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Methodology for Assessing the Risk of Implementing the Strategy of Diversification of Enterprises in the Aspects of Information Technology Management

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Abstract

(1) Background: The article proposes a methodical procedure for assessing the risk of implementing the diversification strategy of an industrial enterprise based on of management information technologies. The result of which was the improvement of the solution of practical tasks of the diversification strategy with the help of economic and statistical modeling; (2) Methods: the article proposes a methodology for assessing the risk of implementing a diversification strategy, which is based on modeling a portfolio of strategies using economic and statistical indicators: mathematical expectation; dispersions; covariances; (3) Results: As a result of the approbation of the methodical approach, the issue of optimization of complex diversification plans of enterprises in the conditions of the implementation of information technologies was considered. This approach is based on achieving such a structure of diversification of the enterprise, when the expected efficiency will be the maximum possible, and the expected risk will be the lowest. The solution to this problem was realized on the example of product diversification, when the enterprise decides to open the production of several heterogeneous goods; (4) Conclusions: It was concluded that combinations of key success factors distinguish one segment from another, then there are always factors that are part of several or many areas. The obtained calculations showed the possibility of using this methodical approach when assessing the risk of implementing a diversification strategy in the conditions of the introduction of information technologies. The possibility of its use in the context of justifying the choice of a variant of a diversified production portfolio of an enterprise organized on the basis of management information technologies is considered.

Keywords: Risk; Strategy; Diversification; Methodological Approach; Portfolio Theory; Management Information Technologies.

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Introduction

Diversification as a tool for reducing risk in the activities of enterprises becomes especially important in conditions of economic growth. At the same time, forming and implementing a diversification strategy is always risky. Information technologies introduced into the activities of industrial enterprises during the implementation of diversification strategies can substantially reduce their risky nature. Therefore, approaches to risk assessment methods for

the implementation of the strategy of diversification of enterprises, taking into account the aspects of information technology management, are becoming relevant.

A significant contribution to the development and implementation of diversification strategies was made in the context of portfolio theory for financial diversification. In the framework of which theoretical and applied solutions have been developed to combine several risky investments into a portfolio in order to reduce the overall risk of the portfolio. At the same time, there is a risky nature and certain limitations of its application in the sphere of the formation of the strategy of diversification of industrial enterprises on the basis of information technologies of management. In this context, the proposed method of assessing the risk of implementing the strategy of diversification of industrial enterprises solves certain tasks and can be applied on the basis of information technologies.

Literature Review

The most thorough scientific studies in the part of risk assessment of the implementation of diversification strategies were decided precisely within the framework of the portfolio theory for the investor. The founder of which was the Nobel laureate H. Markowitz (Markowitz H.; 1952). There are no examples of the application of this theory for the conditions of diversification of production, since its use requires the presence of developed financial markets, which are not available in all countries of the world. Despite the meaningful justification of the portfolio theory by Nobel laureate Harry Markowitz, its application is limited in countries with underdeveloped financial markets. H. Markovets' contribution to the portfolio theory is significant. He substantiated that under certain conditions, the choice of an investor's portfolio can be reduced to the balance of the two most important parameters: (1) the expected return of the portfolio and (2) the risk or deviation of the portfolio (Markowitz H.; 1952). Thus, Markowitz (Markowitz H.; 1952) developed an approach under which portfolio selection should be based on general risk-reward characteristics, as opposed to simply assembling portfolios of securities according to individually attractive risk-reward characteristics.

Another significant representative of portfolio theory is Francois-Serge Lhabitant (F.-S. Lhabitant; 2017), who argued for portfolio diversification, which provides updated information on the practice of combining several risky investments in a portfolio in order to reduce the overall risk of the portfolio. He analyzed various aspects of portfolio diversification, as well as strategies for time diversification and diversification using other risks. Several tools are also proposed for quantification and implementation of optimal diversification.

Considering the important contribution of these scientists to the portfolio theory, its application is possible only in the conditions of developed financial markets. The application

of this approach for industrial enterprises becomes limited and characterized by high risk. At the same time, the use of the diversification strategy becomes one of the directions of development, increasing financial resources and increasing competitiveness. Implementation of diversification strategies at industrial enterprises in the conditions of their informatization becomes one of the key issues of strategic management.

