# Extensive Use of Mathematical Methods is an Important Factor in Improving Economic Analysis

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## ABSTRACT

The article considers a model for optimizing the production of a tourist enterprise in the republic and considers the profitability of an enterprise in a market economy.

**Keywords:** Tourist enterprise, labor, mathematical methods, production, optimization model, firm, profit.

## INTRODUCTION

Mathematical methods make them better without negating the traditional methods and help to objectively analyze the variable outcome indicators through other indicators. One of the advantages of mathematical methods and electronic technologies in the management of the national economy is that they can show the effect of factors on the modeled object, the relationship between the result and the resource. It provides scientific forecasting and management of production results and priorities of the national economy in dozens of industries and thousands of enterprises.

## METHODS

The theoretical and practical significance of mathematical methods and models can be seen in the following:

1. Mathematical methods and models serve as a leading tool in the development of economics and natural sciences.
2. It will be possible to make some corrections during the implementation of predictions made using mathematical methods and models.
3. With the help of economic-mathematical models it is possible not only to analyze economic processes in depth, but also to discover their new unexplored laws. They can also be used to predict the future development of the economy.
4. Economic-mathematical methods and models, along with the simplification of computerization and automation of computational work, facilitate mental labor, help to organize and manage the work of management and economic personnel on a scientific basis.

Economic-mathematical methods is the name of a complex of economic and mathematical sciences. These sciences are used to analyze the whole economy using comprehensive mathematics. Economic-mathematical methods and models include concepts and rules consisting of a system of special sciences, which include:

a) study the impact of objective and subjective factors on economic processes, their relationship;
b) scientific substantiation of business plans and objective assessment of their implementation;
c) identification of positive and negative factors affecting the economy and quantitative assessment of their impact;
g) identification and disclosure of trends and ratios in the development of production, untapped potential resources;
d) generalization of best practices, making optimal management decisions.

In the analysis of economics using mathematical methods and models, production processes are studied in a complementary manner, interconnected. In doing so, any factors, causes, grounds, events, processes that connect them to each other are studied and evaluated. To do this, they are divided into deep, comprehensive, primary and secondary, significant and insignificant, definite and indefinite. It then examines, first of all, the influence of important, fundamental, and determining factors that affect production processes. The study of the impact of all factors on economic processes is a very complex issue, and in practice it is not always necessary to take them into account.

The need to identify the factors that effectively affect the implementation of the business plan of the enterprise, the study of their impact, as well as the need for quantitative assessment and economic analysis of these effects - requires the use of mathematical models.

The subject of economic-mathematical methods and models is the expression of production processes in consumers, manufacturers, associations, associations, socio-economic efficiency and financial results of their activities under the influence of objective and subjective factors on the basis of a system of economic-mathematical models. The subject of economic-mathematical methods and models is understood as the process of production under internal and external factors, the formation of the final results and their evaluation on the basis of mathematical methods.

Different factors have a regular effect on production processes, and they represent different economic laws. For example, in the modeling process, the effect of the price (valuation) factor is studied. If the prices (prices) of raw materials, semi-finished products and finished products change in the economy, the market, it will affect all financial indicators of industry, agriculture, trade and other enterprises.

**MAIN PART**

The tasks of the science of economic-mathematical methods and models in economic analysis are:

1) scientific and economic substantiation of business plans and standards of the enterprise;

2) objective and comprehensive study of the implementation of business plans and compliance with standards;

3) determination of economic efficiency of use of labor, material and financial resources;

4) control over the implementation of commercial accounting requirements;

5) search and evaluation of internal opportunities, identification of trends and ratios of production development;

6) generalization of best practices, verification of the optimality of management decisions.

The above tasks indicate that production situations are multifaceted and multivariate, and that changes are possible. Practice shows that models of market economy analysis can set new tasks for science, because economic and social processes are rapidly growing and changing.

Extensive use of economic-mathematical methods and models improves the direction of economic analysis, increases the effectiveness of economic analysis, creating opportunities for the relationship between different processes, the quantification of their changes and the identification of trends. As a result, while the analysis time is reduced, it is necessary to fully cover the factors affecting economic and commercial activities, and to distinguish the most important ones, replace the previous approximate calculations with exact ones, create and solve multidimensional problems, complex manual calculations. - There will be an opportunity to implement books on computers. The use of economic-mathematical methods in the analysis of the activities of enterprises requires a systematic approach to the study of enterprise economics, taking into account all the existing interrelationships between its various activities.

The analysis of such conditions itself requires a systematic approach from the point of view of cybernetics: the creation of a set of economic-mathematical models that represent the quantitative characteristics of the problem and economic processes to be solved using economic analysis; improving the system of economic information about the activities of the enterprise; availability of technical means for collecting, processing, storage and delivery of targeted economic data for economic analysis; requires the formation of special analytical groups consisting of economists-practitioners, mathematicians-accountants in economic-mathematical modeling, operators-programmers. Mathematical problems created for the purpose of economic analysis can be solved by one of the economic-mathematical methods presented in the following scheme.

