comprehensively covering current security challenges and the objective need for the implementation of artificial intellectualization as a factor of accelerated growth.

The methodical approach proposed by the authors to assess the security development of business entities in the conditions of artificial intellectualization by the method of stochastic factor analysis of the main components makes it possible

to establish the influence of a specific parameter of artificial intellectualization within the limits of the selected component. This allows, on the basis of the presented differentiated set of analytical parameters for the security development of business entities in the conditions of artificial intellectualization and analytical characteristics for each of the identified security components, to offer effective solutions for improving the security development of the business entity.

Further research is required for the development of methodological developments regarding the activation of the use of artificial intelligence at industrial enterprises to increase the efficiency and safety of their activities and development, formulating a methodological principle for increasing the efficiency of the use of artificial intelligence to ensure the safe development of economic entities using a systemic approach.

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