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## **Mathematical Analysis of Risk Management in Industrial Enterprises**

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# Mathematical Analysis of Risk Management in Industrial Enterprises

Jamshid Tukhtabaev <sup>1, a)</sup>, Bakhodir Shadmanov <sup>2</sup>, Oksana Bondarskaya <sup>3</sup>, Kumri Nomozova <sup>4</sup>, Shakhnoza Nurullaeva <sup>5</sup>

<sup>1</sup> Graduate School of Business and Entrepreneurship under the Cabinet of Ministers of the Republic of Uzbekistan, Tashkent, Uzbekistan

<sup>2</sup> University of public safety of the Republic of Uzbekistan, Tashkent, Uzbekistan

<sup>3</sup> Tambov State Technical University, Tambov, Russia

<sup>4</sup> Banking and finance academy, Tashkent, Uzbekistan

<sup>5</sup> Tashkent International University of Financial Management and Technology, Tashkent, Uzbekistan

<sup>a)</sup> Corresponding author: [jamshidtukhtabaev@gmail.com](mailto:jamshidtukhtabaev@gmail.com)

**Abstract.** At present, the problem of ensuring economic security in the company is quite relevant, but, nevertheless, the leaders of many organizations still do not pay enough attention to this issue. The essence of ensuring the economic security of entrepreneurial activity is to prevent possible threats to business, to ensure the effective use of its available resources in order to create and expand conditions for sustainable development, labor efficiency, and obtaining maximum profit. In this article, the authors focus on the analysis of financial risk at enterprises operating in the regions. The relevance of this study is that when using a new element of an innovative nature in the activities of enterprises, a high level of uncertainty arises, and as a consequence, financial risks emerge. The purpose of the study is to examine the management of financial risks at the enterprises under study. In this regard, the article diagnoses the financial position of the enterprise under study, makes scientific conclusions, and develops proposals for practical measures to improve activities.

## INTRODUCTION

Analysis of the financial position of the organization is one of the key points in the system of financial analysis, and its results are also the basis for specific management decisions aimed at achieving the goal of economic unity. These goals may differ at different stages of corporate development: achieving solvency, increasing return on equity, increasing the liquidity of assets, and ensuring business continuity. Especially during financial crises, some Russian organizations have solvency problems. In this situation, it is important to find ways to generate cash and eliminate the lack of funds. Therefore, the development of management measures to increase the return on capital will become an urgent task at the next stage of the company's development.

Assessment of the financial component of the economic security of the enterprise is to determine its financial position. The process aimed at ensuring the financial component of the economic security of an enterprise can be defined as a set of works aimed at ensuring the maximum level of solvency of the enterprise and the liquidity of its working capital [1].

It is important to have more information about the activities of the enterprise under study and make decisions based on it. Economic and financial analysis of the enterprise under study in the context of the formation of market relations should be aimed at ensuring the economic development of the enterprise, strengthening its financial position and increasing the level of economic security. The presence of companies in the market environment is associated with the need to constantly improve production efficiency, combat competition and ensure their economic security [2].

Each operating enterprise in an innovative market economy is vulnerable due to its own competition and uncertainty, which requires measures to ensure financial security [3], [4]. The presence of a new element, especially the innovative nature of the activity, leads to the emergence of a high level of uncertainty and financial risks among companies [5]. The emergence of financial risk in the activities of enterprises can be assessed by the probability of

unexpected loss of economic resources not provided for in projects and plans. The system of economic and financial security of the enterprise will be designed to reduce the likelihood of such situations.

## LITERATURE REVIEW

Among the works on the issues under consideration, it is necessary to single out works on risk management in an organization, analysis and development of an organizational mechanism for the formation of significant innovative products in the region [6], [7].

In modern conditions, all enterprises engaged in the production of agricultural products pay due attention to ensuring the economic security of the enterprise (organization) in the context of globalization [8].

Analysis and systematization of various sources [9], [22], [23], as well as the study of practical experience on the stated topic, make it possible to identify and describe the priority motivational factors that form the basis for minimization in the development of enterprises (organizations) [10], [11], [21].

At the same time, it should be noted that most of the works on this issue consider individual industrial enterprises as an efficiency assessment [12], without taking into account the peculiarities of the diversity of damage sources in complex modern production systems [13], [14], [15].

