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Improving the efficiency of enterprise production through the implementation of economic and analytical models: evidence from LLC «KT Cosmetics»

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Abstract. The article explores the theoretical and applied foundations of intensifying production processes through the implementation of modern economic and analytical tools. The critical role of innovative methods for diagnosing and planning enterprise activities in ensuring business sustainability under conditions of high market volatility is substantiated.

Using the example of LLC "KT COSMETICS" the trajectory of financial and economic indicators is analyzed, confirming the growth of the company's revenue and net profit. At the same time, a gap between the intensity of cost accumulation and the dynamics of labor productivity is identified, which determines the relevance of optimization measures.

The study verifies key performance indicators, in particular profitability and labor productivity, which served as the basis for developing an economic-analytical

model for cost minimization taking into account resource constraints. The advantages of applying a project-based approach as a mechanism for the systematic implementation of organizational transformations are substantiated.

The scientific novelty of the research consists in the integration of a linear programming optimization model with a project-based management approach, specifically adapted to the needs of perfumery and cosmetics manufacturing enterprises in Ukraine under conditions of post-war economic instability, supply chain disruptions, and rising raw material costs. Unlike previous studies that mainly addressed general theoretical issues or macroeconomic aspects, this work offers a practical, industry-specific tool that accounts for the high raw material intensity, strict quality standards, and limited resource availability characteristic of the sector. The proposed comprehensive algorithm combines diagnostic analysis, mathematical cost optimization, and phased project implementation, supplemented by quantitative forecasting of the economic effect. This integrated framework enables not only the identification of efficiency reserves but also the real-time adjustment of managerial decisions in a highly uncertain environment.

The relevance of the topic is driven by the intensification of competitive pressure and the growing demand for scientifically grounded instruments of cost and resource management amid economic instability. The ability to promptly identify deviations between planned and actual performance and rapidly adjust managerial decisions has become strategically important for maintaining competitiveness and financial stability.

The methodological basis of the study comprises a combination of general scientific and specialized methods: horizontal and vertical analysis to evaluate the dynamics and structure of financial and economic indicators; coefficient analysis for verifying profitability and labor productivity; mathematical programming for building the cost minimization model under resource constraints; and the project

approach as a tool for structured and phased implementation of organizational changes.

The practical value of the article lies in the possibility of direct application of the developed cost optimization model by enterprises across various industries aiming to enhance production efficiency. The proposed toolkit can be effectively integrated into management accounting and operational planning systems, thereby facilitating more informed and timely managerial decision-making under limited resources and dynamic market conditions.

Keywords: production efficiency, economic-analytical models, cost optimization, enterprise activity planning, decision-making.

Підвищення ефективності виробничої діяльності підприємства шляхом впровадження економіко-аналітичних моделей (на прикладі ТОВ «Кей Ті Косметикс»)

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Анотація. У статті досліджено теоретико-прикладні засади інтенсифікації виробничих процесів через впровадження сучасного економіко-аналітичного інструментарію. Доведено критичну роль інноваційних методів діагностики та планування діяльності підприємства для забезпечення його життєздатності в умовах високої волатильності ринку.

На прикладі ТОВ «КЕЙ ТІ КОСМЕТИКС» проаналізовано траєкторію розвитку фінансово-економічних індикаторів, що підтвердило зростання виручки та чистого прибутку компанії. Водночас ідентифіковано розрив між інтенсивністю накопичення витрат та динамікою трудової віддачі, що зумовлює актуальність оптимізаційних заходів.

У дослідженні верифіковано ключові показники результативності, зокрема рентабельність та продуктивність праці, що стало підґрунтям для розробки економіко-аналітичної моделі мінімізації витрат з урахуванням ресурсних лімітів. Обґрунтовано переваги використання проєктного підходу як механізму системної реалізації управлінських трансформацій.