In foreign and domestic studies, which are devoted to the problems of strategic management, meaningful features of the concept of «diversification» are distinguished, which are significantly different from each other. F. Kotler believes that «diversification is the use of opportunities outside the industry» (Kotler F., et al.; 2012). According to H. Mintzberg's definition, «diversification is mastering new areas of activity that provide the company with greater profitability. Generating capital in traditional and stable industries, with the help of diversification, organizations master new areas of investment and reduce the level of commercial risk» (Mintzberg Henry; 2007). M. Porter considers diversification as an expansion of the range of products (Porter M.;1985).

The many scientists view on diversification as a way of spreading innovation. This opinion is held by (Kovtunenko Yu.; 2019ж Kaganovska et al., 2022), who substantiates the strategy of diversification as a method of innovative activity. He determines that the use of diversification as a method of reducing innovation risk is appropriate only if the risk is not systematic.

Along with this approach, generally accepted methods of evaluating the innovative development of the industrial potential of the enterprise have been developed, in which considerable attention is paid to diversification strategies (Chukurna O. et al. 2020). In the conditions of implementation of management information technologies, the risk of implementing a diversification strategy at enterprises can be assessed by modeling indications. This approach to risk assessment was substantiated in the scientific works of Babenko V. (Babenko V. et al. 2021).

Filippova, S. proposed approaches to the systematization of numerous and diverse risks that are the basis for creating an effective system for their further identification, analysis and description to increase the effectiveness of risk management (Filyppova, S., et al. 2019).

However, in order to introduce an adequate risk assessment system for implementing the diversification strategy of enterprises, it is necessary to model risk assessment indicators that should adequately reflect the specifics of management information systems (Pasko O.,et al. 2021; 2022). That is why the basis of the approach to the risk assessment of the diversification strategy proposed in this study is the ratio of risk and profit from the implementation of the product diversification strategy on the example of an industrial enterprise based on informatization. The fundamental difference of the proposed approach is that it is based on the methods of economic and statistical modeling and is designed to assess

risks during the implementation of the diversification strategy at industrial enterprises operating in the absence or limitation of financial resources and focused on the introduction of normative management technologies.

Methodology

The methodology of risk assessment based on mathematical and statistical apparatus was used in the study. The numerical characteristics were used, namely:

1) mathematical expectation $m = M\{W\} = \sum_{i=1}^{k} w_i p_i$ random variable W, which is the average of all values w_i, which is found taking into account the probability p_i their possible significance;

2) dispersion $D(W) = M\{(M - m)^2\} = \sum_{i=1}^{k} (w_i - m)^2 p_i$ and standard mean square deviation, which characterize$\sigma = \sqrt{D(W)}$ dispersion of values w, in relation to mathematical expectation т;

3) covariances $v_{12} = M\{(W_1 - m_1)(W_2 - m_2)\}$ of two random variables W_1 і W_2.

If the efficiency variance is zero, there is no uncertainty, and therefore no risk. The greater the variance of performance, the greater the uncertainty and risk. In the future, we will consider the root mean square deviation (RMS) of efficiency as a measure of risk σ.

If there is a choice between two types of diversification projects, in which $m_1 = m_2$ і $\sigma_1 > \sigma_2$, preference should be given to the second option, as it is less risky. In general, when

$m_1<m_2$, $\sigma_1<\sigma_2$ (або $m_1>m_2$, $\sigma_1>\sigma_2$),

there is no unambiguous solution to the problem of choice, and therefore it is necessary to introduce some additional conditions that will reflect the attitude of the company's management to a specific combination т with σ. Often, this condition takes the form of a special function $F(m, \sigma)$ on multiple expected efficiencies and risk. This function grows by σ for risk-averse executives and decreases by σ for managers prone to risk. In general, it should reflect the system of their preferences. At the same time, a manager who is not prone to risk will go for it only if he expects higher values of efficiency, and a manager who is prone to risk may accept a higher risk in order not to lose the expected efficiency. The function should help to find the optimal option for diversification of production.

