



## IQTISODIYOT & TARAQQIYOT

*Ijtimoiy, iqtisodiy, texnologik, ilmiy, ommabop jurnal*

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# APPLICATION OF EXTREME MODELS IN ASSESSING THE ECONOMIC POTENTIAL OF AN ENTERPRISE

**Musayeva Shoira Azimovna**  
Professor, Samarkand Institute of Economics and Service  
E-mail: [musaeva\\_shoira@mail.ru](mailto:musaeva_shoira@mail.ru)  
ORCID: 0009-0000-9577-6976

**Abstract.** This article examines the development of a comprehensive approach to assessing economic potential using an extreme value model. It focuses on maximizing net profit, which is influenced by production, financial, marketing, and other elements of economic potential, as well as on ways to increase the economic potential of a manufacturing enterprise.

**Keywords:** enterprise, market, competition, mechanism, model, factor, profit, resources.

**Annotatsiya.** Ushbu maqolada ekstremal qiymat modelidan foydalangan holda iqtisodiy salohiyatni baholashga kompleks yondashuvni ishlab chiqish masalalari ko'rib chiqiladi. Maqolada ishlab chiqarish, moliyaviy, marketing va iqtisodiy salohiyatning boshqa elementlari ta'sirida shakllanadigan sof foydani maksimal darajada oshirish hamda ishlab chiqarish korxonasining iqtisodiy salohiyatini oshirish yo'llari tahlil qilinadi.

**Kalit so'zlar:** korxonona, bozor, raqobat, mexanizm, model, omil, foyda, resurslar.

**Аннотация.** В данной статье рассматривается разработка комплексного подхода к оценке экономического потенциала с использованием экстремальной модели. Особое внимание уделяется максимизации чистой прибыли, которая формируется под влиянием производственных, финансовых, маркетинговых и других элементов экономического потенциала, а также путям повышения экономического потенциала производственного предприятия.

**Ключевые слова:** предприятие, рынок, конкуренция, механизм, модель, фактор, прибыль, ресурсы.

## INTRODUCTION

In our country, significant attention is being paid by the President and the government to improving market mechanisms, particularly the methodology for analyzing the economic potential of enterprises and economic sectors. Carpet weaving, as an object of economic research, represents not only an attractive area for business development but also a modern expression of distinctive national traditions with socio-cultural significance. The development of carpet weaving contributes to strengthening the competitiveness of light industry, as well as the textile and knitwear sectors, in the global market.

Assessing a company's economic potential is a key element of strategic planning, financial analysis, and management decision-making. In the context of growing competition and a rapidly changing economic environment, the development and application of optimization models that comprehensively consider production, labor, sales, and financial factors are becoming increasingly important.

## LITERATURE REVIEW

Based on international experience, it should be noted that the development of non-cash payments and the digitalization of the financial sector in Uzbekistan have been widely discussed in scientific research and analytical reviews in recent years.

The theoretical foundations and practical aspects of marketing development have been studied by many economists, including M. Porter, D. Evans, I. Ansoff, M. Berman, M. Golubkov, P. Samuelson, and A. Marshall.

It is also important to highlight scholars who have made significant contributions to the development of marketing theory in Uzbekistan. Over the years, research in the field of marketing in the country has been carried out with consideration of national characteristics. These scholars include Zh. Zaynalov, E. Shavkiev, M. Mukhammedov, M. Sharifkhodzhaeva, Sh. Ergashkhodzhaeva, Sh. Musaev, and others.



## RESEARCH METHODOLOGY

The study employed a systematic approach, marketing analysis, benchmarking, and digital metrics. Data were collected and analyzed using mass observation methods based on information obtained from social media platforms.

## ANALYSIS AND RESULTS

Optimization models for assessing economic potential make it possible to formalize a multicriteria problem and identify the most effective option for the development and utilization of an enterprise's resources. Classical optimization models are based on linear and nonlinear programming methods, the theory of system constraints, and modern modeling approaches, including:

- Mathematical programming: Objective functions are formulated, such as profit maximization or cost minimization, while constraints reflecting production, sales, financial, and resource limitations are incorporated into the model.
- Multifactor models: These models consider more than 20 factors affecting economic potential through the application of factor analysis and regression modeling techniques.
- Simulation and scenario modeling: These methods are used to evaluate the sustainability of economic potential under conditions of uncertainty, as highlighted in previous studies.
- Intelligent systems (AI and neural networks): Recent research has focused on the application of machine learning techniques to forecast changes in economic potential based on large volumes of production and financial data.