Elementary mathematical methods are used in justifying the need for various resources, in calculating production costs, in developing plans, in balance sheet calculations.

The classical methods of higher mathematics are not only used in the context of other methods (e.g., mathematical statistics and mathematical programming), but also in their own right. This is due to the fact that the methods of differentiation and integration are widely used in the factor analysis of many economic indicators

**DISCUSSION**

The formation of a market economy in Uzbekistan requires the replacement of economic accounting with trade. The responsibility of economic entities for the operation of a market economy and the existence of competition determine the need to compare results and costs, to analyze the events and indicators of total economic processes. It is therefore important to study and apply new analysis methods.

The widespread use of mathematical methods is an important aspect of improving economic analysis, which increases the efficiency of the analysis of the firm, enterprise and its divisions. This allows you to reduce the analysis time, take into account all the factors, make error-free calculations. In addition, these methods allow to find optimal solutions (solutions) on several criteria.

In particular, the manufacturer's behavior model is based on maximizing profits. Such a criterion is not universal. Maximizing current profits is related to determining the prospects of the enterprise. In the current complex period, the main task is to keep the enterprise as a production unit, so the criterion of maximizing profits does not work, but the criterion of minimizing costs is acceptable.

In a market economy, an enterprise (firm) intends to make a profit or maximize the amount of output.

We consider and apply the model of optimization of production activity of the tourist enterprise:

a) limited production capacity;

b) profit maximization criterion and Kun-Takker method.

Assume that a manufacturing firm produces several different products of the same or permanent structure. In it, the firm's brand product is assumed to be X.

To produce a product, the firm uses live labor L (number of annual workers or number of man-hours) means K (fixed production assets) and packaged labor and labor items M (annual fuel used, raw materials, equipment, etc.).
The resource resources (guest, funds, and materials) that unite the Convention are divided into several boundaries (any category of guest, different equipment). We define resource savings with a vector-column $x = (x_1, x_2, ..., x_n)$ It describes the firm's technology with production functions that represent the consumption of resources and the availability of product quantities:

$$X = F(x) \qquad (1)$$

F (x) is assumed to be a continuous, neoclassical function whose double differential can be found, and its second derivative matrix is negative.
If the product price is $p$ and $j$, the unit price of the resource is $w = \overline{1, n}$, the cost vector is written as follows and the profit is obtained:

$$\Pi(x) = pF(x) - wx \qquad (2)$$

where: $w = (w_1, w_2, ..., w_n)$ - resource value vector series.
The cost of resources has a natural and definite meaning if $x_j$ is the average annual number of workers of a certain qualification and $w_j$ is the annual salary per person; if $x_j$ is the purchased material (fuel energy, etc.), then $w_j$ is the purchase price of that material.
a) If -production funds, then $w_j$ - the amount of annual rent of funds or the cost of repairing the funds.
b) where $R = pX = p(Fx)$ is the firm's annual output or annual income $C = wx$ is the annual cost of production or resources.
Unless other factors affect the amount of resources involved, profit maximization is written as follows:

$$\max_{\{x \geq 0\}} [pF(x) - wx] \qquad (3)$$

This is a nonlinear programming problem, and the Kun-Takker condition is used to solve the $x \geq 0$ problem:

$$\begin{aligned} \frac{\partial n}{\partial x} &= p\frac{\partial F}{\partial x} - w \leq 0 \\ \frac{\partial n}{\partial x} x &= \left(p\frac{\partial F}{\partial x} - w\right) \cdot x = 0 \end{aligned} \qquad (4)$$

If resources are used in the optimal solution $x^* > 0$, then condition (4) is written as follows:

$$p\frac{\partial F(x^*)}{\partial x} = w \qquad (5)$$

or $$p\frac{\partial F(x^*)}{\partial x_j} = w_j, \qquad j = 1,2,\ldots,n$$

at the optimal point, the final product corresponding to the resource unit is equal to the price.
c) maximizing the quantity of products without changing production costs is written as follows:

$$\begin{aligned} &\max F(x) \\ &wx \le C, \quad x \ge 0 \end{aligned} \qquad (6)$$

This problem is a problem of variables that have a linear limit of linear programming. Following the theory, we construct the Lagrange function:

$$L(x,\lambda) = F(x) + \lambda(C - wx)$$

Then we find the maximum value without the variables being negative. To do this, we fulfill the Kun-Takker condition.

$$\begin{aligned} &\frac{\partial F}{\partial x} - \lambda w \le 0 \\ &\left\{\frac{\partial F}{\partial x} - \lambda w\right\} \cdot x = 0 \\ &x \ge 0 \end{aligned} \qquad (7)$$

Apparently (7) corresponds to condition (4). Agar

$$\lambda = 1/p$$

Based on the Cobb-Douglas function, we consider the problem of maximizing the profit of a firm producing the same product using the following example.
For example. If the firm allocates 150 thousand soums for rent and wages, maximize the amount of production (rent of the fund unit $w_K = 50000$, salary $w_L = 100000$.