Results

Regarding the study of the influence of diversification processes on the efficiency of the enterprise, as it follows from numerous conducted scientific studies, two main hypotheses were tested by practical results and their theoretical generalizations:

1) diversification, of course, has a positive effect on the economic and financial condition of the enterprise;

2) the effectiveness of diversification depends to a large extent on the chosen direction.

The first hypothesis is based on a seemingly obvious position: any diversification should lead to a reduction in risk and the creation of a synergistic effect. However, the empirical testing of this hypothesis gave opposite results - both for its confirmation and for proving its failure. At the same time, it was established that, as a rule, at the first stage of the implementation of the decision on diversification, the efficiency of the enterprise increases due to the rational redistribution of resources. Then comes the second stage, during which the efficiency decreases due to the increase in the complexity of management, the detection of contradictions, inconsistencies in management technologies, etc.

As for the empirical verification of the second hypothesis, a general conclusion was made that diversification in industries that corresponded to the company's profile is more effective than penetration into areas not related to the main areas of activity

But the main thing, in our opinion, is that specialists in theory and practical managers are more and more clearly aware that diversification should be considered not as a means to increase the efficiency of the enterprise, but as a condition for its potential growth, thus emphasizing its strategic importance.

It is necessary to decide on questions regarding the conditions under which diversification in production can take place. Necessary and sufficient conditions for diversification at the enterprise are summarized in the table. 1.

Among the listed prerequisites, the most important place belongs to prerequisites with an economic meaning, namely: a drop in the rate of profit in traditional industries or negative dynamics for the value of business, or, on the contrary, very large retained earnings. Budgeting of these processes is a sufficient condition for diversification. These conditions affect the material capabilities of the enterprise.

Table 1. Identification of necessary and sufficient conditions for diversification atrategy in the enterprise

№	Necessary conditions	Sufficient conditions
1	Insufficient speed of asset capitalization	A fairly thorough analysis of the gains from diversification and the risks that come with the consequences of diversification. Sufficient budget for diversification.
2	A sufficient degree of inadmissibility of the existing provisions and the expected benefit from radical changes	A high expected need for change and a high ability of the enterprise to change
3	Having a clear goal - expanding the range of the enterprise's activity into new areas	The management's desire to expand the company's activities and the presence of a group interested in this expansion
4	Sufficient development of the enterprise management system	A new level of management that allows you to manage existing and new business
5	The presence of key competencies in the company's activities, on which the diversification project will be based	Correspondence of the key competencies existing in the enterprise and desired in the markets, which the enterprise will gain as a result of diversification.

In terms of non-material conditions, such factors can be noted as:

1) the ratio of the inadmissibility of the existing position and the expected benefits from radical changes;

2) the ratio of the expected need for changes and the enterprise's ability to change, that is, diversification, and so on.

Innovative expansion of business activity can occur in several production processes. Each of these expansions can lead to an increase in the efficiency of the enterprise's economic activity. This efficiency will be determined by the ratio of the result (in the form of value or profitability) from diversification to all costs that ensured diversification. The magnitude of the effectiveness is probable because it depends on many factors, among of them there may be both expected and unexpected ones. Therefore, in the future, any specific value of the efficiency of economic activity w, which is the result of diversification of production, will be considered the realization of the random variable W.

The main characteristic of random variables is the probability of their occurrence p. Estimating it for any value of W in market conditions is a very difficult task. It is decided by each company manager in the process of diversification, using various expert methods. Therefore, such probabilities are subjective, because they reflect the expert's perception of the plausibility of implementing a particular diversification option.

