

**ASSESSING THE SECURITY OF A MACHINE-BUILDING ENTERPRISE**

**AVALIANDO A SEGURANÇA DE UMA EMPRESA DE CONSTRUÇÃO DE MÁQUINAS**

**EVALUACIÓN DE LA SEGURIDAD DE UNA EMPRESA DE FABRICACIÓN DE MAQUINARIA**

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## ABSTRACT

The relevance of the chosen topic is the insufficient development of the problem of assessing the economic security of organizations. Unfortunately, there is still no unified approach and methodology for assessing economic security in terms of processes at the enterprise (not only in terms of financial), and consideration in the aggregate influence of threats and risks, factors of external influence. Conducting an economic security assessment of a machine-building enterprise requires a considerable amount of time, and the use of different methodologies. The purpose of this article is to study the factors affecting economic security, including machine-building enterprises, and acting as indicators in the development of tools for assessing the economic security of the machine-building enterprise. Particular attention in the work is paid to determining the directions of improving the toolkit for analyzing the economic security of enterprises and developing a toolkit for analyzing the economic security of the enterprise, which specifies the main indicators in terms of threats to economic security for machine-building enterprises.

**Keywords:** economic security, enterprise, evaluation, indicators, methods, tools.

## RESUMO

A relevância do tema escolhido é o insuficiente desenvolvimento do problema de avaliação da segurança econômica das organizações. Infelizmente, ainda não existe uma abordagem e metodologia unificada para avaliar a segurança econômica em termos de processos na empresa (não apenas em termos financeiros), e consideração na influência agregada de ameaças e riscos, fatores de influência externa. A realização de uma avaliação de segurança econômica de uma empresa de construção de máquinas requer uma quantidade considerável de tempo e o uso de diferentes metodologias. O objetivo deste artigo é estudar os fatores que afetam a segurança econômica, incluindo empresas de construção de máquinas, e que atuam como indicadores no desenvolvimento de ferramentas para avaliar a segurança econômica da empresa de construção de máquinas. Atenção especial no trabalho é dada para determinar as direções de melhoria do kit de ferramentas para analisar a segurança econômica das empresas e desenvolver um kit de ferramentas para analisar a segurança econômica da empresa, que especifica os principais indicadores em termos de ameaças à segurança econômica para máquinas- empreendimentos de construção.

**Palavras-chave:** segurança econômica, empreendimento, avaliação, indicadores, métodos, ferramentas.

## RESUMEN

La relevancia del tema elegido es el insuficiente desarrollo del problema de evaluación de la seguridad económica de las organizaciones. Desafortunadamente, todavía no existe un enfoque y una metodología unificados para evaluar la seguridad económica en términos de procesos en la empresa (no solo en términos financieros), y la consideración de la influencia agregada de amenazas y riesgos, factores de influencia externa. Llevar a cabo una evaluación de la seguridad económica de una empresa de construcción de maquinaria requiere una cantidad considerable de tiempo y el uso de diferentes metodologías.

El propósito de este artículo es estudiar los factores que afectan la seguridad económica, incluidas las empresas de construcción de maquinaria, y actuar como indicadores en el desarrollo de herramientas para evaluar la seguridad económica de la empresa de construcción de maquinaria. Se presta especial atención en el trabajo a determinar las direcciones para mejorar el conjunto de herramientas para analizar la seguridad económica de las empresas y desarrollar un conjunto de herramientas para analizar la seguridad económica de la empresa, que especifica los principales indicadores en términos de amenazas a la seguridad económica para las máquinas. empresas constructoras.

**Palabras clave:** seguridad económica, empresa, evaluación, indicadores, métodos, herramientas.

## 1. INTRODUCTION

The level of development of any country's economy depends on the economic condition of the real sector of the economy and its sustainable development. The key factors in this regard are not only the level of production and financial capabilities, economic potential, characteristics of current financial and economic activities, but also threats and risks of internal and external nature that prevent the use of development potential. These characteristics are reflected in the category of economic security (Senchagov, 2015; Tatarkin, Kuklin, 2012; Presidential Decree № 208, 2017; Federal law from N 390-FZ, 2010).