A review of the relevant literature reveals a wide variety of approaches to assessing an enterprise's economic potential. Researchers generally define economic potential as an integrated characteristic that reflects the combination of material, labor, financial, and other resources, as well as the enterprise's ability to utilize them effectively in both the current period and the long term.

The primary objective of the optimization model is to maximize the company's net profit. In other words, the model seeks to identify the optimal allocation of resources and sales planning strategy that generates the highest possible revenue from product sales while minimizing all associated costs.

Mathematically, the objective function can be expressed as follows:

$$\text{Maximize } Z = \sum_{i=1}^n (P_i - C_i - M_i - D_i) * Q_i$$

Where:

$Z$  — objective function (net profit);

$n$  — number of product names (or areas of activity);

$P_i$  — selling price of a unit of output;

$C_i$  — production cost per unit of output;

$M_i$  — marketing costs per unit of production;

$D_i$  — sales and logistics costs per unit of production;

$Q_i$  — volume of product sales.

Each term in the sum represents the net profit obtained from the sale of a specific product. It is calculated as the profit per unit of product multiplied by the corresponding sales volume. As a possible modification of the model, if taxes are considered, a tax coefficient may be included in the model:

$$(P_i - C_i - M_i - D_i) * Q_i * t$$

$$\text{Maximize } Z = (1 - t) \sum_{i=1}^n (P_i - C_i - M_i - D_i) * Q_i$$

Production factors characterize a company's capacity to manufacture products. These factors include constraints related to raw material availability, production equipment capacity, and the balance of the product mix.



One of the key factors influencing a company's production activities is the availability and accessibility of raw materials. Each product requires a specific quantity of different raw materials, the supply of which is limited both in absolute terms and by replenishment rates. To ensure the feasibility and realism of the production plan, constraints on raw material consumption must be incorporated into the model.

Mathematically, this condition can be expressed as follows:

$$\sum_{i=1}^n R_{ij} * Q_i \leq S_j + R_j^{upd}, \quad \forall j = 1, \dots, k$$

- $R_{ij}$  — standard consumption of raw materials of type  $j$  per unit of output  $i$ ;
- $Q_i$  — the planned volume of output of product type  $i$ ;
- $S_j$  — current stocks of raw materials  $j$ ;
- $R_j^{upd}$  — the volume of receipts of raw materials of type  $j$  during the planning period;
- $k$  — total number of types of raw materials;
- $n$  — the total number of product types.

The essence of this constraint is that production volumes cannot exceed the amount permitted by the available and incoming raw materials. Each unit of output requires a specific quantity of each type of raw material, and the total consumption across all product categories must not exceed the available stock.

Within a comprehensive model for assessing an enterprise's economic potential, equipment constraints can be represented by the limited operating time of production equipment. This approach makes it possible to consider not only the nominal production capacity of the equipment but also its actual utilization level and production workload.

Mathematically, this constraint can be formulated as follows:

$$\sum_{i=1}^n t_{ij} * Q_i \leq T_j^{avail}, \quad \forall j = 1, \dots, m$$

Where:

- $Q_i$  — the volume of manufactured products of type  $i$ ;
- $T_{ij}$  — the cost of machine time for the production of one unit of product  $i$  on equipment of type  $j$ ;
- $T_j^{avail}$  — the available operating time fund of equipment of type  $j$  for the billing period;
- $n$  — number of product types;
- $m$  — number of equipment types.

The economic significance of this constraint lies in ensuring that the planned equipment utilization corresponds to its actual production capacity. This prevents excessive workload allocation beyond permissible operating limits while taking into account work schedules, technical conditions, shift arrangements, and planned maintenance activities.

This approach makes the model more flexible and better aligned with the real operating conditions of production equipment, particularly in situations involving a diversified product portfolio and limited technological resources.

In a multiproduct manufacturing environment, maintaining a rational balance among the production volumes of different product groups is an important aspect of planning. Such a constraint helps ensure a stable production structure that is consistent with market demand, the company's strategic priorities, logistics requirements, and production capabilities.

To achieve this objective, a product mix constraint is introduced in the form of a proportional relationship between the output volumes of different product categories. Mathematically, this relationship can be expressed as follows:

$$\beta_{min} \leq \frac{Q_a}{Q_b} \leq \beta_{max}$$

Where:

–  $Q_a, Q_b$  — the volumes of production of products of types a and b, between which it is necessary to maintain a proportion;

–  $\beta_{min}, \beta_{max}$  — the lower and upper limits of the permissible ratio between the corresponding output volumes.