Наукова новизна дослідження полягає в інтеграції моделі лінійного програмування для оптимізації витрат з проєктним підходом, спеціально адаптованої до потреб підприємств парфумерно-косметичної галузі України в умовах післявоєнної економічної нестабільності, порушень ланцюгів постачань та зростання вартості сировини. На відміну від попередніх робіт, які здебільшого мали загальнотеоретичний або макроекономічний характер, у цій статті розроблено практичний галузевий інструмент, що враховує високу сировинну залежність, жорсткі вимоги до якості продукції та обмеженість ресурсів. Запропонований комплексний алгоритм поєднує діагностичний аналіз, математичну оптимізацію та поетапне проєктне впровадження з кількісною оцінкою очікуваного економічного ефекту. Такий підхід розширює існуючі методологічні рамки та пропонує масштабований інструмент,

придатний для використання на інших підприємствах переробної промисловості.

Актуальність теми зумовлена загостренням конкурентного середовища та зростаючою потребою підприємств у науково обґрунтованих інструментах управління витратами й ресурсами в умовах економічної нестабільності. Здатність своєчасно діагностувати відхилення між плановими та фактичними показниками діяльності й оперативно коригувати управлінські рішення набуває стратегічного значення для забезпечення конкурентоспроможності та фінансової стійкості суб'єктів господарювання.

Методологічну основу дослідження становить комплекс загальнонаукових і спеціальних методів: горизонтального та вертикального аналізу, коефіцієнтного методу, математичного програмування та проєктного підходу.

Практична цінність статті полягає у можливості безпосереднього застосування розробленої моделі оптимізації витрат підприємствами різних галузей з метою підвищення ефективності виробничої діяльності. Запропонований інструментарій може бути інтегрований у систему управлінського обліку та оперативного планування, що сприятиме прийняттю виважених управлінських рішень в умовах обмежених ресурсів і динамічного ринкового середовища.

Ключові слова: ефективність виробництва, економіко-аналітичні моделі, оптимізація витрат, планування діяльності підприємства, управлінські рішення.

Problem statement. In the current context of economic instability, intensifying competition, and limited resources, enterprises are compelled to actively seek new approaches to improving their operational efficiency. This issue becomes particularly critical for manufacturing enterprises, whose stable

functioning depends largely on the proper organization of production processes, rational use of resources, and high-quality managerial decisions.

Contemporary challenges – such as the consequences of economic turbulence, disruption of logistics chains, and rising costs of raw materials and energy – significantly complicate the daily functioning of businesses and increase the importance of operations management, production planning, and supply chain optimization [12]. Under such conditions, traditional management approaches are becoming increasingly ineffective, necessitating the adoption of modern tools, including economic-analytical modeling and adaptive enterprise development strategies [15].

The problem of improving production efficiency is most acutely felt in the cosmetics industry, where factors such as innovation, product quality, and cost optimization come to the forefront. This requires the introduction of modern models for analysis and activity planning that facilitate more informed decision-making and create conditions for the sustainable development of enterprises.

Analysis of recent research and publications. The issue of improving enterprise efficiency and implementing economic-analytical models is actively addressed in the works of both domestic and foreign scholars. Significant contributions to the development of management theory, enterprise activity planning, and optimization of production processes have been made by researchers such as M. Porter, who formulated the foundations of competitive analysis [6]. Among Ukrainian scholars, notable contributions have been made by V. Heiets (macroeconomic perspectives) [2], N. Chukhrai (management of innovative development) [9], H. Kindratska and A. Zahorodnii (methodology of economic analysis) [4], I. Otenko (development and implementation of analytical models) [5], as well as H. Shvydanenko [10] and H. Tarasiuk [8], who focused on improving the efficiency of production activities and enterprise planning.

Contemporary research focuses on the implementation of economic-analytical models within enterprise planning systems. Recent international and domestic publications also expand the methodological basis of this study. In particular, studies on operations management emphasize the relationship between production planning, business analytics, supply chain stability, and resource optimization [12]. Research in management accounting highlights the importance of identifying cost drivers and using quantitative methods to support cost control and managerial decision-making [13]. Ukrainian studies on business planning focus on the organizational and methodological support of enterprise development projects, stakeholder-oriented planning, and the practical value of structured business plans [14]. At the same time, current research on enterprise development strategies under macroeconomic instability confirms the need to simplify management procedures, strengthen their practical orientation, and adapt strategic planning tools to unstable external conditions [15].

