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REVIEW PAPER

Modeling the Optimal Distribution of an Enterprise's Resources

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ABSTRACT

In the modern economy, optimizing the use of resources is a key factor in ensuring the success of a company. This article optimizes the allocation of enterprise resources to maximize profits, which contributes to the sustainable development of both the enterprise and the economy of the state. To achieve this goal, the authors have developed a model for the optimal allocation of enterprise funds. The article considers various methods to allocate investor funds to maximize profits. It is concluded that it is impossible to increase income without increasing risk or reduce risk without reducing profit. The portfolio that contains the riskiest assets will be the most diversified and bring the best return per unit. To assess the sustainable development of an enterprise with due regard to its possible risks, it is not enough to use only quantitative methods of risk analysis. It is also necessary to develop a comprehensive methodology that would consider all possible risks typical of Russian enterprises.

HIGHLIGHTS

- The study focuces on the importance of developing a strategic model for resource allocation, which is crucial for businesses to thrive, maintain competitiveness, and optimize their profits in the fiercely competitive market.

Keywords: Optimization, risk management, model, financial activity, sustainable development

The current market is extremely competitive and requires businesses to make the most of their resources. The rational use of funds is the main goal of any business that seeks to maximize its profits and reduce costs and risks (Sharov, 2018).

To achieve this goal, it is necessary to develop a strategic model for the optimal allocation of resources, which allows a company to survive in the market and strengthen its position. The optimal placement of enterprise funds is an integral part of management activities. This allows not only optimizing inner processes at an enterprise but also increasing its competitiveness in the current market environment.

One of the most important tasks in creating such a model is the optimal allocation of enterprise funds, which will ensure minimum production costs and maximum profits (Zyryanov and Abdullina, 2016; Fedorova, 2017; Yashin and Kosareva, 2017).

The model is based on the idea of analyzing all possible options for the allocation of funds and choosing the best development scenario. To attain this end, it is necessary to consider various factors, such as the cost of labor, the cost of materials, other expenses, etc.

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One of its main tasks is to determine the optimal production size. Accordingly, it is necessary to consider the forecast of consumption in the market, the cost of production, sales volume, etc. The model of the optimal allocation of enterprise funds helps find the best balance between profits and costs. The model assists management in making decisions about the flow of resources and determining what investments are needed to maximize the income of an enterprise (Foss, 2007; Morrow *et al*. 2007).

To create such a model, it is necessary to conduct a study based on market and industry analysis, competition assessment, and demand forecasting. Its results will determine the optimal methods of development and cost-effective use of enterprise resources.

METHODS

To build an optimal investment model, several factors should be considered. Firstly, this is the definition of the most promising directions for the development of an enterprise. Secondly, it is necessary to consider the regional typology where the funds will be placed. It is also worth mentioning the balance of costs and revenues, risk analysis, and technical production.

When building a model for the optimal allocation of business funds, various software tools and methods of mathematical modeling can be used. Thus, we applied software with a graphical interface to visually simulate the process of placing the funds. In addition, there are linear programming methods, graphical methods, simulation methods, etc. (Reed and McCauley, 2015; Savchenko, 2018; Sharov, 2018).

A key factor in the development of an optimal model for the allocation of funds is the definition of optimality criteria. These can be, for example, criteria for minimizing production costs, maximizing profits, or minimizing risks. However, the optimal model for distributing funds is not a one-time solution since production and market conditions are constantly changing. Thus, this model must be regularly adjusted to the current conditions.

RESULTS AND DISCUSSION

The development of a model of the optimal allocation of business funds is an important tool for managing commercial organizations. This allows for minimizing costs and increasing profitability, which is the key task for achieving market competitiveness and sustainable economic development (Garanin and Smirnova, 2017). Due to existing challenges and increasing risks, it becomes crucial for entrepreneurs to ensure the reliability and stability of profits (Baburin and Khudyakov, 2016; Batkin and Boikova, 2017).