Suppose, that the enterprise has developed several production diversification projects, from which several comprehensive production diversification plans (CPDP) can be formed. In addition $x_j (j = 1, \ldots, n)$ - everyone's destiny j - th of the diversification project in the total costs of CPDP, so that:

$$\sum_{j=1}^{j=n} x_j = 1. \quad (1)$$

The effectiveness of the CPDV W_p is defined as the sum of the efficiencies W_j all options with "weight" multipliers x_j, i.e:

$$W_p = \sum_{j=1}^{j=n} x_j \cdot W_j. \quad (2)$$

According to the rules of the theory of probability, the effectiveness of CPDP, which can be counted on, is:

$$m_p = M(W_p) = \sum_{j=1}^{j=1} x_j \sum_{s=1}^{s=k} w_{js} p_{js} = \sum_{j=1}^{j=n} x_j \cdot M(W_j) = \sum_{j=1}^{j=n} x_j m_j. \quad (3)$$

The deviation from the expected value of the CPDP efficiency is equal to:

$$W_p - m_p = \sum_{j=1}^{j=n} x_j \cdot (W_j - m_j). \quad (4)$$

The mathematical expectation of the square of this deviation is the efficiency variance CPDP:

$$D_p = D(W_p) = M\{(W_p - m_p)^2\} = \sum_{i=1}^{n} \sum_{j=1}^{n} x_i x_j \cdot M[(W_i - m_i) \cdot (W_j - m_j)] = \sum_{i=1}^{n} \sum_{j=1}^{n} k_{ij} \cdot x_i \cdot x_j, \quad (5)$$

There are the values $k_{ij} = M[(W_i - m_i) \cdot (W_j - m_j)]$ (6)

describe the covariances of the random variables W_i та W_j. It is form a matrix and inform about how strongly one of the random variables affects another. It is known that the covariance of a random variable is on itself (коли $i = j$) is equal to the variance, i.e:

$$k_{ij} = M[(W_j - m_j)^2] = \sigma_j^2. \quad (7)$$

The magnitude $\sigma_p = \sqrt{D_p}$ will be perceived as a "risk of CPDP ".

In the future, we will consider the issue of CPDP optimization, which means achieving such a CPDP structure, when the expected efficiency will be the highest possible, and the expected risk will be the lowest possible. We will consider the solution of such a problem on the example of product diversification, which occurs when the company decides to open the production of several dissimilar products.

Let's assume that the company plans to start production of three types of new products at cost price, respectively C01, C02 та C03 monetary units per piece, which will entail the reengineering of business processes. The company plans its activities for one year. For the year, four scenarios are forecast A1, A2, A3, A4 possible development of events in the

markets with subjective probabilities p1, p2, p3 and p4 accordingly. In each case, the profit from the sale of products will be different, as shown in the table. 2.

Table 2. Characterization of possible situations of implementation CPDP

Product type, i	Production cost, C_{0i}	Income from product sales, H_{ij}			
		A_1 p_1	A_2 p_2	A_3 p_3	A_4 p_4
1	C_{01}	H_{11}	H_{12}	H_{13}	H_{14}
2	C_{02}	H_{21}	H_{22}	H_{23}	H_{24}
3	C_{03}	H_{31}	H_{32}	H_{33}	H_{34}

Let us now determine the effectiveness of the diversification project W_{ij} (in percent), related to the production and sale of products of the type i in the situation A_j, expected profitability ті and risk σ_i, related to the production of these products:

$$W_{ij} = \left(\frac{H_{ij}}{C_{0i}} - 1\right) \cdot 100\%; i \in [1,n]; j \in [1,k], \quad (8)$$

$$m_i = \sum_{j=1}^{k} W_{ij} \cdot p_j; i \in [1,n], \quad (9)$$

$$\sigma_i = \sqrt{\sum_{j=1}^{k} (W_{ij} - m_i)^2 \cdot p_j}; i \in [1,n] \quad (10)$$

Calculations based on the data in the table. 1 lead to the results presented in table. 3.

Table 3. The results of calculations of the efficiency of diversification

Product type, i	W_{ij}				m_i	σ_i
	A_1 p_1	A_2 p_2	A_3 p_3	A_4 p_4		
1	W_{11}	W_{12}	W_{13}	W_{14}	m_1	σ_1
2	W_{21}	W_{22}	W_{23}	W_{24}	m_2	σ_2
3	W_{31}	W_{32}	W_{33}	W_{34}	m_3	σ_3

