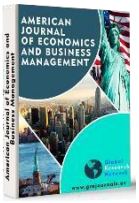

American Journal of Economics and Business Management

Vol. 8 Issue 3 | **pp.** 1037-1045 | **ISSN:** 2576-5973

Available online @ https://www.globalresearchnetwork.us/index.php/ajebm

Article

The Role of Econometric Models in Increasing The Economic Efficiency of Industrial Industries

Rakhimov Anvar Norimovich[1]

1. University of Economics and Pedagogy, Uzbekistan

* Correspondence: sanjar.8548@mail.ru

Abstract: The purpose of this study is to investigate the role of econometric models in improving the economic efficiency of industrial sectors with regard to the profits of assets, the use of resources and forecasting mechanisms. Utilising such a systematic methodology integrating factor analysis and DuPont model to assess economic performance, the study bridges the existing gap in integration of economic approaches and industrial efficiency analysis. It finds that through the application of econometric forecasting tools one can optimize resource allocation and increase profitability indicators. These results indicate technological integration of superior econometric modelling techniques in the process of the decision making may lead to sustainable industrial growth. Implications of this research are relevant to policymakers and industry leaders who need to aim at data driven strategies to boost economic efficiency.

Keywords: Industrial Sector, Innovative Development, Econometric Model, Efficiency, Assets, Profitability, Socio-Economic Forecasting, Individual, Expert, Interview, National Economy, Region, Scientific and Technical Progress, Standard of Living, Volume of Resources, External Economic Situation, Ecology

1. Introduction

In the correct assessment of industrial sectors and finding ways to fully realize their economic potential, the benefits of industrial sectors operating in a market economy determine the practical importance of analytical methodological tools. At the same time, if the aim of the research is the systematic analysis of the potential of industrial sectors, it is advisable to choose a comprehensive form of diagnosing the potential of industrial sectors; if the aim is to assess the individual potential of industrial sectors, it is advisable to choose case studies. The analysis of the complex economic potential of industrial sectors is directly related to the trends in evaluating the results of external and internal users.

One of the most important areas of economic potential analysis is the study of the level of efficiency of its use. Defining efficiency as an economic category causes many discussions. The problem is that the complexity of the studied categories and the uncertainty of the conceptual and methodological approach should be taken into account when measuring them. At the same time, the concept of economic efficiency, developed in economic literature and economic practice, retained its logical content over a fixed period of time (as a ratio of the maximum desired effect to the optimal value of costs or resources).

In order to determine the criteria for assessing the efficiency of using the complex economic potential of industrial sectors, a matrix of a large number of interrelated

Citation: Norimovich R. A. The Role of Econometric Models in Increasing The Economic Efficiency of Industrial Industries. American Journal of Economics and Business Management 2025, 8(3), 1037-1045.

Received: 10th Feb 2025
Revised: 17th Feb 2025
Accepted: 28th Feb 2025
Published: 13th Mar 2025

assessment characteristics (quantitative and qualitative indicators) must be reasonable, providing the necessary level of objective assessment. This set of synthetic assessment indicators should have a multifaceted transformation in detail, adapting to the information and analytical requests of all interested parties: managers, specialists of different levels of management, external contractors (current indicators calculated on the basis of basic management data, accounting and reporting from the system of aggregate indicators formed on the basis of information from state financial reports).

Literature Review

In the sources, as a means of innovative and technological improvement of systems, Z.Vanessa, D.Vikenti and a number of research scientists present scientific approaches to the application of the SEEM-Smart methodology in the electrical engineering industry. This study on the introduction of smart technologies into the system proposes the SEEM-Smart methodology as a model for stimulating innovation that best supports the development of Smart PSS [1].

In their work "Life cycle cost analysis of industrial bioenergy projects: development of a simulation tool and its application to three demand sectors in Africa", the Spanish economists O. Gavalda, A. González, M. Raya and M. Owens reviewed a set of methodological tools for costing renewable energy projects and identified their main features, strengths and weaknesses [2].

Researcher M. Zanon Zotin's research uses the COFFEE Integrated Global Assessment Model (IAM) with a detailed description of industrial processes to understand the role of the industrial sector in climate change mitigation scenarios with different temperature ambitions, citing an operational research tool [3].

