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METHODS OF ASSESSING THE ECONOMIC EFFICIENCY OF THE INDUSTRIAL SECTOR AND THEIR IMPROVEMENT

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A B S T R A C T

This article examines in detail the economic efficiency indicators of the industrial sector and their calculation methods. Using existing methods, their improved methods and boundary criteria are proposed. Also, based on these methods, the economic efficiency of the industrial sector's resources is assessed and analyzed. In addition, proposals are developed to improve the economic efficiency of the industrial sector.

K E Y W O R D S

Industry, efficiency, economic efficiency of the industrial sector, evaluation methods, evaluation criteria.

Introduction

In the current global crisis and geopolitical situation, there is a decrease in the level of economic and technological efficiency in the industrial sector, in particular, a decrease in the efficiency of labor and other economic resources in the sector. However, increasing efficiency in industrial production has always been a key indicator of the long-term well-being and development opportunities of societies. In particular, the share of industrial products in GDP is 24.4 percent in Germany, 25.2 percent in Poland, 20.7 percent in Switzerland, 20.4 percent in Italy, 28.6 percent in Kazakhstan [8] and 26.7 percent in Uzbekistan, as well as 32 percent of total employment in China, 27 percent in Germany and Italy, 24 percent in Japan, 22 percent in Kazakhstan and 13.5 percent in Uzbekistan [9].

Therefore, in recent years, our country has been implementing intensive reforms to effectively use and further develop the existing potential of the industry, modernize industrial production and diversify products, digitize processes, increase investment attractiveness, and increase the efficiency of the sector based on the effective use of existing factors in order to achieve sustainable economic development, improve the living standards of the population, and increase the share of industry in providing employment.

In Uzbekistan, within the framework of the “Uzbekistan-2030” strategy, such important tasks as “Development of “driver” industries and full utilization of the industrial potential of the regions, bringing the value added in the industry to 45 billion dollars and creating 2.5 million high-income jobs, increasing the share of technological products produced in the industry from 25 to 32 percent, and doubling labor productivity in the processing industry” have been set [1]. In order to ensure the

effective implementation of these tasks, it is necessary to conduct a deep analysis of the existing industrial potential in our country, ensure its effective use and further sustainable development, select the factors affecting it and economically assess its condition, as well as develop scientifically based proposals and practical recommendations by developing forecast indicators for the future. This reflects the relevance of the topic of this research.

Analysis of literature on the topic

The study of the level of development of industrial sectors over a certain period of time allows us to assess their resilience to external influences and to identify those sectors that have achieved economic growth and continue to develop in difficult conditions [2]. At the same time, the assessment based on efficiency indicators expresses the relationship between “inputs” and “outputs” of the sector's activities. It also helps to better understand how resources are allocated and used for various products [3]. In addition, the assessment of the efficiency of industrial production is useful for the effective organization of material and labor resources, as well as time-saving measures [4].

According to M. Mojaverian, economic growth in each sector requires an increase in the volume of production in this sector. According to the theories of production and supply, production can be increased in two ways: first, by increasing production by using more factors of production, and second, by using advanced technologies and using factors of production efficiently [5].

In our opinion, it is precisely in the conditions of today's uncertainty and market economy that it is appropriate to increase production volumes based on the "second theory" mentioned above. Because resources are limited and their cost continues to increase. This requires the efficient and optimal use of resources in industry, and this process is carried out on the basis of an assessment of economic efficiency in the sector.

However, in practice, the economic efficiency of an industrial sector cannot be assessed by a single methodology or by a single method. Because this is a complex process, namely, the complexity lies in the fact that, firstly, it is not possible to measure the factors used in real time or accurately calculate the results (indicators), and also some factors cannot be measured at all (for example, quality factors and environmental factors). Therefore, there are different scientific views on this issue.

In particular, according to AT Trofimova, the economic efficiency of industry should be assessed not by a single indicator, but based on the dynamics of a system of economic efficiency indicators. Including labor productivity, capital efficiency, material efficiency, cost indicators, reserve capacity of a production unit, material consumption, labor intensity, etc.