This condition ensures:

- balance of supply and demand within various product categories;
- maintaining competitive positions in each area;
- uniform loading of technological lines;
- alignment with corporate strategy (e.g. prioritizing the production of highly profitable or innovative products).

If the enterprise's product range includes more than two key groups, this constraint can be generalized to a system of proportional ratios, or replaced by a condition on the output structure using weighting coefficients:

$$\gamma_j^{min} Q_{total} \leq Q_i \leq \gamma_j^{max} Q_{total}, \quad \forall j=1, \dots, k$$

Where:

$Q_i$  — the volume of output of product i;

$Q_{total} = \sum_{i=1}^n Q_i$  — the total volume of all manufactured products;

$\gamma_j^{min}, \gamma_j^{max}$  – the minimum and maximum allowable share of product group (j) in total output;

$k$  – number of product groups;

This condition allows:

- control the structure of the production program;
- prevent imbalances between product lines;
- adhere to the marketing strategy (for example, maintain the premium segment at least 30%, but not more than 50%);
- flexibly scale the model as the number of products or product range changes.

Thus, the assortment constraint serves as a regulator of the production profile and contributes to the stability of both the operational and sales processes of the enterprise.

The enterprise's sales subsystem acts as a key link between the production system and the market. The effectiveness of finished product sales directly influences revenue, capital turnover, logistics costs, and, consequently, the overall economic potential of the enterprise.

The optimization model takes into account the following key constraints and parameters related to sales.

Finished product warehousing is an important element in the material flow chain from production to the final consumer. Limited warehouse capacity requires efficient inventory management, especially under conditions of changing demand, seasonal fluctuations, or possible delivery delays.

To formalize this constraint, the following mathematical relationship is used:

$$\sum_{i=1}^n Q_i V_i \leq W_{ready}$$



$Q_i$  — the volume of production (or output) of products of type  $i$  subject to storage;

$V_i$  — specific warehouse volume per unit of product of type  $i$  (in  $m^3$ ,  $m^2$ , pallet places, etc.);

$W_{ready}$  — total available warehouse capacity for storing finished products;

$n$  is the number of product types.

This constraint reflects the need to take into account the physical capacity limits of warehouse infrastructure. It helps prevent excessive production volumes that may result in inventory accumulation, product deterioration (particularly for perishable goods), increased storage costs, or the need to use alternative storage facilities.

For the sustainable operation of an enterprise, it is important not only to produce and sell products in a timely manner but also to maintain a minimum required level of inventory in the warehouse. Such inventory serves several important purposes, including:

- compensation for demand fluctuations;
- ensuring uninterrupted shipments;
- reservation of products for long-term contracts;
- reducing risks due to logistics disruptions.

From a mathematical point of view, the minimum stock condition is expressed as follows:

$$Q_i^{stock} \geq Z_i^{norm}, \quad \forall i = 1, \dots, n$$

$Q_i^{stock}$  — actual inventory volume of finished product type ( $i$ ) in the warehouse;

$Z_i^{norm}$  — standard (safety) inventory level for product ( $i$ );

$n$ — number of product types.

If the stock is formed due to the difference between the output of products and their sales in the current period, then:

$$Q_i^{prod} - Q_i^{sell} \geq Z_i^{norm}, \quad \forall i = 1, \dots, n$$

Where:

$Q_i^{prod}$ — volume of manufactured products;

$Q_i^{sell}$ — volume of shipped (sold) products;

This constraint ensures that the warehouse maintains a minimum safety stock level necessary for uninterrupted operations. Failure to maintain this reserve may result in lost sales opportunities due to product shortages, particularly during unexpected increases in demand or temporary logistics disruptions.

Financial constraints play a central role in the development of a realistic optimization model. They establish the boundaries within which an enterprise can conduct production, sales, investment, and marketing activities while maintaining financial stability and solvency.

An enterprise must preserve its ability to meet current financial obligations in a timely manner. Within the optimization model, this constraint serves as an indicator of financial sustainability, helping to prevent cash flow shortages and reduce financial risks. Even when gross profit levels are high, a company may face liquidity challenges if incoming cash flows are delayed or insufficient to cover current obligations. Therefore, the model should account for the relationship between cash inflows and cash outflows during the planning period.