These studies are sources that help explain the evaluation and significance of the results obtained based on the use of industrial system modeling and model optimization tools. Researchers M. Jedrzejczyk, P. Kopka, B. Foadlar, as well as D. Lukas and others emphasize that the correct formulation of a scientific problem is measured by its correspondence to the mathematical modeling apparatus. They believe that the realization of an object is directly related to the correct use of mathematical equipment [4].

2. Materials and Methods

The methodology of this study is a systematic method of evaluating the economic efficiency of the industrial sectors by referring to the econometric models. Both qualitative and quantitative methods are employed to analyze the key economic indicators in the asset profitability, means of resource utilization, and forecasting mechanisms. Attention was then focused on the theoretical frameworks and methodological tools available in the literature relevant for industrial efficiency assessment. To assess the financial performance of industrial enterprises, a factor analysis is performed in conjunction with the DuPont model in order to achieve multi-dimensional patterns of efficiency. It developed an interrelated matrix of assessment characteristics (quantitative and qualitative), covering the whole of economic performance. Data collected used financial statements, economic reports and expert opinion for the purpose of accuracy and reliability. Trends were analyzed econometric modeling used to identify patterns and forecast economic outcome, and was applied to analyze the factors influencing industrial efficiency in detail. Finally, the research also validates the findings of the proposed models using statistical techniques. Future economic scenarios were assessed using predictive models that offer a valuable view into decision making processes for industry stakeholders. The study attempts to extend the precision of the economic assessments and aid strategic industrial sector decision making through economic analyses, integrating econometric tools into efficiency analysis. The methodology is structured to address the industrial efficiency dynamics with a holistic scope so that data driven approaches are essential in achieving optimized economic outcome and improving the industrial performance.

3. Results and Discussion

It confirms the appropriateness of using the following tools to measure the effectiveness of using the complex economic potential of industrial sectors: specific indicators, including those grouped by functional components, and general and integrated indicators [5]. We offer a gradual system. Analysis of resource utilization efficiency is the first level. The second level is concerned with the possibility of creating a system of generalization of resource utilization efficiency indicators on the basis of the system of target indicators, which is accepted as a vector field of complex economic potential of enterprises in this research [6].

An objective assessment of the achieved level and dynamics of indicators of efficiency of use of the complex economic potential of industrial sectors should be taken into account, taking into account the influence of a set of factors, the quantitative and qualitative expression of their influence should be obtained through analysis. In scientific work, to use the factor analysis methodology, the starting point of which is the DuPont model, the issues of transforming the proposed indicators into deterministic multifactor models are summarized [7].

1. An asset profitability model that describes the efficient use of assets in industrial sectors.

$$\text{ROA} = \frac{NP}{A} = \frac{NP \cdot S_V \cdot E}{A \cdot S_V \cdot E} = \frac{NP}{S_V} \cdot \frac{S_V}{E} \cdot \frac{E}{A} = ROS \cdot CET \cdot \frac{E}{A}, \quad (1)$$

In this case, NP is net profit; Sv - sales volume; YE - equity value; A - total assets of the industry;

ROS = $\frac{NP}{S_V}$ - Sales profitability; CET = $\frac{S_V}{E}$ - Private equity turnover ratio; $\frac{E}{A}$ - Independence (autonomy) or coefficient of the share of private capital in the total value of assets of industrial sectors.

2. You can analyze the profitability of assets in relation to their use:

$$ROA = \frac{NP}{A} = \frac{\frac{S_V - S}{S}}{\frac{A}{S}} = \frac{\frac{S_V}{S} - \frac{S}{S}}{\frac{A}{S}} = \frac{\frac{S_V}{S} - 1}{\frac{A}{CA} \cdot \frac{CA}{Z} \cdot \frac{Z}{S}} = (D_1 - 1) \cdot D_2 \cdot D_3 \cdot D_4, \quad (2)$$

In this, - The share of revenue corresponding to a single amount of the total cost of the manufactured product, - Value of assets used in total assets value; - Value of assets used, reserve ratio; - Use of reserves.

3. The equity profitability model, which describes the efficiency of using equity capital:

$$ROE = \frac{NP}{E} = \frac{NP \cdot S_V \cdot A}{E \cdot S_V \cdot A} = \frac{NP}{S_V} \cdot \frac{S_V}{A} \cdot \frac{A}{E} = ROS \cdot \frac{S_V}{A} \cdot \frac{E + L}{E} = ROS \cdot CAT \cdot (1 + R_{LE}), \quad (3)$$

In this, CAT= $\frac{S_V}{A}$ - Industrial sector asset turnover ratio; L – The amount of loan funds; RLE= $\frac{L}{E}$ - Financial independence factor.