Let's assume that the management of the enterprise wants to form a CPDP from two types of products. It is possible to form three different CPDP, namely: 1st CPDP for products of the first and second types, 2nd CPDP for products of the first and third types, 3rd CPDP for products of the second and third types. For each of these CPDPs, the behavior of expected performance and risk can be established σ_p depending on the structure of the CPDP. In general, the expected profit of CPDP can be determined as follows:

$$m_p = \sum_{i=1}^{k} \sum_{j=1}^{n} x_i p_j W_{ij} = \sum_{i=1}^{k} x_i m_i. \quad (11)$$

For the listed variants of CPDP, it can be found using the formula:

$$m_{p1} = x_1 m_1 + x_2 m_2; m_{p2} = x_1 m_1 + x_3 m_3; m_{p3} = x_2 m_2 + x_3 m_3. \quad (12)$$

The variance of the expected profit of the first variant of CPDP is:

$$D_{p1} = \sum_{j=1}^{4} p_j \left[\left(x_1 W_{1j} + x_2 W_{2j} \right) - \left(x_1 m_1 + x_2 m_2 \right) \right]^2. \quad (13)$$

After elementary transformations of the right-hand side of this equation, the following expression of risk for the first variant of CPDP takes the form:

$$\sigma_{p1} = \sqrt{x_1^2 \sigma_1^2 + x_2^2 \sigma_2^2 + 2 x_1 x_2 \sigma_{12}}, \quad (14)$$

where:

$$\sigma_1^2 = \sum_{j=1}^{4} p_j \left(W_{1j} - m_1 \right)^2; \sigma_2^2 = \sum_{j=1}^{4} p_j \left(W_{2j} - m_2 \right)^2, \quad (15)$$

$$\sigma_{12} = \sum_{j=1}^{4} p_j \left(W_{1j} - m_1 \right) \left(W_{2j} - m_2 \right). \quad (16)$$

Similarly, it can be proved that:

$$\sigma_{p2} = \sqrt{x_1^2 \sigma_1^2 + x_3^2 \sigma_3^2 + 2 x_1 x_3 \sigma_{13}}; \sigma_{p3} = \sqrt{x_2^2 \sigma_2^2 + x_3^2 \sigma_3^2 + 2 x_2 x_3 \sigma_{23}}. \quad (17)$$

Using the data of table 2. from expressions (13) - (17) the required values can be found $m_{p1}, m_{p2}, m_{p3}, \sigma_{p1}, \sigma_{p2}, \sigma_{p3}$. Calculations make it possible to investigate the peculiarities of behavior m_p and σ_p with corresponding changes in the structures of the CPDP.

Next, an example of the application of the proposed methodology, defined for the justification of strategic complex plans for diversification of production, will be given.

Ordering everything stated above, it is advisable to focus on the next project of the diversification strategy for YuzhMash LLC.

The development of the dairy industry indicates the possibility and necessity of further expansion of the company's range of equipment for the dairy industry. The increase in the volume of production and sales of dairy products, in turn, causes the need to update the fixed assets of industrial enterprises. As a result, in addition to the existing assortment of LLC «YuzhMash», the lines for the production of soft cheeses, butter, and yogurts may be in the greatest demand in the near future. At the same time, the analysis of the industry shows that the demand for the existing types of manufactured products will not change significantly.

Thus, LLC «YuzhMash» is proposed to put into production three new technological lines: butter production line; soft cheese production line; yogurt production line.

To determine the optimal production diversification project, below are the results of calculations based on the following methodical approach.

The data of possible situations of the planned cost and profits from the sale of each type of diversified products are summarized in the table. 4.

Table 4. The ccharacteristics' of possible implementation situations

Type of technological line	Cost, UAH thousand	Income from sale, H_{ij}			
		A_1	A_2	A_3	A_4
		$p_1 = 0{,}4$	$p_2 = 0{,}2$	$p_3 = 0{,}1$	$p_4 = 0{,}3$
Production line of butter	134,7	167,0	153,6	181,8	169,7
Production line of yogurt	106,35	125,5	142,5	147,8	129,75
Production line of soft cheeses	146,4	175,7	188,9	171,3	194,7

The effectiveness of diversification (profitability of sales of products of a type and in a situation, expected profitability and risk associated with the production of these products) is determined by formulas (8) - (11). The results of the calculations according to the data in the table. 3 is summarized in table. 5.