Thus, additional studies that take into account certain features and difficulties in managing all possible risks in organizations are currently of a certain theoretical and practical interest in the stated study.

## MATERIALS AND METHODS

In the course of our research we used such methods of analysis as the method of analysis and synthesis, the transition from the particular to the general, critical analysis, the method of logical imperatives, and diagnostics of the financial condition based on a comprehensive analysis of financial statements.

## RESULTS

In order to competently manage and manage all possible risks in organizations, it is necessary to accurately, timely and skillfully detect them. The manifestation of risk largely depends on the internal characteristics of a functioning enterprise, so it is difficult to imagine a universal assessment method for a qualitative analysis of the occurrence of risk [17], [18], [19], [20]. Such an assessment implies a process in which the magnitude (degree) of risk is determined qualitatively or quantitatively. We were most interested in getting to know the largest farm, “Muchkap-Niva” LLC. The main types of specialization of which are the grown products of cereals, legumes, oilseeds, as well as the organization of work in non-core areas, such as: grain wholesale, purchase and sale of land.

You can more clearly present the analyzed indicators in Figure 1, where the dynamics of the financial results of “Muchkap-Niva” LLC for 2017-2019 [16] opportunity in the short term to repay its long-term obligations with the help of slow-selling assets.

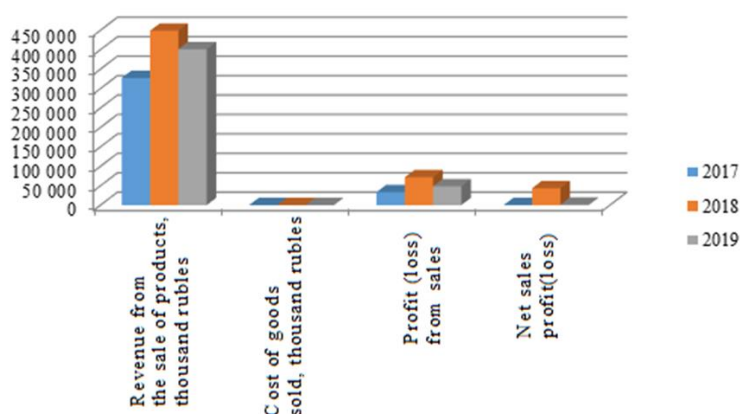
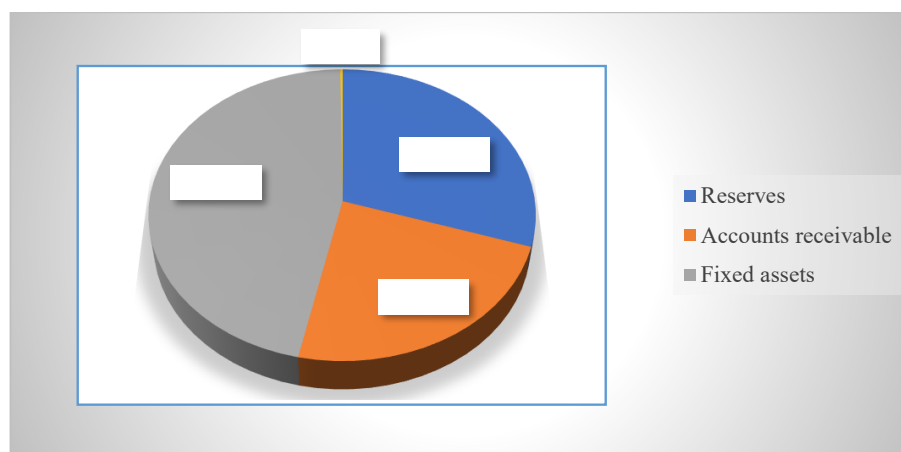