4. Overall index of economic growth stability -kg (including dividend payments):

$$k_g = \frac{NP - D}{E} = \frac{NP_R \cdot NP \cdot S_V \cdot A}{E \cdot NP \cdot S_V \cdot A} = \frac{NP_R}{NP} \cdot \frac{NP}{S_V} \cdot \frac{S_V}{A} \cdot \frac{A}{E} =$$

$$= \frac{NP_R}{NP} \cdot \frac{NP}{S_V} \cdot \frac{S_V}{A} \cdot \frac{E+L}{E} = \frac{NP_R}{NP} \cdot \frac{NP}{S_V} \cdot \frac{S_V}{A} \cdot \left(1 + \frac{L}{E}\right) = \quad (4)$$

$$= d_{NP_R} \cdot ROS \cdot CAT \cdot (1 + R_{LE}),$$

here, D – In a reporting period, the portion of net profit allocated to the payment of dividends.; NPR - Capitalized (regrouped) portion of net profit for the reporting period (the difference between net profit and dividends); d_{NP_R} - Capital share of net profit.

5. Net income coverage ratio:

$$K_{МП} = \frac{CF}{NP} = \frac{CF \cdot L \cdot E \cdot CA \cdot S_V}{NP \cdot L \cdot E \cdot CFA \cdot S_V} = \frac{CF}{S_V} \cdot \frac{L}{E} \cdot \frac{CA}{L} \cdot \frac{S_V}{CA} \cdot \frac{E}{NP}, \quad (5)$$

here, СФ - Net cash flow from operating (current) activities (the difference between cash inflows and cash outflows from ordinary activities); CA - Volume of traded assets; $\frac{CF}{S_V}$ - Cash Coverage Ratio of Sales Income; $\frac{CA}{L}$ - Solvency ratio (coverage of total working capital obligations); $\frac{S_V}{CA}$ - Current assets turnover ratio; $\frac{E}{NP}$ - Net Profit and Equity Multiplier.

6. Economic value added related to sales revenue:

$$EVA^*_{S_V} = \frac{EVA}{S_V} = \frac{EVA}{S_V} \cdot \frac{S}{S} = EVA \cdot \frac{1}{S} \cdot \frac{МЗ + OT_{ECH} + AO + Пр}{S_V} = EVA \cdot \frac{ME + TE + AE + \frac{Пр}{S_V}}{S}, \quad (6)$$

here, S - Cost of goods manufactured; MZ - Material costs; OTESN - Pay wages in one social payment; AO- Depreciation payments; Пр - Other expenses; ME- material capabilities; TE - workforce; AE – Consumption options.

7. Economic value added associated with the number of employees:

$$EVA^*_N = \frac{EVA}{N} = \frac{EVA}{N} \cdot \frac{S_V}{S_V} = \frac{EVA}{S_V} \cdot \frac{S_V}{N} = \frac{EVA}{S_V} \cdot L_P, \quad (7)$$

here, N- Number of workers in industries; LP - Labor productivity.

8. Economic value added associated with assets:

$$EVA^*_A = \frac{EVA}{A} = \frac{EVA}{S_V} \cdot \frac{S_V}{A} = \frac{EVA}{S_V} \cdot CAT. \quad (8)$$

Adapting the DuPont model technique expands the analytical possibilities for studying evaluation indicators, and modifying the original formulas allows identifying and measuring the influence of a number of important factors [8].

The study of the economic potential of industrial sectors aims to prepare an analytical base that allows increasing the validity of managerial decision-making in an ever-changing external environment.

One of the scientific types of prediction of the future is forecasting. Prognosis means the ability to see the trends and results of the possible development of the organism in the

near future based on the scientific method. The scientific discipline that develops the theory, law and method of prediction was called forecasting [9].

The fields of forecasting are wide and varied. It is possible to forecast geographical, geological, environmental, biological, medical, scientific and technological, economic, social processes, military and foreign political situation, legislation, cultural and aesthetic fields.

Socio-economic forecasting deals with forecasting the development of the national economy, specific sectors and regions, scientific and technical progress, population growth, living standards, amount of resources, external economic conditions and the environment. Now let's talk about forecasting in production management [10].

The scheme of coordination of goals and resources in the production and management process is shown in Figure 1. The first stage in the observed process is forecasting. As a result of forecasting, the question of possible development of the economy, meeting the needs of society and efficient use of resources will be solved.

