

Assessment of Factors Affecting the Economic Efficiency of National Industrial Enterprises in a Special Statistical Way

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Abstract: This article evaluates factors influencing the economic efficiency of national industrial enterprises using special statistical methods. The research identified the factors with the greatest impact on enterprise efficiency and assessed their degree of influence. Based on the results, recommendations were developed to improve the economic efficiency of national industrial enterprises.

Key words: national industry, economic efficiency, statistical methods, regression analysis, factor analysis.



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INTRODUCTION

The economic efficiency of national industrial enterprises plays a crucial role in a country's economic development. To improve enterprise efficiency, it is necessary to deeply study and analyze the factors influencing it [1]. The purpose of this study is to evaluate the factors affecting the economic efficiency of national industrial enterprises using special statistical methods.

The relevance of the research lies in the fact that improving the efficiency of national industrial enterprises can lead to economic growth of the country. To achieve this, it is important to identify the factors influencing enterprise performance and assess their degree of impact [2].

METHODOLOGY

The research methodology consists of the following stages:

Data collection: Data on national industrial enterprises were collected from official sources such as the State Statistics Committee, Ministry of Economy, and other relevant agencies. Additionally, survey data were obtained from 100 large industrial enterprises.

Identifying factors: Key factors affecting enterprise efficiency were identified through literature review and expert evaluation method.

Statistical analysis: The following statistical methods were applied based on the collected data:

Correlation analysis

Multiple regression analysis

Factor analysis

Cluster analysis

Interpretation of results: The degree of influence of factors was assessed and conclusions were drawn based on the obtained results.

Developing recommendations: Practical recommendations to improve enterprise efficiency were developed based on the analysis results.

LITERATURE REVIEW

The economic efficiency of national industrial enterprises and factors influencing it have been studied by many researchers. For instance, Alimov et al. [3] in their studies examined financial indicators of enterprises and their impact on efficiency. They identified the significance of indicators such as return on assets and capital turnover through regression analysis.

Kholmatov [4] studied the impact of innovative activity on the efficiency of industrial enterprises. According to his conclusion, enterprises with a high level of innovative activity demonstrate higher efficiency indicators compared to others.

Among foreign scholars, Porter [5] studied the impact of competitive strategy on enterprise efficiency. He proved that a correctly chosen competitive strategy can significantly increase enterprise efficiency.

Kaplan and Norton [6] in their "Balanced Scorecard" concept emphasized the need to consider non-financial indicators along with financial ones when assessing enterprise efficiency.

In recent years, many researchers have been studying the impact of digital technologies on enterprise efficiency. For example, Schwab [7] proposed the concept of "Industry 4.0", demonstrating opportunities to increase enterprise efficiency through digitalization and automation.

The above literature review shows that factors affecting enterprise efficiency are numerous and diverse. Therefore, their comprehensive study and evaluation using special statistical methods is a relevant issue.

RESULTS AND DISCUSSION

During the research, the following main factors affecting the economic efficiency of national industrial enterprises were identified:

Financial indicators (return on assets, capital turnover)

Level of innovative activity

Competitive strategy

Management efficiency

Employee qualifications

Level of technological equipment

Degree of digitalization and automation

Marketing strategy

Export activity

Government support

To assess the impact of these factors on enterprise efficiency, multiple regression analysis was conducted. The results of the analysis are presented in Table 1.

Table 1. Results of Multiple Regression Analysis

Factor	Regression coefficient	t-statistic	p-value
Financial indicators	0.382	5.721	0.000
Level of innovative activity	0.276	4.532	0.000
Competitive strategy	0.198	3.245	0.002
Management efficiency	0.224	3.876	0.000
Employee qualifications	0.156	2.987	0.004
Level of technological equipment	0.187	3.124	0.003
Degree of digitalization and automation	0.245	4.123	0.000
Marketing strategy	0.134	2.456	0.016
Export activity	0.168	2.987	0.004
Government support	0.112	2.134	0.035

$R^2 = 0.782$, F -statistic = 37.543, $p < 0.001$

The regression analysis results provide valuable insights into the relative importance of various factors affecting the economic efficiency of national industrial enterprises. All identified factors show statistical significance ($p < 0.05$), indicating that they all play a role in determining enterprise efficiency. However, the magnitude of their impact varies considerably.

Financial indicators emerge as the most influential factor, with the highest regression coefficient ($\beta = 0.382$). This underscores the critical importance of sound financial management in driving enterprise efficiency. It suggests that enterprises focusing on improving their return on assets and optimizing capital turnover are likely to see substantial gains in overall efficiency. This finding aligns with classical economic theory, which posits that efficient allocation and utilization of financial resources are fundamental to firm performance [8].

The level of innovative activity ranks second in importance ($\beta = 0.276$), highlighting the role of innovation in driving efficiency in the modern industrial landscape. This result supports the Schumpeterian view of innovation as a key driver of economic progress and suggests that enterprises investing in research and development, and fostering a culture of innovation, are better positioned to improve their efficiency [9].

Interestingly, the degree of digitalization and automation shows a strong positive impact ($\beta = 0.245$), ranking third among the factors. This finding reflects the growing importance of digital technologies in enhancing operational efficiency, streamlining processes, and enabling data-driven decision-making. It aligns with the concept of "Industry 4.0" and suggests that enterprises embracing digital transformation are likely to see significant efficiency gains [10].