Table 5. The results of calculations of the efficiency of diversification

Type of technological line	W_{ij}				m_i	σ_i
	A_1	A_2	A_3	A_4		
	$p_1 = 0{,}4$	$p_2 = 0{,}2$	$p_3 = 0{,}1$	$p_4 = 0{,}3$		
Production line of butter	24%	14%	35%	26%	23,7%	5,76%
Production line of yogurt	18%	34%	39%	22%	24,5%	7,61%
Production line of soft cheeses	20%	29%	17%	33%	25,4%	6,22%

An example of the calculation for the first technological line:

1) the profitability of the sale of products of the first type in the conditions of four scenarios of the possible development of events in the markets with different subjective probabilities:

$$W_{A=0,4} = \left(\frac{167,0}{134,7} - 1\right) \cdot 100\% = 24\%$$

$$W_{A=0,2} = \left(\frac{153,6}{134,7} - 1\right) \cdot 100\% = 14\%$$

$$W_{A=0,1} = \left(\frac{181,8}{134,7} - 1\right) \cdot 100\% = 35\%$$

$$W_{A=0,3} = \left(\frac{169,7}{134,7} - 1\right) \cdot 100\% = 26\%$$

2) average expected return:

$$m_1 = 0,4 * 24\% + 0,2 * 14\% + 0,1 * 35\% + 0,3 * 26\% = 23,7\%$$

3) the risk associated with the production of products of the first type:

$$\sigma_1 = \sqrt{(24\% - 23,7\%)^2 * 0,4 + (14\% - 23,7\%)^2 * 0,2 + (35\% - 23,7\%)^2 * 0,1 + (26\% - 23,7\%)^2 * 0,3} = 5,76$$

Thus, the company is considering three different comprehensive production diversification plans (CPDP), namely:

1st CPDP – products of the first and second types;

2nd CPDP – products of the first and third types;

3rd CPDP – products of the second and third types.

For each of these CPDP, it is possible to establish the behavior of expected profit and risk depending on the structure of CPDP. Calculation formulas (13) - (17) are necessary.

These calculations make it possible to investigate the peculiarities of the behavior of profit and risk indicators with corresponding changes in the portfolio structure. The results of the calculations are given in the table. 6.

An example of calculation for the first version of CPDP with production shares of 90% and 10%, respectively:

1) the expected profit of the given CPDP:

$$m_{p1} = 0{,}9 * 23{,}7 + 0{,}1 * 24{,}5 = 23{,}78$$

2) the risk of this CPDP:

$$\sigma_{12} = 0{,}4 * (24 - 23{,}7) * (18 - 24{,}5) + 0{,}2 * (14 - 23{,}7) * (34 - 24{,}5) + 0{,}1 * (35 - 23{,}7)(39 - 24{,}5) + +0{,}3 * (26 - 23{,}7) * (22 - 24{,}5) = -14{,}55$$

$$\sigma_1^2 = 0{,}4 * (24 - 23{,}7)^2 + 0{,}2 * (14 - 23{,}7)^2 + 0{,}1 * (35 - 23{,}7)^2 + 0{,}3 * (26 - 23{,}7)^2 = 33{,}21$$

$$\sigma_1^2 = 0{,}4 * (18 - 24{,}5)^2 + 0{,}2 * (34 - 24{,}5)^2 + 0{,}1 * (39 - 24{,}5)^2 + 0{,}3 * (22 - 24{,}5)^2 = 57{,}85$$

$$\sigma_{p1} = \sqrt{0,9^2 \cdot 33{,}21 + 0,1^2 \cdot 57{,}85 + 2 * 0{,}9 * 0{,}1 * (-14{,}55)} = 5{,}75$$

Table 6. The results of calculations of the structure and expected effectiveness of CPDP