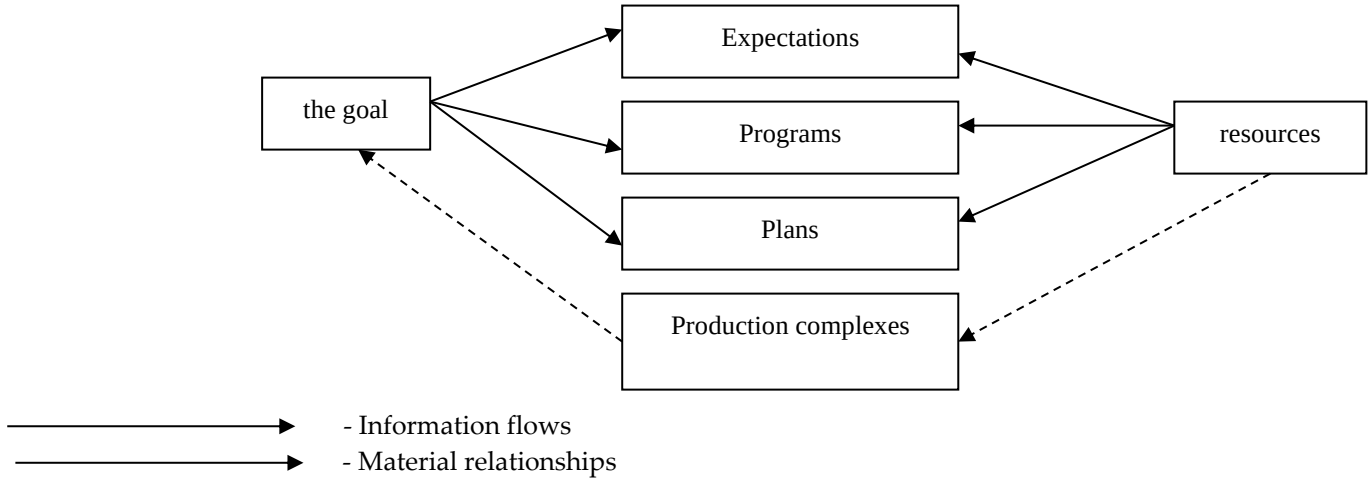

Figure 1. Production and management process flow chart.

The main functions of forecasting include: scientific analysis of social, economic, scientific and technical processes and laws, the ability to anticipate possible and multivariate future developments, problems and laws; assessment of the possibilities of active influence on these processes is included.

Predictive information about effective options for social and economic development is used as a basis for creating complex programmes.

Programs fall between forecasts and plans in the production and management flow chart. They are closer to plans in terms of direction and forecasts in terms of time.

In the forecasting process, the forecast object must be comprehensively analyzed when creating the task. This requires studying the definition of the object and its subject, forecasting tasks, its dependence on the external environment, its structure, and its activation and management mechanism. Formal content analysis requires the creation of its models, the sphere of influence on the object, and the optimal management method.

The systems we are looking at are social and economic systems, and their analysis is very complex. We use system theory and systematic analysis to manage complex things.

A feature of the research methodology is the use of a functional approach in analysis. The system is connected to the external environment through input and output signals. Suppose the state of the system at time t is defined by three vectors:

Input state vector $X_t = (x_1, x_2, \dots, x_m)_t$

Output state vector $Y_1 = (y_1, y_2, \dots, y_m)_t$

The internal state vector of the system $S_t=(s_1, s_2,..., s_m)_t$.

If the state of the system's output in period t depends on the state of the input, then the dependence of its internal state is as follows:

$$y_t = f(X_t, S_t). \quad (9)$$

Such a description of complex systems is very effective. Econometric forecasting models are based on this approach.

The division of forecasts into types is carried out depending on the goal, task, object, time, scientific-methodological and organizational, and result indicators. We divide socio-economic forecasts into types according to the main criteria (Figure 2).