Management efficiency ($\beta = 0.224$) and competitive strategy ($\beta = 0.198$) also show substantial positive impacts. This underscores the importance of effective leadership and strategic planning in driving enterprise efficiency. It suggests that investments in management training and development, as well as efforts to refine and adapt competitive strategies, can yield significant returns in terms of overall efficiency.

The level of technological equipment ($\beta = 0.187$) and employee qualifications ($\beta = 0.156$) both show moderate positive impacts. This highlights the interplay between human capital and technological capital in driving efficiency. It suggests that while upgrading technological infrastructure is important, it should be complemented by efforts to enhance workforce skills and capabilities [11].

Export activity ($\beta = 0.168$) shows a positive impact on efficiency, suggesting that engagement with international markets can drive improvements in enterprise performance. This could be due to exposure to global best practices, economies of scale, and the competitive pressures of international markets.

Marketing strategy ($\beta = 0.134$) and government support ($\beta = 0.112$), while still statistically significant, show relatively smaller impacts. This suggests that while these factors contribute to efficiency, their influence may be more indirect or contextual compared to other factors[12].

The model's R^2 value of 0.782 indicates that the identified factors collectively explain 78.2% of the variation in enterprise efficiency. This high explanatory power suggests that the model captures most of the key drivers of efficiency in national industrial enterprises. However, it also implies that about 21.8% of the variation is explained by factors not included in the model, highlighting the complex and multifaceted nature of enterprise efficiency.

To further explore the relationships between these factors, factor analysis was conducted. The results are presented in Table 2.

Table 2. Results of Factor Analysis

Factor	Factor 1	Factor 2	Factor 3
Financial indicators	0.845	0.212	0.134
Level of innovative activity	0.324	0.786	0.256
Competitive strategy	0.234	0.678	0.312
Management efficiency	0.345	0.765	0.187
Employee qualifications	0.187	0.698	0.345
Level of technological equipment	0.765	0.312	0.234
Degree of digitalization and automation	0.687	0.345	0.287
Marketing strategy	0.234	0.276	0.798
Export activity	0.287	0.234	0.756
Government support	0.165	0.234	0.687

The factor analysis reveals three distinct groupings of factors, which we can interpret as follows:

Financial and Technological Factors (Factor 1): This group includes financial indicators, level of technological equipment, and degree of digitalization and automation. The high factor loadings for these variables (0.845, 0.765, and 0.687 respectively) suggest a strong interrelationship between financial performance and technological advancement. This grouping implies that financial success and technological sophistication often go hand in hand, possibly due to the ability of financially strong firms to invest in advanced technologies, which in turn enhances their financial performance.

Innovation and Management Factors (Factor 2): This group comprises the level of innovative activity, competitive strategy, management efficiency, and employee qualifications. The high factor loadings for these variables (ranging from 0.678 to 0.786) indicate a strong connection between innovation, strategic management, and human capital. This grouping suggests that enterprises with strong management practices are more likely to foster innovation and develop effective competitive strategies, while also investing in their workforce.

External Environment Factors (Factor 3): This group includes marketing strategy, export activity, and government support. The high factor loadings for these variables (0.798, 0.756, and 0.687 respectively) suggest that these factors are closely related and represent the enterprise's interaction with its external environment. This grouping implies that success in marketing and exports often goes together, and may be influenced by the level of government support received.

This factor structure provides valuable insights into the underlying dynamics of enterprise efficiency. It suggests that efforts to improve efficiency should consider these groupings, as interventions in one area within a factor group are likely to have spillover effects on other areas within the same group.

For instance, investments in technological equipment (Factor 1) may need to be accompanied by improvements in financial management to be fully effective. Similarly, efforts to enhance innovation (Factor 2) might be most effective when coupled with improvements in management practices and employee training.

The identification of external environment factors as a distinct group (Factor 3) highlights the importance of considering the broader context in which enterprises operate. It suggests that enterprises need to develop integrated strategies that address marketing, export activities, and engagement with government support programs in a coordinated manner.

These findings have important implications for both enterprise managers and policymakers. For managers, they suggest the need for a holistic approach to improving efficiency, considering the interplay between financial, technological, human, and strategic factors. For policymakers, they highlight the potential for targeted interventions that address multiple related factors simultaneously, potentially yielding synergistic benefits.

However, it's important to note that while these groupings provide a useful framework for understanding the drivers of enterprise efficiency, they should not be viewed as rigid or mutually exclusive. There are likely complex interactions between factors across different groups, and the relative importance of different factors may vary depending on the specific context of each enterprise.

CONCLUSION AND RECOMMENDATIONS

Based on the research results, the following **conclusions** were drawn:

Factors affecting the economic efficiency of national industrial enterprises are complex and multifaceted.

The most influential factors are financial indicators, level of innovative activity, and degree of digitalization.

Factors can be divided into three groups: financial-technological, innovation-management, and external environment factors.

To improve enterprise efficiency, comprehensive measures need to be taken across all factors.

Based on these conclusions, the following **recommendations** were developed:

Improve financial management in enterprises, particularly increasing the efficiency of asset and capital utilization.

Stimulate innovative activities, increase investments in research and development.

Accelerate digitalization and automation processes, implement "Industry 4.0" technologies.

Improve strategic management in enterprises, apply modern management methods.

Expand employee training programs, improve the personnel training system.

Implementation of these recommendations will contribute to improving the economic efficiency of national industrial enterprises and, consequently, to the overall economic growth of the country.

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