A company's profit is defined as the difference between the proceeds from activities and costs, as well as the other costs and losses incurred during operation (Sergienko, 2018). To maximize profits, there are two approaches: to reduce costs and increase revenue. Currently, cost reduction is a preferred approach as it is more realistic in the modern environment. To achieve this goal, a company can use cheaper equipment and raw materials, as well as introduce scientific and technological advancements and modernize its activities.

Considering information breakthroughs, the automation and digitalization of production can optimize production capacities and increase a company's profitability. To reduce resource costs, it is important to use resource-saving technologies in production processes (Zarubina, 2015; Belyakova *et al*. 2017). Choosing the right resource provider is also an important factor. However, mass layoffs and bonus cuts are not effective methods of cost reduction since they can negatively affect the emotional climate, production efficiency, and a company's brand image, which ultimately can lead to a decrease in demand for a company's products.

A company's profit grows through increasing sales and revenue. To attain this end, an enterprise can increase the output and demand for its goods and services. However, with the growth of production and sales, financial costs also increase.

To achieve these goals, a company can use the following strategies:

- To improve marketing activities and launch mass advertising campaigns to increase brand awareness;
- To develop a unique product and obtain a patent for exclusive rights to its production to avoid direct competition;

- To upgrade the product or its features to maximize customer satisfaction.

In modern practice, capital turnover acceleration is sometimes used to maximize a company's profits. This method consists in reducing the need for additional financial resources and increasing production volumes. This approach is effective only if a company is already profitable. Otherwise, a more rapid turnover can worsen its financial state, therefore it is not widespread in modern business.

In joint-stock companies, there are two conflicting goals: profit maximization and shareholder welfare. As a result, this situation might cause a conflict of interest. The main goal of small businesses is to make short-term profits, which can lead to a lack of resources for long-term development and productivity. Striving for short-term profits, a company's management might deviate from the goal of profit maximization (Kotlyar, 2016; Bazarnov and Golovanov, 2018).

Modern entrepreneurs face an important task, i.e., to maximize their profits, which is a necessary condition for the sustainable development of their company. The level of income is the main indicator of the successful functioning of a company, and achieving the maximum level of profit becomes their main goal. To attain this end, it is necessary to consider the factors influencing the growth of profits and manage them. Competent long-term planning, allocation of resources, and implementation of measures to increase a company's profitability play an important role in ensuring the efficiency of financial and economic activities and achieving the maximum profit (Politkova, 2016; Baronina and Timakova, 2017). The progress and development of the company have an impact on its effective functioning and the economy of the country.

Principles of modeling the optimal allocation of an enterprise's funds

Determining the optimal allocation of enterprise funds is the process of selecting the most appropriate set of investments in such a way as to satisfy the current and future needs of an enterprise. The optimal allocation of funds includes capital management, the use of financial resources and property to ensure the long-term efficiency of an enterprise (Tarakanova and Mukhina, 2018; Prokopovich and Savyak, 2022).

The principles of modeling the optimal allocation of enterprise funds are to reduce costs and increase profits to the maximum level when choosing a specific investment portfolio. The optimal allocation of enterprise funds includes the following factors (Fedorova, 2017):

1. Investment in the most promising projects. An enterprise should choose investments that have high profitability and ensure additional financial well-being. This can be done by analyzing cash, real estate, equipment, and other assets available for investments.
2. Balancing risk and return. An enterprise must keep a balance between risk and return when choosing a particular investment. The selection of a project with high ROIs must be balanced with an assessment of the risks that may arise.
3. Exploring investment opportunities. An enterprise must evaluate all available investment options to select the project that is most suitable for investment. This might include the analysis of markets, trends, and investor needs.
4. Profitability assessment. An enterprise must evaluate the returns and costs of its investment to determine which project is the most cost-effective. This can be done by applying various methods of evaluating profitability, such as net present value, internal rate of return, etc.
5. Financial stability. An enterprise must be financially stable to invest in new projects and grow. This can happen through cash management, cost control, and capital building.