Mathematical formalization:

$$\sum_{i=1}^n R_i^{in} - \sum_{j=1}^n R_j^{out} \geq L_{min}$$

Where:

$R_i^{in}$  — expected cash flow from source  $i$  (e.g. sales revenue, customer advances, subsidies, loans),  
 $i=1, \dots, n$ ;

$R_j^{out}$  — mandatory payments in direction  $j$  (for example, salary, taxes, rent, utility bills, debt servicing),  
 $j=1, \dots, m$ ;

$L_{min}$  — the minimum acceptable cash balance that ensures liquidity (specified in absolute terms or as a percentage of expenses).

The economic rationale behind the solvency equation is to ensure a stable cash position for an enterprise throughout the planning horizon. It reflects the requirement that the total amount of expected cash inflows—including sales revenue, loans, advance payments, and other sources of income—must be sufficient to cover all mandatory operating expenses, such as salaries, taxes, rent, utility payments, and purchases of raw materials and supplies. In addition, the enterprise should maintain a reserve equal to the minimum cash balance required to support financial stability.

Therefore, the solvency constraint is not merely a technical requirement; it represents a fundamental financial criterion that ensures all decisions generated by the optimization model are consistent with the enterprise's actual financial capacity and long-term sustainability.

$$L_{min}$$

Product profitability reflects the efficiency of producing and selling each type of product. It indicates the amount of profit generated per unit of resources invested. Within the optimization model, this constraint functions as a screening mechanism that excludes low-efficiency or economically unattractive products from the production program.

Even when a particular product is technically feasible to manufacture and has market demand, its production may not align with the company's financial objectives if its profitability falls below the established minimum threshold. Therefore, incorporating a profitability constraint helps ensure the economic efficiency and financial sustainability of the overall production program.

Formal definition of profitability per unit of output

For each position  $i=1,2,\dots,n$  the profitability is calculated as:

$$Rent_i = \frac{P_i - C_i - M_i - D_i}{C_i + M_i + D_i}$$

Where:

- $Rent_i$  — profitability of product  $i$ ;
- $P_i$  — selling price of a unit of output;
- $C_i$  — production cost per unit of output;
- $M_i$  — marketing costs per unit of production;
- $D_i$  — sales and logistics costs per unit of production;

Mathematical formalization of the constraint:



$$Rent_i \geq Rent_i^{min}, \text{ Where } \forall i \in S$$

$Rent_i^{min}$  minimum required rate of profitability for product (i);

$S$  – a subset of products to which profitability control applies (possibly not to all types).

The practical significance of this constraint lies in excluding unprofitable or low-efficiency products from the production program, ensuring a minimum acceptable level of profitability in the use of production capacity, and simplifying product mix decisions by focusing only on products that generate sufficient profit.

A possible extension of the model is the use of the weighted average profitability of finished products:

$$\frac{\sum_{i=1}^n ((P_i - C_i - M_i - D_i) * Q_i)}{(\sum_{i=1}^n (C_i + M_i + D_i) * Q_i)} \geq R^{avg-min}$$

Where is the acceptable minimum weighted average profitability for the entire product range.  $R^{avg-min}$

The profitability constraint transforms the model from a simple profit-maximization tool into a mechanism for selecting a production structure that meets the required level of economic efficiency.

Thus, the combination of the proposed constraints forms a realistic model that reflects the key resources, capabilities, and operational limitations of an enterprise. The model provides both a mathematical foundation and practical applicability for strategic planning and the optimization of production and sales programs.

The developed model enables the integration of strategic and operational indicators within a unified mathematical framework. It can be implemented using Excel, Python (with libraries such as PuLP, Pyomo, and Gurobi), R (with the LPSolve package), or specialized optimization software. This approach provides a flexible and quantitatively robust assessment of an enterprise's economic potential while supporting informed and effective optimization decisions.

## CONCLUSION AND RECOMMENDATIONS

One of the scientific results of this research is the development of a comprehensive approach to assessing economic potential using an extreme value model. The objective function of the model is the maximization of net profit, which is determined by production, financial, marketing, and other elements of economic potential. The application of this model makes it possible to identify effective ways to increase the economic potential of a manufacturing enterprise.

In general, the conducted research confirms the necessity and practical relevance of applying econometric methods in the process of analyzing economic potential and identifying reserves for its further growth.

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## IQTISODIYOT & TARAQQIYOT

*Ijtimoiy, iqtisodiy, texnologik, ilmiy, ommabop jurnal*

**Ingliz tili muharriri:** Feruz HAKIMOV

**Musahhih:** Zokir ALIBEKOV

**Sahifalovchi va dizayner:** Hasan MAQSUDOV

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