Structure of CPDP		The expected effectiveness and risks of CPDP options					
The fate of the production of the first equipment	The fate of the production of the second equipment	Option 1 (1 i 2)		Option 2 (1 i 3)		Option 3 (2 i 3)	
		m_{p1}	σ_{p1}	m_{p2}	σ_{p2}	m_{p3}	σ_{p3}
1,0	0,0	23,7%	5,76%	23,7%	5,76%	24,5%	7,61%
0,9	0,1	23,78%	5,75%	23,87%	5,62%	24,59%	7,51%
0,8	0,2	23,86%	5,73%	24,04%	5,52%	24,68%	7,41%
0,7	0,3	23,94%	5,87%	24,21%	5,46%	24,77%	7,32%
0,6	0,4	24,02%	6,01%	24,38%	5,44%	24,86%	7,18%
0,5	0,5	24,1%	6,19%	24,55%	5,47%	24,95%	7,05%
0,4	0,6	24,18%	6,4%	24,72%	5,55%	25,04%	6,91%
0,3	0,7	24,26%	6,66%	24,89%	5,66%	25,13%	6,76%
0,2	0,8	24,34%	6,95%	25,06%	5,81%	25,22%	6,59%
0,1	0,9	24,42%	7,36%	25,23%	5,99%	25,31%	6,41%
0,0	1,0	24,5%	7,61%	25,4%	6,22%	25,4%	6,22%

Table data. 6 show that, depending on the structure of the CPDP, an increase in the expected profit of a given CPDP can be accompanied by either an increase or a decrease in its risk. For each variant of CPDP, it is possible to to choose such a quantity of products, at which the project risk has the lowest possible value (see Table 7).

Table 7. The results of the search for the optimal structure of CPDP

Structure of CPDP		Portfolio option	Expected effectiveness	Expected risk
The fate of the production of the first equipment	The fate of the production of the second equipment			
0,8	0,2	1 i 2	23,86	5,73
0,6	0,4	1 i 3	24,38	5,44
0	1,0	2 i 3	25,4	6,41

Calculations showed that the least risky and sufficiently profitable variant of the portfolio of diversified products production, in which 60% are occupied by technological lines for the production of butter and 40% by lines for the production of soft cheeses.

Discussion

Regarding the study of the influence of diversification processes on the efficiency of the industrial enterprise and the impact of the conducted scientific research on practical results and their theoretical generalization, two main hypotheses were tested:

1) diversification, of course, has a positive effect on the economic and financial condition of the enterprise;

2) the effectiveness of diversification largely depends on its chosen direction.

The first hypothesis is based on an obvious position: any diversification should lead to a reduction in risk and the creation of a synergistic effect. However, as a result of empirical testing of this hypothesis, opposite results were obtained.

As a result to confirm it, and to prove its failure. At the same time, it was established that at the first stage of the implementation of the decision on diversification, the efficiency of the enterprise increases due to the rational redistribution of resources.

At the second stage, efficiency decreases due to the increase in management complexity, the detection of contradictions, inconsistencies in management technologies, etc.

As for the empirical verification of the second hypothesis, a general conclusion was made that diversification in industries that corresponded to the company's profile is more effective than penetration into areas not related to the main lines of activity. Thus, diversification should be considered not as a means to increase the efficiency of the enterprise, but as a condition for its potential growth, thereby emphasizing its strategic importance.

Conclusion

The article proposes a methodical procedure for assessing the risk of implementing the diversification strategy of an industrial enterprise in the conditions of informatization. The result of which was the improvement of solving purely practical tasks of diversification of production with the help of economic and statistical modeling on the basis of the investment "portfolio" theory. It was concluded that the enterprise that chooses a diversification strategy and enters a new direction of activity is, as a rule, not an absolute novice in it, ignorant of the internal and external conditions of activity in this direction. Diversification must necessarily be based on the availability of certain resources, skills, competencies, including those necessary for making a decision to enter a new field of activity. It should be noted that any diversification strategy uses a certain number of synergy elements that are present in the main areas of activity. If combinations of key success factors distinguish one segment from another, then there are always factors that are part of several or many areas. Relying on these joint resources and competences, the enterprise within the framework of the new line of activity will have competitive advantages due to the experience and resources accumulated and created in traditional directions and on the basis of information management technologies.

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Conflict of interest

The authors declare no potential conflict of interest regarding the publication of this work. In addition, the ethical issues including plagiarism, informed consent, misconduct, data fabrication and, or falsification, double publication and, or submission, and redundancy have been completely witnessed by the authors.

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