An important factor in the successful economic development of the country is fundamentally «not a raw material» economy, but an economy that creates a product, including innovation. Machine building is one of the industries of the national economy, which can create an innovative product, form new jobs, and create added value not only through markups and resale, but also through the formation of wages in the processing of raw materials. Further development of the country's economy is largely determined by the realization of the economic potential of the machine-building industry enterprises. The slowdown of the global economy, currency volatility, border closures, pandemic, and the difficult political situation also affect the economic situation of enterprises. There is a need for a toolkit based on indicators to identify and assess the state of «economic danger», to assess the impact of threats to enterprises to take timely measures to reduce the impact of risks. The significance of the study lies in the possibility of using the results obtained for the most complete analysis of economic security at the enterprise of the machine-building industry

## 2. METHODOLOGY

When writing the paper, the following methods were used: theoretical (review of scientific literature), economic and mathematical (to determine the trend of changes), analytical method (to interpret changes in indicators and results), economic and statistical (to assess the dynamics of changes).

Sources of information in writing the work were educational and scientific materials on the topic of research. The issues of economic security research are considered in the economic literature, the study of these issues was addressed by such scientists as: Senchagov V.K. (2015), Tatarkin A., Kuklin A. (2012), Belovitsky K.B., Nikolaev V.G. (2017), Koshkina I.A. (2005), Suglovov A.E., Khmelev S.A., Orlova E.A. (2017), Kormishkina A., Kormishkin E.D., Ilyakova I.E. (2017), Karzaeva N.N. (2017), Kopytko, M.I. (2014). Issues related to the study of risks are considered in the works of such researchers as Vasilkov Y.V., Gushchina L.S. (2017), Kazantseva S.Y., Mezentseva Y.R., Gaidarova L.V., Kleimenova K.A. (2018), Grabovy P.G. (2017). The issues of challenges and threats are considered in the works of researchers: Doroshenko M.V., Isupova O.A. (2018), Lugovkina O.A. (2015). The regulatory framework on issues related to economic security is presented in the documents of the Presidential Decree № 208 «On the Economic Security Strategy of the Russian Federation for the period up to 2030» (2017), and Federal law from N 390-FZ «On security» (2010).

## 3.RESULTS

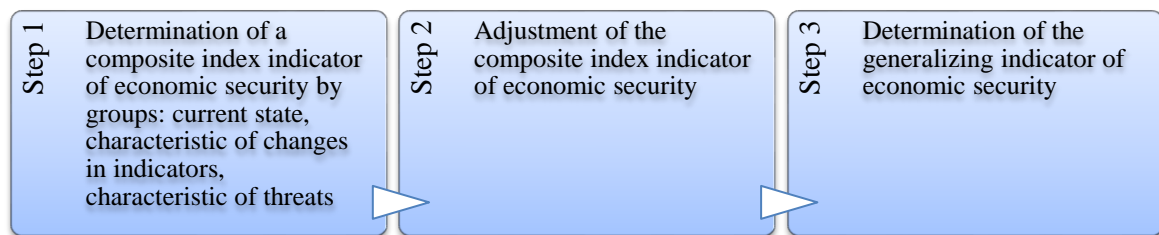
Machine building is a branch of the national economy, which forms new jobs, creates added value not only at the expense of markup and resale, but also at the expense of wage formation in the process of processing raw materials and materials. In industry, mechanical engineering accounts for 12% of output, the dynamics of the index of industrial production is reflected in the dynamics of changes in the volume of production in mechanical engineering, so it is advisable to form and use a system of evaluation for enterprises of this industry (Industrial production, 2018).