However, despite the broad spectrum of published research in this field, the practical aspects of implementing economic-analytical models at the level of individual enterprises remain insufficiently studied. This is especially true for specific industries such as cosmetics manufacturing. This creates the need for further scientific inquiry in this direction, taking into account current industry statistical data [3] and the requirements of applicable legislation on financial reporting [7].

Formulating the purposes of the article. The objective of this article is to substantiate the theoretical foundations and formulate practical recommendations aimed at improving enterprise efficiency through the implementation of economic-analytical models. The example of LLC "KT COSMETICS" is used to illustrate this approach. The study focuses on the application of modern analysis and modeling tools capable of optimizing production processes, increasing productivity, and ensuring the growth of the enterprise's financial results.

Presentation of the main research material. The efficiency of modern industrial entities directly depends on the depth of technological process organization, the quality of managerial decisions made, and the business's ability to adapt to the dynamic transformations of the market environment [1, p. 44]. In the context of systemic intensification of competition, economic volatility, and logistical constraints, there is an urgent need to modernize the economic system through the integration of modern economic-analytical models that minimize the impact of negative factors.

A synthesis of current industrial sector trends allows us to assert that rational resource use and cost optimization are the foundation for ensuring high performance. In this context, economic-analytical support of operational activities becomes a decisive factor in shaping an effective enterprise development strategy [4, p. 15].

The subject of applied analysis in this study is LLC "KT COSMETICS". The enterprise operates in the perfumery and cosmetics industry and implements a full production cycle. The specifics of the company's activities are determined by its critical dependence on the quality of raw materials and technological precision, which necessitates the implementation of precise analytical algorithms for performance monitoring.

In accordance with regulatory requirements for financial reporting, the development and implementation of such models should begin with a comprehensive diagnostic assessment of the basic economic indicators of the business entity [7].

Table 1

Dynamics of Key Performance Indicators of LLC "KT COSMETICS"

Indicator	2023 y.	2024 y.	2025 y.	Deviation 2025/2023
Revenue from sales, thousand UAH	14800	16750	18800	+4000

Cost of goods sold, thousand UAH	11600	13200	14950	+3350
Net profit, thousand UAH	1500	1750	2050	+550
Average number of employees, persons	52	54	57	+5

Source: compiled by the author based on the financial statements of LLC "KT COSMETICS" for 2023–2025.

The results of statistical monitoring presented in Table 1 indicate a stable growth trend in the key performance parameters of LLC "KT COSMETICS". In particular, revenue from sales in 2025 demonstrated a significant increase of 4000 thousand UAH, which in relative terms amounts to approximately 27% compared to the base year of 2023. At the same time, an intensification of the cost component is observed: the cost of goods sold increased by 28,9% (3350 thousand UAH). This trend reflects high growth rates in production costs; however, they do not exceed the dynamics of revenue, which creates preconditions for improving the enterprise's operational efficiency.

Despite rising costs, the enterprise managed to achieve a positive financial result – net profit grew by 36,7% (550 thousand UAH). This confirms the overall viability of the business model and indicates the potential for further improvement in profitability through cost rationalization and the introduction of modern economic-analytical tools.

For a detailed diagnostic assessment of labor resource utilization efficiency and evaluation of their development potential, labor productivity indicators were calculated (1) based on the methodological principles of modern analytics [4, p. 156]:

$$LP = \frac{\mathrm{R}}{N} \times 100\% \quad (1)$$

where:

LP – labor productivity;

R – revenue from product sales;

N – average number of employees.