Methods for optimizing the allocation of an enterprise's resources

Methods for optimizing the allocation of enterprise resources are a set of tools and technologies aimed at their optimal use to minimize costs and increase the efficiency of business activities. The optimal distribution of enterprise resources includes such tasks as minimizing production costs, reducing the time-to-market, and improving the quality of products and services (Shapkin and Shapkin, 2013).

There are different methods for optimizing the distribution of enterprise resources but the most common are those based on mathematical modeling and data analysis. For example, this list comprises linear and dynamic programming methods, simulation methods, sensitivity analysis methods, etc. (Foss, 2007; Domashchenko and Finogenova, 2010).

One of the most effective methods for optimizing the allocation of enterprise resources is the distribution of budget funds. The essence of this method lies in the fact that the most important tasks that need to be solved by an enterprise at a given time are determined, then the amount of financial resources that are required for their implementation are identified, and the funds are distributed to ensure the maximum efficiency in the use of the budget.

In addition, a method for optimizing the allocation of enterprise resources is ABC analysis. This method consists in classifying all the costs of the enterprise into three groups: A – the most important and expensive costs, B – moderate costs, and C – minor costs. After conducting an ABC analysis of an enterprise, it can focus on optimizing the costs in group A, which have the greatest impact on the financial result.

Methods of maximizing a company's profit

The concepts of income and profit play a crucial role in economics. Income represents the money or material values received over a certain period. Profit is the positive difference between the total income and the costs of producing, acquiring, storing, transporting, and selling goods and services.

Income and profit comprise the cash or material values received as a result of production activities. However, they differ in the role of costs. If the sum is considered before deducting all costs, then this is income (Kiseleva and Tramova, 2021).

Ways to increase a company's profit are presented in Table 1 (Zastupov, 2021).

Here is a description of the main elements of the model: objective function, constraints, and decision variables.

The model of the optimal allocation of enterprise funds is a mathematical model used to find the optimal distribution of financial and material resources of an enterprise to maximize its profits. This model assumes that the enterprise has certain funds that can be distributed among various activities. The optimal distribution of these funds can be achieved by solving a certain mathematical problem.

The goal of this model is to find the optimal allocation of funds given limited resources or product quality requirements.

The optimal allocation of enterprise funds allows one to increase revenues, reduce costs, optimize the use of resources, and improve the efficiency of an enterprise. Therefore, the model of the optimal allocation of enterprise funds is an important tool for making managerial decisions.

Building a mathematical model as exemplified by a specific problem

A key element to the model of the optimal allocation of enterprise funds is the objective function. It reflects the optimization goal that an enterprise sets for itself. The most used function is to maximize a company's profit. This includes all the costs associated with the production of goods or services.

However, this model has several limitations. Such constraints define the allowable limits for changing the variables that affect the solution of the problem set. For example, these might include limits on the quantity of goods produced, the availability of limited resources, and technical limitations on production capacity.

Another important element of this model is decision variables. They determine the optimal way to use resources in various areas of the enterprise. Decision variables might include sales volume, number of employees, advertising costs, etc.

Thus, the model of the optimal allocation of enterprise funds comprises three main elements: the objective function, constraints, and decision variables. It aims at identifying the optimal allocation of resources to achieve the main goal of the enterprise, i.e., profit maximization (Akhmetzyanov, 2023).