The improvement of the tools for assessing the economic security of a machine-building enterprise consists in changing some assessment parameters, proposing a system for calculating safety indicators, using indicators in the assessment system - characteristics of

threats to economic security, and developing an application that allows you to automate the calculation of financial and economic security of machine-building enterprises. The analysis of the economic security of the organization will be evaluated in accordance with the following assumptions (Koshkina, 2005):

$$Composite\ index\ (CI) = \begin{cases} \text{good condition, } CI \geq 0,99 \\ \text{pre - crisis condition, } 0,7 \leq CI < 0,99 \\ \text{crisis condition, } CI < 0,7 \end{cases}$$

The assumptions in the scale are based on Asaul A.N.'s methodology of crisis recognition. In general, the process of analyzing the economic security of an enterprise is presented in Figure 1 (Koshkina, 2005).



**Figure 1.** Analysis of economic security of the enterprise

First there is a definition of a complex indicator of economic security by groups. As the mathematical apparatus it is proposed to use the method of profiles and hierarchy analysis technique. The systems of economic security indicators of organizations, based on which the composite index will be determined, should be formed taking into account the specifics of the activity of the enterprise. As a rule, an expert group of decision-makers can be organized for this purpose. The composite index of economic security will be calculated for each group separately.

At the second stage, an adjustment is made to the complex group index of economic security. At the further, final stage, the calculation of the generalizing indicator of economic security of the enterprise (GI) takes place and on the basis of the obtained assessment a set of

measures to prevent the manifestation of threats, prevent the emergence of risk situations, eliminate the crisis, improve economic security is formed.

The analysis of economic security of the enterprise is carried out according to groups of indicators characterizing efficiency and financial condition, market position, production processes, human resources and management, development, investment attractiveness.

Comprehensive assessment of economic security is carried out in the following areas: current indicators, indicators of indicator changes; indicators characterizing threats. In accordance with the data of the dissertation research Koshkina I.A. (2005), the generalized indicator is calculated as the sum of points of combinations of the complex indicator in the areas of current indicators, indicators of indicator changes; indicators characterizing threats.

The development of a system of indicators is important. The main difficulty is to determine the threshold values for each indicator. The system of indicators for assessing the economic security of the enterprise must take into account the industry orientation and specificity. To diagnose the economic security of the machine-building enterprise, groups of indicators have been developed:

- indicators of the current state, these indicators characterize the state of economic security of the enterprise for a certain reporting period, the threshold values of the indicators are taken on the basis of standards, industry average assessments or expert evaluations;
- indicators of changes in indicators of current state, evaluating changes taking place at the enterprise, the threshold values are 100%;
- indicators characterizing the impact of threats to economic security, assessing the impact of the external environment on the indicators of economic security of the enterprise, assessment at the level of yes-0, no-1, thresholds characterized as a threat is not manifested (no-1).

Table 1 presents the indicators by which economic security will be assessed by the indicators of statics

**Table 1**  
Indicative list of indicators recommended for the analysis of current values of indicators  
(some indicators)

Name of the group of indicators	Indicator name	Threshold value of the indicator
1. Performance and financial indicators	Products sold, thousand rubles.	plan
	Profit before tax	plan
	Profitability indicators	industry average value, plan
	Liquidity and financial stability indicators	standard
2. Indicators describing the position of the enterprise in the market	Sales volume by main nomenclature	plan
	Market share	taking into account the share of the previous period
	Product renewal	plan, previous year's level
	Ratio of sales volume growth rate to expenses on marketing research and sales promotion	1
	Costs of warranty repair	previous year's level
	Storage costs of finished products	plan
	Product quality level	plan, previous year's level
	.....	
3. Internal processes in the organization	Net profit per 1 rouble of marketable output	plan
	Rhythmicity coefficient	1
	Output per worker	plan, previous year's level
	Material capacity	plan
	Average age of equipment	5 years
	Productivity	plan, previous year's level
	Capacity utilization rate	plan, previous year's level
	Installed equipment ratio	plan, previous year's level
	Operational equipment ratio	plan, previous year's level
	Losses due to poor maintenance	plan, previous year's level
	Defects detected in production	plan, previous year's level
	.....	
4. Indicators characterizing management and human resources	Percentage of employees who received advanced training (passed to the planned)	plan, previous year's level
	Real average salary of workers	Industry and regional average value
	Personnel turnover	previous year's level
	....	
5. Indicators of development and investment attractiveness	Share of expenditures on research and development	plan, previous year's level
	Introduction of innovations	plan, previous year's level
	Level of novelty in products	plan, previous year's level
	Investments in projects	yes -1
	Efficiency of investment projects (implemented)	plan
	Availability of in-house scientific and technical facilities	yes -1
	Use of special equipment	yes -1
	Cutting edge materials application	yes -1
	Level of investment risk	0,1
...		