$$X = F(K,L) = 3 \cdot K^{2/3} \cdot L^{1/3}$$

If so, find the limit of the final exchange of stock and labor at the optimal point?
Solve. It is known that $F(0,L) = F(K,0)$ means $K^* > 0$, $L^* > 0$ in the optimal solution. Therefore, condition (7) is as follows:

$$\begin{cases} \dfrac{\partial F}{\partial K} = \lambda w_K \\ \dfrac{\partial F}{\partial L} = \lambda w_L \end{cases} \qquad (8)$$

or in our example

$$\frac{2}{3} \cdot \frac{F(K^*, L^*)}{K^*} = \lambda w_K$$
$$\frac{1}{3} \cdot \frac{F(K^*, L^*)}{L^*} = \lambda w_L$$

Dividing the first equation by the second, we find:

$$\frac{2L^*}{K^*} = \frac{w_K}{w_L}$$

Putting it under the following condition, we find $w_K K^* + w_L L^* = 150$:

$$K^* = \frac{2}{3} \cdot \frac{150}{w_K} = 20, \quad L^* = 5$$

The solution can be expressed geometrically. In Figure 1, the isocosta line (constant cost line for S = 50,100,150 s) and isoquants (constant X = 25.2; 37.8 gross product line).



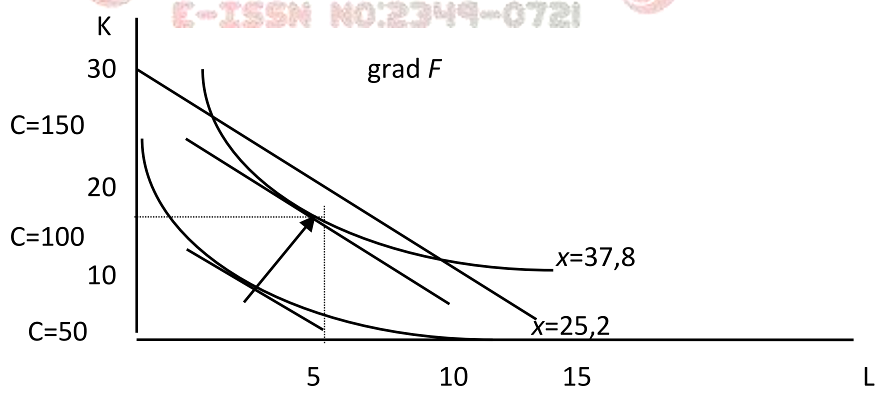


Figure 1 (Author's development).

Isocosts are written by the following equation:

$$5K + 10L = C = const$$

Isoquants are explained by the following equations:

$$3K^{2/3}L^{1/3} = X = const$$

At the optimal point $K^* = 20$, $L^* = 5$ isoquant $X^* = 37{,}8$ and isocosta $C = 150$, their gradients are $\left(\frac{\partial F}{\partial K}, \frac{\partial F}{\partial L}\right)$, $(w_K, w_L)$ collinear.

Optimal point stock and labor exchange:

$$S_K = \frac{\partial F / \partial L}{\partial F / \partial K} = \frac{1 - L \cdot K^*}{\alpha \cdot L^*} = \frac{1}{2} \cdot \frac{20}{5} = 2$$

This means that one worker can be replaced by two unit funds. Solving the problem of maximizing the firm's profit, we find the resource demand $x^* > 0$. The corresponding cost is $C^* = wx^*$ . Now we find the production of the product without changing the cost. The optimal solution in the above neoclassical production function is the $x^* > 0$ single solution.



So, on the one hand:

$$\frac{\partial F(x^*)}{\partial x} = \frac{1}{p} w, \qquad wx^* = C^*, \qquad n(x^*) \geq n(\bar{x}^*)$$

on the other hand:

$$\frac{\partial F(\bar{x}^*)}{\partial x} = \lambda w, \qquad w\bar{x}^* = C^*, \qquad F(\bar{x}^*) \geq F(x^*)$$

Because

$$n(*) = pF(x^*) - wx^* \geq pF(\bar{x}^*) - w\tilde{x}^* = n(\bar{x}^*) \text{ and } wx^* = w\tilde{x}^* = C^*,\ F(x^*) \geq F(\tilde{x}^*)$$

$$F(\tilde{x}^*) \geq F(x^*) \text{, therefore } F(\tilde{x}^*) = F(x^*)$$

the solution to the problem is unique, $\tilde{x}^* = x^*$.

If the problem of the maximum of profit has a unique solution, then the problem of maximizing the quantity of the product in the case of $x^* > 0$ and accordingly the given costs $C^* = wx^*$ is true.

**CONCLUSION**

Economic-mathematical methods do not negate traditional methods. It helps to develop them further and to analyze the performance indicators in terms of other indicators in an objectively changing environment. The importance and advantages of mathematical methods and models are: they use material, labor and monetary resources rationally; serves as a leading tool in the development of economic and natural sciences; it will be possible to make some corrections during the compilation of predictions and their implementation; economic processes are not only analyzed in depth, but also their new unexplored laws and trends can be revealed; Facilitates the mechanization and automation of computational work, mental labor.

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