FIGURE 1. Dynamics of financial results of “Muchkap-Niva” LLC for 2017-2019

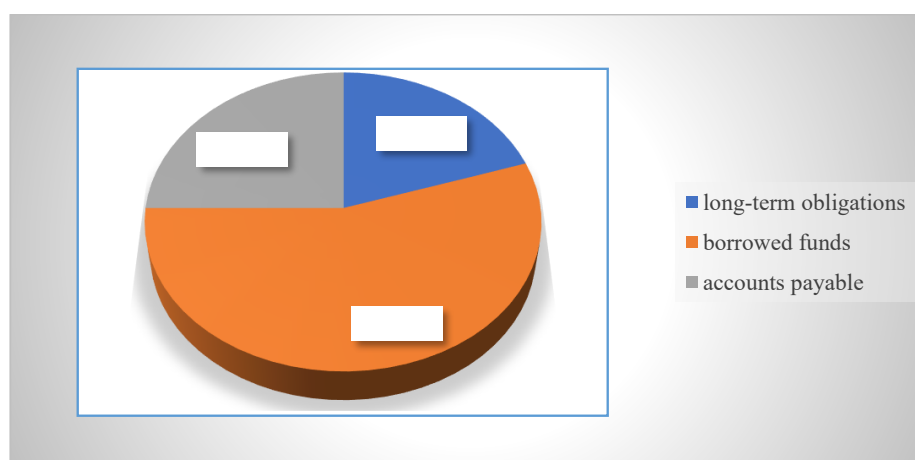
Thus, for a complete analysis and identification of risk situations at the LLC “Muchkap-Niva” enterprise, we will diagnose the financial condition based on a comprehensive analysis of financial statements.



**FIGURE 2.** The structure of the asset balance of “Muchkap-Niva” LLC for 2019, %

In the structure of the balance sheet of “Muchkap-Niva” LLC for the period 2017-2019 the largest share is occupied by short-term liabilities. The share of short-term liabilities to the total balance sheet currency for 2019 amounted to 45.9% against 31.7% in 2017.

Equity in dynamics takes a positive trend, however, the share as of 2019 is 42.9% Long-term liabilities in dynamics decreased by 25,273 thousand rubles. in absolute terms and by 27.8% in relative terms.



**FIGURE 3.** The structure of the liability of the balance sheet of “Muchkap-Niva” LLC for 2019, %

Liabilities are grouped according to the urgency of payment of obligations.

The most urgent assets have the abbreviation P1, corresponding to the indicator accounts payable. Over the next three periods, the indicator takes a positive trend and shows an increase in 2019 compared to 2017 by 46,201 thousand rubles.

To find short-term liabilities (P2), it is necessary to add borrowed funds, estimated liabilities and other liabilities. This indicator in dynamics increases by 86,741 thousand rubles. and in 2019 is 185,841 thousand rubles.

The value of P3 indicates long-term liabilities. To find this indicator, it is necessary to refer to the final fourth section, to line 1400 in the balance sheet of "Muchkap-Niva" LLC. In 2019, the indicator decreased by 25,273 thousand rubles and amounted to 65,565 thousand rubles.

To find the group of permanent assets P4, it is necessary to add the final third section of the balance sheet of "Muchkap-Niva" LLC with income and expenses of future periods. At the end of 2019, the indicator increased by 44,564 thousand rubles compared to 2017 and amounted to 251,418 thousand rubles.

To determine the absolute liquidity of the balance sheet of "Muchkap-Niva" LLC for 2017-2019. Let's put the calculated results in Table 1 and draw the appropriate conclusions.

**TABLE 1.** Absolute liquidity conditions

Year	Active	Liquidity conditions	Year	Passive
2017	A <sub>1</sub> = 4 900 A <sub>2</sub> = 13 222 A <sub>3</sub> = 169 352 A <sub>4</sub> = 246 824	< < > >	2017	P <sub>1</sub> = 37 506 P <sub>2</sub> = 99 100 P <sub>3</sub> = 90 838 P <sub>4</sub> = 206 854
2018	A <sub>1</sub> = 3 483 A <sub>2</sub> = 119 913 A <sub>3</sub> = 112 857 A <sub>4</sub> = 265 183	< > > >	2018	P <sub>1</sub> = 52 407 P <sub>2</sub> = 101 621 P <sub>3</sub> = 97 009 P <sub>4</sub> = 250 399
2019	A <sub>1</sub> = 1 316 A <sub>2</sub> = 133 006 A <sub>3</sub> = 187 811 A <sub>4</sub> = 264 398	< < > >	2019	P <sub>1</sub> = 83 707 P <sub>2</sub> = 185 841 P <sub>3</sub> = 65 565 P <sub>4</sub> = 251 418

Table 1 shows that in 2017 and 2019 the balance sheet is absolutely illiquid, since out of the four ratios characterizing the ratio of assets by liquidity and liabilities by maturity, only two are fulfilled. In 2018, the situation is more favorable, in this period the second inequality is fulfilled, where we notice that the organization covers long-term liabilities with slowly sold assets. Thus, the agricultural enterprise "Muchkap-Niva" LLC is at risk at the end of the reporting period.