Economists N.S. Kalita and G.I. Mantsurov emphasized that when assessing economic efficiency based on generalized methodologies, the following should be taken into account [7]:

- reduce costs, taking into account savings in labor and material costs;
- achieving growth rates in production volume and labor productivity;
- conditional savings in capital investments resulting from the efficient use of fixed production assets;
- saving management costs resulting from improving the entire structure and organization of management.

As noted above, it is appropriate to consider the economic efficiency of the industrial sector by areas of activity. In particular, management efficiency, economic efficiency, financial efficiency, innovation efficiency, investment efficiency, and social efficiency.

Research Methodology

This study examines the methods of assessing the economic efficiency of the canoe network and empirical studies and theoretical views on their improvement. Also, based on empirical studies and theoretical views, the methods of assessing the economic efficiency of the canoe network were improved. The study used analysis and synthesis, deduction and induction, tabular, graphical, economic and mathematical methods, as well as the works of local and foreign scientists on the topic.

Analysis and Results

As noted above, economic efficiency (E_{ef}) are important indicators, and according to classical and non-classical economic theories, it is generally expressed as follows.

$$E_{ef} = \frac{R}{F} \tag{1}$$

here, R – total income, F – total resources.

This formula is a general expression of the assessment of economic efficiency, and its components are the following assessment methods.

1) Efficiency of fixed and working capital (return) in the industrial sector (E_b^f and E_w^f).

$$E_b^f = \frac{Q}{BF} \tag{2}$$

here, Q – volume of industrial products, BF – the annual average value of fixed assets.

$$E_w^f = \frac{Q}{WF} \tag{3}$$

here, WF – the annual average value of working capital.

2) Capital efficiency in the industrial sector (E_k).

$$E_k = \frac{Q}{K} \tag{4}$$

here, K – capital volume.

3) Labor productivity in the industrial sector (L_p).

$$L_p = \frac{Q}{L} \tag{5}$$

here, L – labor costs.

This can be used to make an assessment of all resources used in the industry.

It is also important to economically assess the efficiency of working capital use in industrial enterprises in a market economy. Because in such conditions based on strong competition, the marginal revenue of enterprises is equal to their marginal cost ($MR = MC$). This represents the optimal state in which the enterprise can achieve the highest efficiency.

Therefore, it is necessary to find an answer to the question "is it in an optimal state where it can achieve high efficiency or not?" for each industrial enterprise. In this case, the financial assessment of the efficiency of the activities of industrial enterprises is a general assessment method, which does not indicate whether the enterprise is using financial resources optimally. Therefore, it is appropriate to

economically assess the efficiency of the use of each financial resource (factor) used in industrial enterprises.

Based on this study, we propose the following methods for calculating the main indicators of the economic efficiency of the industrial sector: efficiency of fixed and circulating funds (return), capital efficiency, labor productivity, efficiency of investment return and innovation efficiency (Table 1).

Table 1 Indicators for assessing the economic efficiency of an industrial sector and methods for calculating them[1]

Efficiency indicator	Calculation method	Note
Fixed assets efficiency (E_b^f)	$E_b^f = 1 - \frac{Q}{BF}/100$	Q – volume of industrial products, BF – the annual average value of fixed assets.
Working capital efficiency (E_w^f)	$E_w^f = 1 - \frac{Q}{WF}/100$	WF – the annual average value of working capital.
Capital efficiency (E_k)	$E_k = 1 - \frac{Q}{K}/100$	K – capital volume.
Labor productivity (L_p)	$L_p = 1 - \frac{Q}{L}/100$	L – labor costs.
Return on investment efficiency (I_w^{ef}) (the volume of additional output per investment cycle)	$I_w^{ef} = \frac{\Delta Q}{K_w}, \rightarrow Q_1 \le Q_2$	ΔQ – additional production volume, K_w – turnover of working capital.
Innovation efficiency (In_{inn}^{ef})*	$In_{inn}^{ef} = \sqrt{\frac{L_p^{ef\,2} + AC_{inn}^{ef\,2} + PR_{inn}^{ef\,2} + T_{inn}^{ef\,2}}{4}}$	L_p^{ef} – contribution of talented personnel, AC_{inn}^{ef} – contribution to innovative activities, PR_{inn}^{ef} – innovative product contribution, T_{inn}^{ef} – the contribution of innovative technologies.