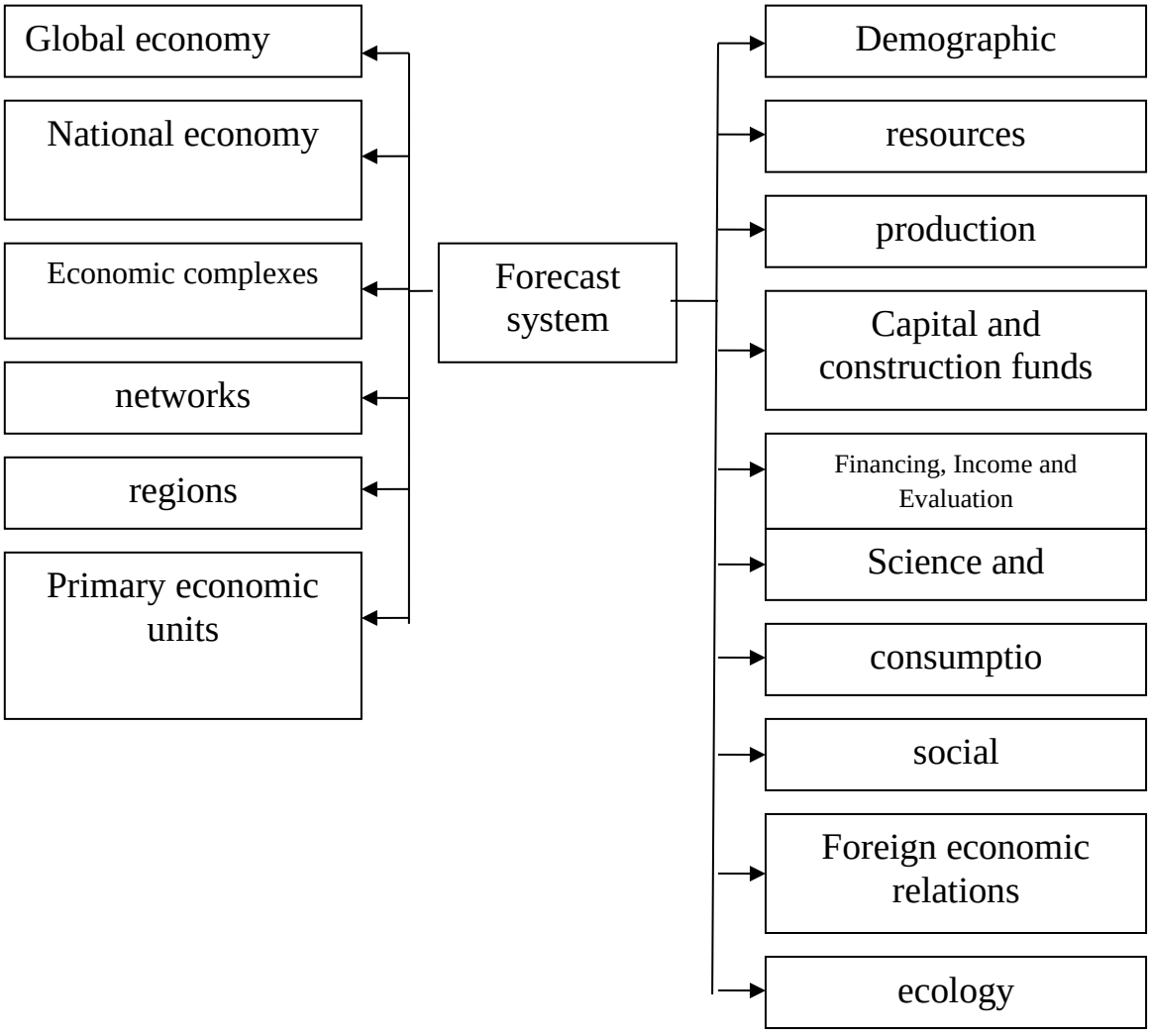

Figure 2. Forecast Type Classification Chart.

The rapid development of forecasting as a science in the past fifteen years has given rise to a multitude of forecasting techniques, processes, methods and measures that are unparalleled in their importance. Their careful organization has expanded the forecasting tools using indirect and undervalued methods.

The forecasting method means understanding the set of methods and approaches to thinking that allow to clearly discuss the future development of the object based on the analysis of retrospective data, external (external) and internal (internal) relationships and the subject of forecasting, as well as their dimensions within the framework of the observed event or process.

The various classification principles of forecasting methods are presented in the available sources. An important feature of the classification of forecasting methods is the level of formalization that covers them completely.

The second classification mark is the general principle of the influence of forecasting methods, and the third is the method of obtaining reliable information. Depending on the degree of formalization, economic forecasting methods can be divided into intuitive and formalized.

Intuitive forecasting methods are used in cases where many factors cannot be taken into account due to the complexity of the object. In this case, expert assessment is used. In this case, individual and group expert assessments differ.