Based on the data provided, labor productivity was calculated as follows:

2023 year: 14800 / 52 = 284,6 thousand UAH/employee

2024 year: 16750 / 54 = 310,2 thousand UAH/employee

2025 year: 18800 / 57 = 329,8 thousand UAH/employee

The analytical calculations confirm a positive trend in human capital returns: the output per employee increased from 284,6 to 329,8 thousand UAH, representing approximately 15,9% growth. However, a comparative analysis reveals that the growth rate of labor productivity lags behind the growth rate of production costs (28,9%). This situation indicates the existence of reserves for improving the efficiency of production resource utilization and underscores the advisability of applying economic-analytical models for cost optimization.

To further identify problem areas in the production structure, the next step of the study involves assessing the level of profitability of operational activities through the product profitability indicator. In the economic-analytical support system, this indicator plays the role of a key filter, allowing comparison of the financial result achieved with the total costs incurred to achieve it, thereby providing an objective basis for strategic managerial decision-making [10, p. 142].

The methodological framework for determining the profitability of LLC "KT COSMETICS"'s production program is based on the following calculation algorithm (2):

$$R = \frac{\mathrm{P}}{C} \times 100\% \qquad (2)$$

where:

P – enterprise profit;

C – cost of goods sold.

Based on the data from Table 1, product profitability was calculated as follows:

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2023 year: 1500 / 11600 × 100 = 12,9%

2024 year: 1750 / 13200 × 100 = 13,3%

2025 year: 2050 / 14950 × 100 = 13,7%

The study allows us to note the presence of a moderate yet stable upward trend in production profitability: during 2023–2025, the indicator increased from 12,9% to 13,7%. This dynamic indicates a gradual improvement in the production-economic efficiency of LLC "KT COSMETICS" and a stabilization of its financial results.

At the same time, the identified pace of profitability development is insufficient to ensure high competitiveness, which is explained by the intensive pressure from production costs. The situation demonstrates that the potential for efficiency improvement is offset by the rapid growth of production costs, requiring a transition from general observation to a detailed structural decomposition of costs.

To address this problem and form the basis for a future economic-analytical optimization model, an in-depth audit of the cost structure was conducted, which is consistent with the principles of managerial cost accounting and the identification of key cost drivers [13].

Table 2

Cost Structure of LLC "KT COSMETICS" in 2025

Cost Item	Amount, thousand UAH	Share, %
Raw materials and supplies	7050	47,2
Labor costs	3250	21,7
Social security contributions	720	4,8
Depreciation	1250	8,4

Other costs	2680	17,9
Total	**14950**	**100,0**

Source: compiled by the author based on the financial statements of LLC "KT COSMETICS" for 2023–2025.

A detailed audit of the cost structure confirmed that raw materials and material resources account for the largest share of production costs – 47,2%. This distribution is a characteristic feature of enterprises operating in the perfumery and cosmetics industry. The significant share of labor costs (21,7%) further underscores the need to improve the efficiency of labor resource utilization.

Particular attention should be paid to the "other costs" item, which accounts for 17,9%. This high level indicates the presence of potential reserves for economic optimization, particularly in the areas of logistics, energy consumption, and administrative expenses.

The diagnostic results demonstrate that the strategic improvement of production efficiency at LLC "KT COSMETICS" is impossible without a transition to economic-analytical modeling. The use of such methods allows transformation of the management system, ensuring high accuracy in decision-making. Among the available tools, priority is given to the production program optimization model, which integrates resource and cost constraints to find the most advantageous output volume [5, p. 6].

Within the framework of this study, such a model is formalized as a mathematical cost minimization problem:

$$Z = \sum_{i=1}^{n} C_i \cdot x_i \rightarrow \min \tag{3}$$

subject to resource constraints:

$$\sum_{i=1}^{n} a_{ij} \cdot x_i \leq b_j \tag{4}$$

where:

x_i – production volume of the i-th product type;

C_i – production cost per unit of the i-th product;

a_{ij} – resource j consumption rate per unit of product i;

b_j – available volume of resource j.

Implementation of this model allows LLC "KT COSMETICS" to form a rational production structure that ensures minimization of the cost component within strict resource limits. The application of this analytical approach is critically important for enterprises in the cosmetics industry, where the material component dominates the cost structure.