Table 2 presents a list of indicators that will be used to characterize the impact of threats to the economic security of the enterprise. The values of normal and critical states are recommended.

**Table 2**  
Threats to the economic security of the enterprise

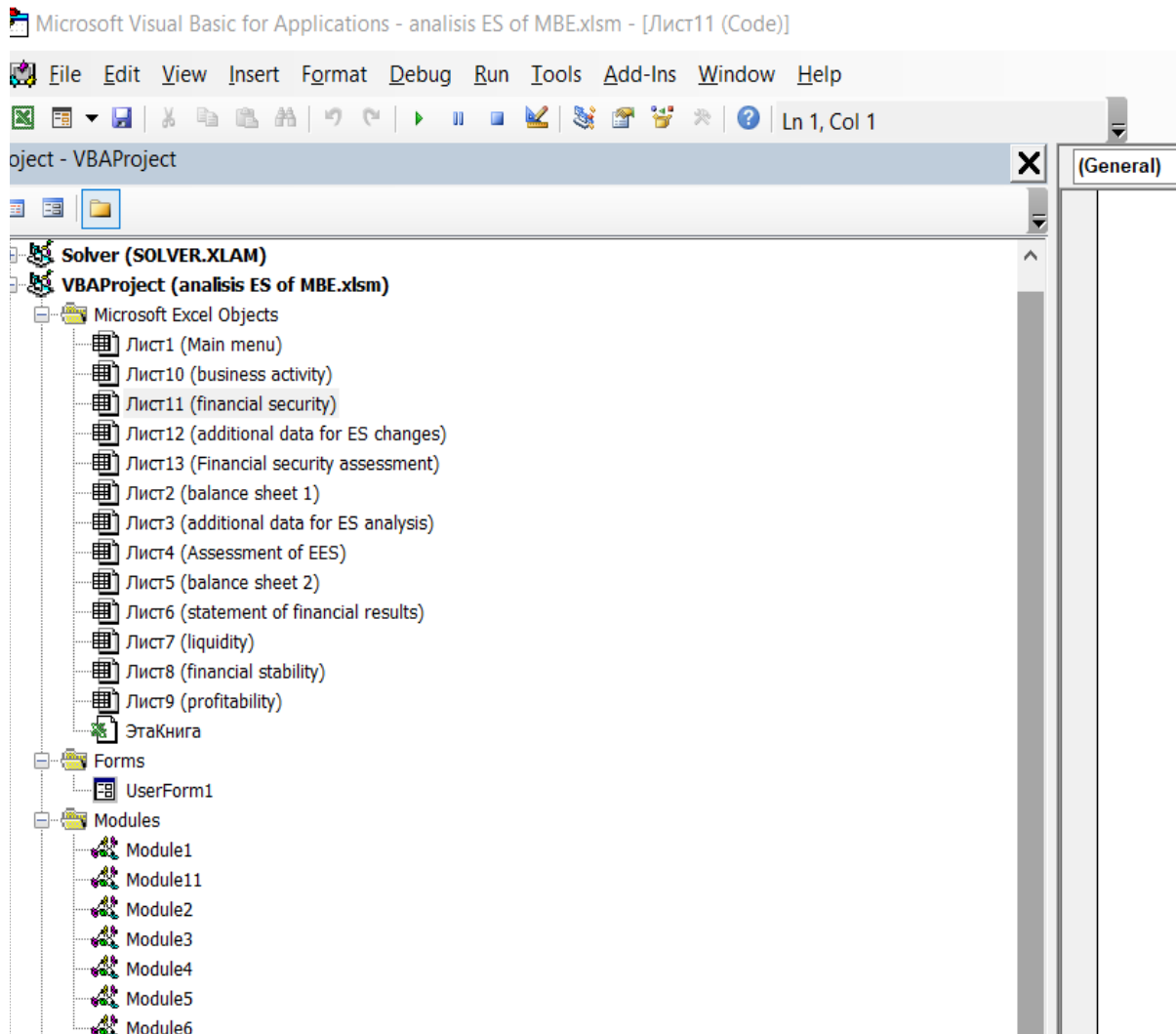
No	Indicator name	Normal value	Critical value
<b>General characteristics of threats in the external environment</b>			
1.	Increase in the inflation rate	No	Yes
2.	Increase in the refinancing rate	No	Yes
3.	Change in exchange rates	No	Yes
4.	Increase in commodity prices	No	Yes
5.	Bankruptcy of partners	No	Yes
6.	Increase of tax burden	No	Yes
7.	Irregularity of deliveries	No	Yes
8.	Failure to comply with contract terms	No	Yes
9.	Decrease of purchasing power	No	Yes
10.	Emergence of competitors with a higher level of competitiveness	No	Yes
11.	Restriction of competition	No	Yes
12.	Increase of tariffs for energy carriers	No	Yes
<b>Characteristics of threats in the region</b>			
1.	Decrease in gross regional product	No	Yes
2.	The excess of the inflation rate in the region, over the inflation rate of the state	No	Yes
3.	Natural resource constraints	No	Yes
4.	Remote location of suppliers (buyers)	No	Yes
5.	Decrease in the export potential of the region	No	Yes
6.	Decrease in the level of use of information technologies	No	Yes
7.	Population aging	No	Yes
8.	Decrease in educational level of the population	No	Yes
9.	Increased outflow of the economically active population	No	Yes
10.	Strengthening environmental problems in the region	No	Yes
<b>Industry threat characteristics</b>			
1.	Monopolization in the industry	No	Yes
2.	Decline in price elasticity	No	Yes
3.	Increasing the level of competition in the industry	No	Yes
4.	Low competition among suppliers	No	Yes
5.	Underdeveloped market infrastructure	No	Yes
6.	High capital intensity of the industry	No	Yes
7.	Difficulty forming alliances	No	Yes
8.	Complexity of technology	No	Yes
9.	Barriers to entry and exit to the industry market	No	Yes
10.	Low profitability	No	Yes