A specific problem of the optimal allocation of enterprise funds might be as follows:

"Enterprise X is engaged in the manufacturing and sale of two types of products: A and B. There are 200,000 units of materials, 4,000 working hours, and 500,000 funds are spent monthly. Product A brings

Table 1: Methods of maximizing a company's profit

No.	Method	Method description	Main disadvantages
1	Method to in crease production volume	This method consists in the production and sale of more goods or services for gaining profit. It is effective only if there is demand for products in the market. An increase in the number of jobs associated with this method has a positive effect on the social sphere. This method is considered one of the most effective	This method is characterized by an increase in production costs. Increasing output requires more equipment, labor, and resources, which incurs additional costs
2	Method to increase the cost of products	This method of increasing profits is extremely risky. The manufacturer must be sure that buyers are ready to purchase the product even if the price rises	In some cases, consumers may refuse to purchase a product not only because of the increased price but even if it is lowered in the future. This risk of losing customers is critical
3	Method to conclude additional agreements with other organizations	The essence of this method is to find new connections with other organizations for the purpose of mutually beneficial cooperation. This approach results in higher profits for all parties and less risk since the responsibilities are defined in a formal contract. This method is considered the most effective	The main disadvantage of this approach is its complexity. It is not always possible for a company to establish profitable cooperation with an other company. This process can be long and laborious
4	Method to optimize costs	This method of reducing the cost of goods is based on the acquisition of resources at a lower price or reduction in the use of certain factors of production, such as labor, equipment, and floor space	The disadvantage of this approach lies in the possible decrease in product quality, which can lead to the loss of many customers in favor of competitors
5	Method to motivate staff	Employee motivation is an effective way to increase profits. Employees are convinced that their income depends on the profitability of the enterprise, which encourages them to invest more effort. There are two categories of motivation: Material: monetary rewards, social security, discounts, and financial incentives. Intangible: career growth, training at the expense of the company, public recognition	This approach can cause additional costs for the employer to conduct motivational activities, such as paying for the services of a business coach for conducting a motivational lecture for company employees
6	Method to expand the range of products	The method assumes that the entrepreneur develops and produces a new type of goods or services, selects a market for this product, and then promotes it. This approach allows to increase the profit of the entrepreneur through the successful implementation of this additional product	The disadvantage of this approach is the additional costs of the entrepreneur for the creation of new products and no guarantee of full payback, as well as the profit generated from production
7	Method to develop and implement a new business plan	This method is considered one of the most effective for increasing the profitability of the enterprise. It implements a specific business plan prepared by an experienced specialist based on the analysis of customer needs. This implementation involves the owner of the enterprise giving instructions to their employees	The disadvantage of this approach is the risk of implementing an erroneous business plan and possible negative consequences that can not always be corrected. There is also the problem of poor-quality execution of the business plan by employees of a particular organization
8	Method to sell or lease used property	This method consists in the sale or lease of used items in production. In the event of a sale, this property is often considered unusable, and the entrepreneur can make additional profit by reselling it. The entrepreneur can also resell work equipment and make some profit	When implementing this method, it is possible to reduce production, which can be compensated by the employer by increasing working hours. However, this may lead to the risk of losing qualified employees and reducing the quality of work. As a result, product quality may deteriorate, and customers may be lost

9	Method to open new markets	Increasing the company's profit is one of the most effective ways. It requires the demand of buyers for products. It includes the search for new markets, cooperation with them, and an increase in output	Increasing the cost of producing more goods or services is a downside to this approach. However, if the new market turns out to be unclaimed, these costs may not pay off
10	Method to use new technologies	The introduction of the latest technologies, such as improved equipment, into production increases its efficiency. New technologies and automation techniques lead to a reduction in staff,which cuts wage costs and improves product quality	One of the main disadvantages is the high cost of acquiring new technologies and no guarantee they will generate profits

Table 2: Groups of enterprise assets

No.	Asset group	Risk ratio (G_i)	Interest rate (P_i)
1	Cash and equivalent funds	0.05	0
2	Funds on a correspondent account with the cash processing center	0	0
3	Funds on the reserve account in the Central Bank	0	0
4	Securities of the Government of the Russian Federation	0.1	0.15
5	Government guaranteed loans	0.2	0.1
6	Local government securities	0.2	0.15
7	Correspondent accounts of non-resident banks in hard currency	0.25	0.3
8	Loans to other banks	0.25	0.35
9	Short-term loans	0.3	0.5
10	Factoring operations	0.5	0.37
11	Loans to non-resident companies and individuals for consumer purposes	0.5	0.38
12	Long-term loans	0.5	0.43
13	Leasing operations	0.6	0.4
14	Securities of joint-stock companies and other enterprises acquired by the bank	0.7	0.52
15	Other participation rights acquired by the bank	0.8	0.55
16	Arrears on loans	1	0.15
17	Protested bills	1	0.45
18	Futures transactions	1	0.75
19	Guarantees and pledges	1	0.8
20	Trust (intermediary operations)	1	0.65