Note:* The integral indicators used to calculate this indicator are defined as follows.

1) Contribution of qualified personnel (L_p^{ef}).

$$L_p^{ef} = \frac{L_p}{L_t} \tag{6}$$

[1]Developed by the author.

here, L_p – the number of skilled workers employed in the industry (or their labor input), L_t – the total number of employees employed in the industry.

2) Contribution of innovative activity (AC_{inn}^{ef}).

$$AC_{inn}^{ef} = \frac{AC_{inn}}{AC_t} \quad (7)$$

here, AC_{inn} – the number of newly established innovative activities (directions), AC_t – total number of activities (directions).

3) Contribution of innovative products (PR_{inn}^{ef}).

$$PR_{inn}^{ef} = \frac{PR_{inn}}{PR_t} \quad (8)$$

here, PR_{inn} – the volume of newly produced innovative products (services), PR_t – total volume of products (services).

4) Contribution of innovative technologies (T_{inn}^{ef}).

$$T_{inn}^{ef} = \frac{T_{inn}}{T_t} \quad (9)$$

here, T_{inn} – newly introduced innovative technologies, T_t – total technologies.

The proposed (Table 2) threshold criteria for assessing the economic efficiency of the industrial sector can be expressed as follows.

Table 2

Evaluation criteria and threshold values of economic efficiency indicators of the industrial sector[2]

No.	Evaluation indicators	Evaluation criteria and threshold values
1	Fixed assets efficiency (E_b^f)	This indicator $-\infty < E_b^f \le 1$ It accepts interval values and can be evaluated in 4 ways according to the following threshold criteria: - the efficiency level is zero, in which $E_b^f = 1$ if; - low efficiency, in which $0 < E_b^f < 1$ if; - the level of efficiency is medium, in which $E_b^f = 0$ if; - high level of efficiency, in which $-\infty \leftarrow E_b^f < 0$ if.
2	Working capital efficiency (E_w^f)	This indicator $-\infty < E_w^f \le 1$ It accepts interval values and can be evaluated in 4 ways according to the following threshold criteria: - the efficiency level is zero, in which $E_w^f = 1$ if; - low efficiency, in which $0 < E_w^f < 1$ if; - the level of efficiency is medium, in which $E_w^f = 0$ if; - high level of efficiency, in which $-\infty \leftarrow E_w^f < 0$ if.

[2]Developed by the author.

3	Capital efficiency (E_k)	This indicator $-\infty < E_k \le 1$ It accepts interval values and can be evaluated in 4 ways according to the following threshold criteria: - the efficiency level is zero, in which $E_k = 1$ if; - low efficiency, in which $0 < E_k < 1$ if; - the level of efficiency is medium, in which $E_k = 0$ if; - high level of efficiency, in which $-\infty \leftarrow E_k < 0$ if.
4	Labor productivity (L_p)	This indicator $-\infty < L_p \le 1$ It accepts interval values and can be evaluated in 4 ways according to the following threshold criteria: - the efficiency level is zero, in which $L_p = 1$ if; - low efficiency, in which $0 < L_p < 1$ if; - the level of efficiency is medium, in which $L_p = 0$ if; - high level of efficiency, in which $-\infty \leftarrow L_p < 0$ if.
5	Return on investment efficiency (I_w^{ef})	This indicator $0 \le I_w^{ef} \le K_w^t$ It accepts interval values and can be evaluated in 4 ways according to the following threshold criteria: - the efficiency level is zero, in which $I_w^{ef} = 0$ if; - the level of efficiency is medium, in which $I_w^{ef} = \frac{1}{2} K_w^t$ if; - high level of efficiency, in which $I_w^{ef} \to K_w^t$ strives; - the efficiency level is the highest (max), in which $I_w^{ef} = K_w^t$ if. K_w^t – the volume of working capital in period t.
6	Innovative efficiency (In_{inn}^{ef})	This indicator $0 \le In_{inn}^{ef} \to \infty$ accepting values, how much is its value $In_{inn}^{ef} \to 1$ The more innovative the effort, the higher the “higher” the innovation efficiency will be, and vice versa.