To assess changes, it is advisable to consider the growth rate of indicators of the current state. Threshold values are selected for the indicators on the basis of normative values, industry average values and on the basis of expert evaluation in the organization. The proposed system of indicators for assessing the economic security of the machine-building enterprise can be adjusted depending on the objectives of the enterprise, this system is mainly designed for small and medium-sized businesses.

When forming the assessment of economic security the following assumptions are taken: if the indicator value is greater than the threshold value for, then the threshold value is taken to calculate a particular indicator, provided that the growth of the indicator is favorable, if the growth of the indicator is not favorable. The proposed threshold values of the indicators, which can be adjusted to the specifics of the enterprise, and are in fact universal.

As an auxiliary assessment tool, it is advisable to use business applications based on MS Excel, using macros. MS Excel is a widely used software product, there is a possibility to unload reports from 1C program to MS Excel, which makes it possible to use the application for almost any enterprise (taking into account the configuration of calculation parameters). Figure 2-4 illustrates possible configurations of the program. The program uses programming system in MS Excel - VBA in Figure 2. reflects the main pages and macros of this program.



**Figure 2.** Elements of the Economic Security Assessment Program

The program includes and uses 13 sheets: the Main Menu, the result sheets: the assessment of ESE (economic security evaluation of the enterprise), the assessment of financial security, three sheets with the initial data: asset liability balance sheet and income statement, two sheets with additional data to form the economic security assessment and worksheets to calculate liquidity, financial stability, profitability, turnover, the data that will be used in the evaluation.