120 rubles of profit per unit and requires 5 units of materials and 2 working hours. Product *B* makes a profit of 200 rubles and requires 8 units of materials and 3 working hours. The production quantity of product *A* cannot exceed 30,000 units.

It is necessary to determine the optimal amount of production for each type to maximize the company's profit."

The target function in this model is the profit of the enterprise. Let us denote this function by *P*:

$$P = 120A + 200B$$

Where *A* is the number of *A* units produced and *B* is the number of *B* units produced.

The next step is to express the constraints associated with available resources. In this case, we have the following restrictions:

- – the amount of materials: $5A + 8B \leq 200{,}000$;
- – the number of working hours: $2A + 3B \leq 4{,}000$;
- – the availability of funds: $120A + 200B \leq 500{,}000$;
- – product A limit: $A \leq 30{,}000$.

The decision variables in this model are the A and B values.

Thus, the mathematical model of the optimal allocation of enterprise funds can be represented as a system of equations and inequalities:

Table 3: Company's investments

No.	Asset group	Risk ratio (G_i)	Interest rate (P_i)
X_1	Cash and equivalent funds	0.05	0
X_2	Securities of the Government of the Russian Federation	0.1	0.15
X_3	Government guaranteed loans	0.2	0.1
X_4	Local government securities	0.2	0.15
X_5	Correspondent accounts of non-resident banks in hard currency	0.25	0.3
X_6	Loans to other banks	0.25	0.35
X_7	Short-term loans	0.3	0.5
X_8	Factoring operations	0.5	0.37
X_9	Loans to non-resident companies and individuals for consumer purposes	0.5	0.38
X_{10}	Long-term loans	0.5	0.43
X_{11}	Leasing operations	0.6	0.4
X_{12}	Securities of joint-stock companies and other enterprises acquired by the bank	0.7	0.52
X_{13}	Other participation rights acquired by the bank	0.8	0.55
X_{14}	Arrears on loans	1	0.15
X_{15}	Protested bills	1	0.45
X_{16}	Futures transactions	1	0.75
X_{17}	Guarantees and pledges	1	0.8

To maximize P = 120A + 200B

With due regard to limitations:

$5A + 8B \leq 200{,}000$

$2A + 3B \leq 4{,}000$

$120A + 200B \leq 500{,}000$

$A \leq 30{,}000$

Where A and B are the decision variables.

The solution of these equations using the methods of mathematical programming will determine the optimal amount of each type of product and the maximum profit that the enterprise can receive.

Here is another example.

Under the allocation of resources by an enterprise, we understand such investments as:

- Loans to enterprises and organizations;
- Investing in securities, including treasury bills, domestic foreign exchange loans, investments in shares of banks and enterprises;
- Debt obligations (bills or certificates of deposit);
- Loans to other banks;
- Purchasing foreign currency for the purpose of playing on the exchange rates (foreign currency – ruble; ruble – foreign currency);
- Factoring operations;
- Leasing operations;
- Futures operations.

We know the amount of funds the company attracted in previous periods and the total amount of funds invested by the bank for a period $t=S_t$. Investments are made in the following directions:

$$X_{1t} + X_{2t} + \ldots + X_{rt}$$

These investments have the same turnover, i.e., the refund period is the same.

For each type of asset invested in a certain direction, there are interest rates that are valid for the period P_{it}, $i = 1 \div r$, $t = 1 \div T$, which is set by the beginning of each period.