Individual expert assessments include: "interview" method – where the expert has direct contact with the "question and answer" specialist; "analysis" method – where a logistical analysis of the expected situation is carried out, and analytical written reports are prepared; "scenario writing" method – based on identifying the logic of an event or process over time in different conditions.

The formalization method group includes induction and modeling. The first group includes the least squares method, the exponential smoothing method, and the mean shift method.

The second group includes structural, diverse, and matrix modeling.

In the classification of forecasting methods, combined methods that integrate various other approaches hold a unique place. For example, collective expert evaluations and expert surveys, among others.

When classifying forecasting methods, it should be assumed that forecasting methods should be placed in a meaningful system, and the subject of forecasting should be determined by economic development processes and their laws. Modeling describing one or another process and event is the most common method. The method that gives good results in forecasting the future state of an event is modeling.

Building a model based on a preliminary study of the object, identification of its important properties, experimental and theoretical analysis of the model, comparison of the results with object data; making corrections to the model - this is part of the modeling method.

There are serious difficulties in the method of modeling the object that is being developed according to the forecast, and they require great attention. Difficulties in the application of modeling lead to the complexity of the structure of the forecast object. Therefore, in most cases, it is necessary to use not a single model, but a system of models and methods.

In this case, each action is carried out clearly and sequentially.

The system of forecasting models is a set of methods and models. These provide an opportunity for agreement and non-contradiction based on the study of the future state and development of the object, future and current trends and forecasting laws. In this case, the forecasting set is assembled into the system based on the sequence of the model.

There are three steps to building a forecasting model:.

In the first stage Models and interconnected subsystems of the model are created and transformed into individual structures that provide interaction for the purpose of prediction.

In the second stage A system of interconnected predictive models is created, and their interconnectedness is verified.

In the third stage Unique separate systems are identified and developed to create a typical forecasting system. A method is sought to apply them in order to compile a summary of forecasts.

One of the main goals of forecasting is to reduce the inevitable uncertainty associated with future decision making. Through this approach, forecasting the complex economic potential of industries can be used to predict the future performance of industries as a tool for making short-term and long-term economic decisions, to ensure the appropriateness of investments.

At present, when determining the fate of industrial sectors, it is determined whether the issues of forecasting the crisis and the pre-crisis financial situation in the future correspond to the goals of their future activity. It is necessary to determine its presence and development prospects at all stages of the life cycle of industrial sectors, therefore, forecasting the bankruptcy of industrial sectors in real economic conditions can be classified as one of the most important areas.

The results of determining the probability of bankruptcy of industrial sectors reflect the level and state of use of their economic potential.

He considers it appropriate to consider the main methods and approaches to forecasting economic indicators, and to evaluate forecasting alternatives based on a specially developed computer model. This model allows for highly variable calculations of scenarios for the development of complex economic potential of industries, taking into account the influence of various factors of the external and internal environment.

Modelling the complex economic potential of industrial sectors remains an effective tool for managerial decision-making.

For this purpose, a comparative model for forecasting the complex economic potential of industrial sectors was developed based on the system of main target indicators, which is taken as a vector field of the complex economic potential of industrial sectors and its assessment mechanism.

The system of indicators formed during the modeling process allows to obtain a predictable estimate of the level of utilization of the complex economic potential of industrial sectors and their efficiency.

The development of scenario options requires combining them with all situations identified during the study of economic potential (expected, preliminary or planned, real). Taking into account the settlement area and on the basis of criteria accepted by the management of industries, options for combining certain conditions and "business trends" are determined in the matrix.

4. Conclusion

Increasing the economic potential of industrial sectors and production efficiency is one of the important directions of the current economic policy. The demands and needs of the population for various products and services are growing year by year. Meeting this demand requires the use of intensive technologies in the production of industrial sectors, the introduction of sufficient investments and the use of new methods, as well as the improvement of management mechanisms. In this chapter of the scientific work, these factors and criteria are evaluated on the basis of statistical methods.

In order to further develop industries based on different forms of ownership and use their economic potential at a higher level, the following is proposed: developing new and modern types of products and services, continuing to expand the types of products and services; Improving accounting for some types of products and services; increasing attention to training qualified specialists in the field of products and services; accelerating the creation of new jobs in the field of products and services; broad involvement of new innovative technologies in the field of products and services; focusing on increasing the share of modern services such as communications, information, computer programming services, etc.

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