1	<b>Navigating through tables</b>			
5	<b>Generalizing assessment</b>			
6	crisis	2017		
7	crisis	2018		
9	<b>Indicators of the current state</b>			
10	The name of the indicator	The coming period		Reporting period
11		CI	Characteristics of the situation	CI Characteristics of the situation
12	Performance indicators and financial indicators	0,732	pre-crisis	0,597 crisis
13	Indicators describing the position of the enterprise in the market	0,903	pre-crisis	0,903 pre-crisis
14	Internal processes in the organization	0,882	pre-crisis	0,834 pre-crisis
15	Indicators characterizing management and human resources	0,972	pre-crisis	0,950 pre-crisis
16	Indicators of development and investment attractiveness	0,458	crisis	0,458 crisis
17	Aggregate indicators	0,789	pre-crisis	0,749 pre-crisis
20	<b>State change indicators</b>			
21	The name of the indicator	The coming period		Reporting period
22		CI	Characteristics of the situation	CI Characteristics of the situation
23	Performance indicators and financial indicators	0,760	pre-crisis	0,680 crisis
24	Indicators describing the position of the enterprise in the market	0,971	pre-crisis	0,972 pre-crisis
25	Internal processes in the organization	0,968	pre-crisis	0,918 pre-crisis
26	Indicators characterizing management and human resources	0,997	normal	0,954 pre-crisis

**Figure 3.** Overview of the page with the final calculations on the economic security of the enterprise

This page shows the evaluation of economic security by current state, change, and threats. The evaluation is performed for the last reporting period and the one preceding it, based on the data of the accounting financial statement form asset, balance sheet liability and financial result form.

	A	B	C	D	E	F	G	H	I	J	K
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**Figure 4.** Overview of the page with calculations on the financial component of the economic security of the enterprise

Using the calculation mechanism in MS Excel significantly reduces the complexity of calculations, the application for calculations in MS Excel is possible to rebuild for any enterprise, any sphere, any industry, which is also an objective advantage of using the software environment of MS.

#### 4 DISCUSSION

As part of the study, an algorithm for analyzing economic security, evaluation indicators and their threshold values are proposed, as well as:

- formed an evaluation system consisting of indicators, on the basis of which the analysis of economic security and threshold values of these indicators - indicators, the excess of which can transfer an enterprise from a safe state to a dangerous, the system includes an assessment of threat factors, including for enterprises of the machine-building complex;

- developed and tested a methodology for assessing economic security, taking into account the risk and threat indicators;
- developed a program for assessing economic security.

To automate the calculations and optimize the time for the assessment, a business application is proposed, which allows, based on the developed methodology, to assess the state of economic security of the machine-building enterprise. The application is implemented in MS Excel software environment. This program allows to process the data represented in the tabular form received from 1C-ERP. One of the widespread products of accounting the results of the enterprise activity is 1C, this program allows to realize the unloading of reporting data to MS Excel, which greatly facilitates the development of software products and use the results of calculations of the program.

## 5 CONCLUSION

There are many problems in assessing the economic security of enterprises. Most of the developed methodologies assume the assessment of the financial component of economic security with the use of methods for assessing the probability of bankruptcy of an enterprise. This approach does not take into account the nature of internal processes and evaluates the final impact of these "processes" on the indicators of financial statements (on the basis of which the assessment of the financial component of economic security is formed). Also one of the problems of assessing economic security using mathematical models is the difficulty of mastering these models and the lack of programs for calculations.

It should be noted that most of the studied methods are characterized by the fact that they usually evaluate the current state of the enterprise. At the same time, the complex methodology does not directly consider threats, the maximum that can be considered is the possible prevented damage. In our opinion, the work with threats in the evaluation system will make it possible to predict the possible negative impact on the state of economic security. Timely prevention of these situations or "risk taking" is necessary in order to assess threats through risk indicators. The assessment of economic security is important and, as well as any other economic analytical information, it is necessary for timely decision-making, formation of proactive measures. For formation of modern tools of economic security assessment it is

necessary that assessment system would take into account not only indicators of financial solvency, but also characteristics of internal processes, as well as threats and risks of enterprise activity. In addition, for the successful implementation of the evaluation process it is necessary to have adequate software tools.

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