We cannot place assets as an investment with a maximum interest rate due to the restrictions imposed by the Central Bank of Russia, tax laws, and common sense.

Let all the investments be divided into groups according to the degree of risk, i.e., each type of investment corresponds to its default coefficient of funds G_i from the interval (0.1). Multiplying it by X_{it}, we get the amount of funds placed with due

regard to the risk of non-return of funds (Table 2).

One can invest in an enterprise in several ways.

In view of the above, we select the methods presented in Table 3.

Let us introduce the following notation:

G is a risk ratio;

P is an interest rate;

K_t is bank capital = 66,000;

K_p is credit resources;

C is current account balances = 35,371;

S_t is total assets = 566,929.

Since we need to maximize income, the objective function will take the following form:

$$0 \times X_1 + 0.15 \times X_2 + 0.1 \times X_3 + 0.15 \times X_4 + 0.3X_5 + 0.35 \times X_6 + 0.5 \times X_7 + 0.37 \times X_8 + 0.38 \times X_9 + 0.43 \times X_{10} + 0.4 \times X_{11} + 0.52 \times X_{12} + 0.55 \times X_{13} + 0.15 \times X_{14} + 0.45 \times X_{15} + 0.75 \times X_{16} + 0.8 \times X_{17} \Rightarrow \max$$

For each direction of investment, restrictions are imposed:

$$X_1,\ldots X_{17} \leftarrow 0.8 \times S_t = 0.8 \times 566,\ 929 = 453{,}543.2$$

$$X_1,\ldots X_{17} \leftarrow 0.01 \times S_t = 0.01 \times 566{,}929 = 5{,}669.3$$

The sum of all invested funds must be equal to the sum of all assets:

$$X_1 + \ldots + X_{17} = 566{,}929$$

According to the rules, the risk should not exceed 25% of the company's capital but in this case, the risk is under 158% of the company's capital, which is alarming. However, there are no other solutions to the problem.

$$0.1 \times X_1 + 0.1 \times X_2 + 0.2 \times X_3 + 0.2 \times X_4 + 0.25 \times X_5 + 0.25 \times X_6 + 0.3 \times X_7 + 0.5 \times X_8 + 0.5 \times X_9 + 0.5 \times X_{10} + 0.6 \times X_{11} + 0.7 \times X_{12} + 0.8 \times X_{13} + X_{14} + X_{15} + X_{16} + X_{17} \leftarrow 1.58 \times K_t = 1.58 \times 66{,}000 = 10{,}428$$

There are also restrictions on the amount of all loans:

$K_p \leftarrow 0.7 \times C$, for our task, we amended the form as follows:

$K_p \leftarrow 1 \times C$, which means the following:

$$X_3 + X_6 + X_7 + X_9 + X_{10} + X_{14} \leftarrow 1 \times C = 1 \times 35{,}371$$

We solve this problem with the help of Excel and the Solver add-in.

CONCLUSION

Thus, a model of the optimal allocation of enterprise funds is an important tool for business. It helps increase profits, determine drawbacks, and improve the efficiency and competitiveness of a company. Perspectives and further studies in this area might be concerned with new methods and tools that help entrepreneurs use their resources more efficiently and achieve their goals.

In addition, the model of the optimal allocation of enterprise funds is vital for making managerial decisions. It allows one to optimize the use of resources and increase the efficiency of an enterprise while maximizing its profits.

An objective function reflects the optimization goal set by an enterprise. Possible constraints are related to limited resources and other parameters that hinder the production process. Decision variables determine the best way to use resources in various areas of an enterprise.

The decision-making algorithm in the model includes steps from formulating the problem and collecting data to monitoring and correcting the results.

The optimization results should be analyzed and assessed for their impact on a company's profit. It is necessary to consider possible risks and adjust decisions if needed.

As a result, the model of the optimal allocation of enterprise funds plays a crucial role in optimizing a company's activities and maximizing profits.

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