Table 2 presents the calculated liquidity ratios characterizing the solvency of "Muchkap-Niva" LLC.

**TABLE 2.** Liquidity ratios characterizing the solvency of "muchkap-niva" llc for 2017-2019

Indicators	Methodology for the calculating balance sheet	standard	2017	2018	2019	Deviation (+;-)	
						2019/ 2017	2019/ 2018
Current coefficient liquidity (Ccl)	$\frac{1200}{1500}$	1-3	1,37	1,53	1,20	-0,17	-0,33
Absolute liquidity ratio (Alr)	$\frac{1240 + 1250}{1510 + 1520}$	0,2-0,5	0,04	0,02	0,01	-0,03	-0,01
Quick liquidity ratio (Qlr)	$\frac{1230 + 1240 + 1250}{1510 + 1520 + 1550}$	0,7-1	0,13	0,80	0,50	0,37	0,30
General liquidity ratio (Glr)	$\frac{1200}{1510 + 1520 + 1550}$	≥ 1	1,37	1,53	1,20	-1,11	-0,33

In accordance with the calculated indicators of the liquidity of the balance, in table 2 we can draw the following conclusions.

The ratio is found as the ratio of current assets to current liabilities. In 2019, the indicator decreased by 0.17 compared to 2017 and amounted to 1.2, which is 0.2 higher than the standard value.

The absolute liquidity ratio has a negative trend throughout 2017-2019 and does not fit into the recommended values. LLC "Muchkap-Niva" is not able to cover part of the short-term debt with the available funds, there is no guarantee of repayment of debts.

Throughout all years, the coefficient takes a positive value and corresponds to the standard. In 2019, the indicator increased by 1.11 and amounted to 1.2.

An analysis of the calculation of profitability indicators in "Muchkap-Niva" LLC for 2017-2019 is presented in Table 3.

**TABLE 3.** Profitability indicators characterizing the performance of “muchkap-niva” llc for 2017-2019, %

Indicators	Method of calculation (by lines balance)	2017	2018	2019	Deviation (+;-)	
					2019/2017	2019/2018
Return on equity	$\frac{2400}{1300} \times 100\%$	0,08	17,39	0,41	0,33	-16,98
Return on assets	$\frac{2400}{1600} \times 100\%$	0,04	8,68	0,17	0,13	-8,51
Profitability of sales	$\frac{2200}{2110} \times 100\%$	10,12	15,95	12,09	1,97	-3,86

Note that (in Table 3) the profitability indicators for the analyzed periods take on positive values as a result of the profitable activities of “Muchkap-Niva” LLC.

Return on equity increased in 2019 by 0.33 and amounted to 0.41. The highest value of the indicator is observed in 2018 and is 17.39.

To find the return on assets, it is necessary to divide the net profit by the balance sheet currency. In 2019, the indicator at “Muchkap-Niva” LLC was 0.17, which is 0.13 more than in 2017. In 2019, the indicator increased by 1.97 compared to 2017 and amounted to 12.09.

In the course of assessing the financial condition of the organization, it was revealed that the threat to the economic security of “Muchkap-Niva” LLC is the risks associated with liquidity, solvency, and as a result, loss of financial stability of the organization.

## CONCLUSION

When diagnosing the financial condition of “Muchkap-Niva” LLC, it turned out that the financial component of economic security is in the area of financial risk. At the enterprise for 2017-2019, there is an absolute illiquidity of the balance sheet and a decrease in the financial stability of the enterprise.

The most important resource that increases and determines the internal and external competitiveness of enterprises is information. The use of modern information technologies at enterprises allows:

- increasing the efficiency of enterprise management by continuously providing managers of lower and higher management systems with large-scale, prompt and reliable information based on a single database;
- ensuring the accounting and control of the receipt and expenditure of funds at all levels of income from trade and provision of services;
- increasing the efficiency of data exchange between mutual divisions;
- reducing business costs by automating information processing processes.

The presence of a new element, especially the innovative nature of the activity, leads to a high degree of uncertainty among companies and the emergence of financial risks. Financial risk is assessed on the basis of the probability of unforeseen, unforeseen by projects and plans, losses of economic resources. The security system of the organization today is designed to reduce the likelihood of such circumstances.

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