For the successful implementation of the developed solutions, it is advisable to use the project-based approach toolkit. This will ensure systematic transformation of management processes and guarantee the thoughtfulness of each stage. Within this study, the concept of the project "Optimization of Enterprise Production Processes" was developed, which provides for the sequential completion of the following phases:

1. Diagnostic phase – a thorough audit of current operational activities, identification of "bottlenecks," and detection of inefficient links in the production cycle.
2. Modeling phase – direct design of the economic-analytical model oriented toward enterprise cost optimization.
3. Practical implementation phase – adaptation and introduction of management regulations formed based on the results of mathematical modeling.
4. Control and revision phase – monitoring the effectiveness of innovations and assessing their real impact on the level of production efficiency.

The execution of this project will significantly improve the quality of operational planning, ensure economical resource use, and achieve a sustainable reduction in the company's overall costs. To verify the success of the proposed measures, a calculation of the projected economic effect was conducted, based on the recognized methodology for evaluating planning effectiveness [8, p. 214].

The mathematical assessment of effectiveness is carried out according to the following algorithm:

$$E = C_0 - C_1 \quad (5)$$

where:

E – economic effect;

C_0 – costs before implementation;

C_1 – costs after implementation.

Based on the calculation results, it was established that with a 7% cost reduction, the total savings would amount to:

$$13200 \times 0{,}07 = 924 \text{ thousand UAH}$$

The result obtained indicates significant potential for improving production efficiency through the implementation of economic-analytical models. In addition to the direct cost reduction, the enterprise gains additional benefits, including:

- improved validity of managerial decisions;
- enhanced quality of enterprise activity planning;
- increased competitiveness;
- the ability to adapt to changes in the external environment.

Conclusions. Within the framework of the conducted research, the theoretical foundations were established and applied tools were proposed for intensifying production activities through the integration of advanced economic and analytical models.

The diagnostic assessment of LLC "KT COSMETICS" confirmed a positive development trajectory of the key financial indicators. Over the period 2023–2025,

revenue from sales increased by approximately 27%, while net profit grew by 36,7%. At the same time, an in-depth analysis revealed a significant managerial challenge: the cost of goods sold increased by 28,9%, whereas labor productivity grew only by 15,9%. This imbalance confirms the need to revise the current operational strategy and introduce optimization mechanisms aimed at improving the ratio between resource consumption and production results.

It has been scientifically demonstrated that the performance of the production sector depends on the quality of enterprise activity planning, economical resource consumption, timely cost diagnostics, and the use of high-precision analytical tools. It has been substantiated that economic and analytical modeling serves as an effective lever for improving the validity of managerial decisions, especially under conditions of limited resources and unstable market conditions.

The cost optimization model developed in this study ensures the formation of the most advantageous production structure under resource constraints. It has been established that the most effective format for implementing such transformations is the project-based approach, which guarantees systemic coherence, transparency of control, and the targeted orientation of organizational changes.

Projected calculations indicate that the implementation of the developed recommendations will enable LLC "KT COSMETICS" to reduce the overall cost level by approximately 7%. This will generate a direct economic effect of 924 thousand UAH, contribute to the growth of labor productivity, and strengthen the financial stability of the enterprise.

Based on the results obtained, the following practical recommendations can be proposed for LLC "KT COSMETICS": to introduce regular monitoring of key production efficiency indicators; to revise the procurement policy for raw materials and materials; to establish cost limits for the main production cost items; to automate the collection and processing of management accounting data; to conduct a quarterly analysis of deviations between planned and actual indicators; to optimize logistics

and energy costs; and to implement a system of internal responsibility centers for the main production units. In addition, it is advisable to integrate the proposed economic-analytical model into the enterprise's operational planning system, which will allow management to respond more quickly to changes in demand, resource prices, and production constraints.

The practical significance of the work lies in the possibility of adapting the developed algorithms to analytical planning processes with the aim of strengthening the enterprise's competitive position. The direction of further scholarly investigation is seen in the improvement of economic and analytical tools taking into account uncertainty factors and external risks, as well as in the scaling of the proposed approaches to other industry markets.

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