The above-mentioned indicators of economic efficiency of the industrial sector, their evaluation criteria and threshold values serve to further improve the methodology for assessing the economic efficiency of the industrial sector (enterprises) and increase the accuracy of its assessment results.

The above-mentioned indicators of the efficiency of industrial resources were assessed using traditional methods. As noted above, these indicators are internal (extensive) factors that affect the economic efficiency of the industrial sector (Table 3).

Table 3 **Internal (intensive) factors affecting the economic efficiency of an industrial sector**[3]

Years	Investment efficiency in the industrial sector, billion soums	Efficiency of fixed assets in the industrial sector, billion soums	Labor productivity in the industrial sector, billion soums/thousand people
2010	0.922	0.985	0.763
2011	0.923	0.985	0.710
2012	0.929	0.985	0.655
2013	0.932	0.985	0.585
2014	0.939	0.986	0.516
2015	0.945	0.986	0.448
2016	0.943	0.988	0.379
2017	0.955	0.987	0.185
2018	0.961	0.986	-0.305
2019	0.966	0.985	-0.771
2020	0.961	0.987	-1,038
2021	0.954	0.987	-1,448
2022	0.953	0.987	-2,056
2023	0.965	0.986	-2,586

Using the threshold criteria of the interval values accepted by the efficiency indicators calculated based on the proposed methods, the efficiency levels of the industrial sector resources were assessed in 4 categories as follows:

1)The efficiency of investments in the industrial sector was assessed in accordance with the second-order criterion of assessment, that is, with the criterion of "low efficiency" of investments in the sector;

2) The efficiency of fixed assets in the industrial sector was also assessed in accordance with the second-order assessment criterion, that is, the “low efficiency” of fixed assets in the sector;

3) Labor productivity in the industrial sector was assessed in accordance with the third and fourth order criteria for assessing it, that is, labor productivity in the sector was assessed with the criterion of "medium level of efficiency" in 2010-2017 and "high level of efficiency" in 2018-2023.

Conclusion and Suggestions

Thus, calculations for assessing investment efficiency show that in the period 2010-2023, there were downward trends in the efficiency of investments in fixed capital in the industrial sector. This situation can be explained by the following:

- the increase in the volume of investments in the industrial sector has mainly occurred in the last 5-6 years. Also, most of them are large medium and long-term investment projects. The return on investments directed to these projects will certainly begin after the project is launched at full capacity, that is, there are "logs" here;
- investments in the sector are not used directly for the production process, but for non-production purposes, for example, the purchase of expensive inventory for buildings, offices, and management;
- the majority of investments are directed to the purchase of equipment and technologies, as is known, technologies have a high value, and in this case the volume of investments is high compared to the volume of production. This in itself leads to a decrease in investment efficiency.

[3]Author's calculations based on data from the Statistical Agency under the President of the Republic of Uzbekistan.

It is advisable to divide the factors affecting the economic efficiency of an industrial sector into two groups according to their source of origin and whether they can be influenced or not. That is,
1) internal factors, that is, factors that can be controlled (in turn, they should also be distinguished according to two different approaches):
a) extensive factors (quantitative indicators);
b) intensive factors (relative indicators).
2) external factors, that is, factors that cannot be controlled, must be isolated, studied and analyzed;
During the study, the impact of factors affecting the volume of industrial production was quantitatively assessed. In particular, the quantitative impact of internal (extensive) factors was assessed: the volume of investments (3.61), the annual average value of fixed assets (0.96), the number of employed people (1819.57), the number of industrial enterprises (8.19), as well as internal (intensive) factors: investment efficiency (53.46), labor productivity (1.04), as well as external factors: exports of industrial products (0.98), imports of industrial products (1.58), and the volume of real incomes of the population (1.08).

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