

MUHANDISLIK

& IQTISODIYOT

ijtimoiy-iqtisodiy, innovatsion texnik,
fan va ta'limga oid ilmiy-amaliy jurnal

2026
mart



**TOSHKENT SHAHRIDAGI TURIN
POLITEXNIKA UNIVERSITETI**

*Xalqaro ilmiy-amaliy onlayn konferensiya
materiallari to'plami*

**“GLOBAL RAQAMLI INTEGRATSIYALASHUV:
2030-YILGACHA YASHIL IQTISODIYOTGA O'TISHDA
TEXNOLOGIK VA INDUSTRIAL SANOATNI RIVOJLANTIRISH
ORQALI MIKRO VA MAKROIQTISODIY BARQAROR
O'SISHNI TA'MINLASH DOLZARBLIGI”**

**“GLOBAL DIGITAL INTEGRATION: THE RELEVANCE OF
ENSURING MICRO AND MACROECONOMIC SUSTAINABLE
GROWTH THROUGH TECHNOLOGICAL AND INDUSTRIAL
DEVELOPMENT IN THE TRANSITION TO A GREEN
ECONOMY BY 2030”**

**«ГЛОБАЛЬНАЯ ЦИФРОВАЯ ИНТЕГРАЦИЯ:
АКТУАЛЬНОСТЬ ОБЕСПЕЧЕНИЯ УСТОЙЧИВОГО
МИКРО- И МАКРОЭКОНОМИЧЕСКОГО РОСТА ЧЕРЕЗ
РАЗВИТИЕ ТЕХНОЛОГИЧЕСКОЙ И ИНДУСТРИАЛЬНОЙ
ПРОМЫШЛЕННОСТИ В ПЕРЕХОДЕ К ЗЕЛЁНОЙ
ЭКОНОМИКЕ К 2030 ГОДУ»**

3-MAXSUS SON



74-91 xalqaro daraja
ISSN: 2992-8982



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ijtimoiy-iqtisodiy, innovatsion texnik,
fan va ta'limga oid ilmiy-amaliy jurnal

*Elektron nashr.
2026-yil, mart.*

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- 05.01.00 – Axborot texnologiyalari, boshqaruv va kompyuter grafikasi
- 05.01.01 – Muhandislik geometriyasi va kompyuter grafikasi. Audio va video texnologiyalari
- 05.01.02 – Tizimli tahlil, boshqaruv va axborotni qayta ishlash
- 05.01.03 – Informatikaning nazariy asoslari
- 05.01.04 – Hisoblash mashinalari, majmualari va kompyuter tarmoqlarining matematik va dasturiy ta'minoti
- 05.01.05 – Axborotlarni himoyalash usullari va tizimlari. Axborot xavfsizligi
- 05.01.06 – Hisoblash texnikasi va boshqaruv tizimlarining elementlari va qurilmalari
- 05.01.07 – Matematik modellash
- 05.01.11 – Raqamli texnologiyalar va sun'iy intellekt
- 05.02.00 – Mashinasozlik va mashinashunoslik
- 05.02.08 – Yer usti majmualari va uchish apparatlari
- 05.03.02 – Metrologiya va metrologiya ta'minoti
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- 05.05.06 – Qayta tiklanadigan energiya turlari asosidagi energiya qurilmalari
- 05.06.01 – To'qimachilik va yengil sanoat ishlab chiqarishlari materialshunosligi
- 05.08.03 – Temir yo'l transportini ishlatish
- 05.09.01 – Qurilish konstruksiyalari, bino va inshootlar
- 05.09.04 – Suv ta'minoti. Kanalizatsiya. Suv havzalarini muhofazalovchi qurilish tizimlari
- 10.00.06 – Qiyosiy adabiyotshunoslik, chog'ishtirma tilshunoslik va tarjimashunoslik
- 10.00.04 – Yevropa, Amerika va Avstraliya xalqlari tili va adabiyoti
- 08.00.01 – Iqtisodiyot nazariyasi
- 08.00.02 – Makroiqtisodiyot
- 08.00.03 – Sanoat iqtisodiyoti
- 08.00.04 – Qishloq xo'jaligi iqtisodiyoti
- 08.00.05 – Xizmat ko'rsatish tarmoqlari iqtisodiyoti
- 08.00.06 – Ekonometrika va statistika
- 08.00.07 – Moliya, pul muomalasi va kredit
- 08.00.08 – Buxgalteriya hisobi, iqtisodiy tahlil va audit
- 08.00.09 – Jahon iqtisodiyoti
- 08.00.10 – Demografiya. Mehnat iqtisodiyoti
- 08.00.11 – Marketing
- 08.00.12 – Mintaqaviy iqtisodiyot
- 08.00.13 – Menejment
- 08.00.14 – Iqtisodiyotda axborot tizimlari va texnologiyalari
- 08.00.15 – Tadbirkorlik va kichik biznes iqtisodiyoti
- 08.00.16 – Raqamli iqtisodiyot va xalqaro raqamli integratsiya
- 08.00.17 – Turizm va mehmonxona faoliyati

Ma'lumot uchun, OAK

Rayosatining 2024-yil 28-avgustdagi 360/5-son qarori bilan "Dissertatsiyalar asosiy ilmiy natijalarini chop etishga tavsiya etilgan milliy ilmiy nashrlar ro'yxati"ga texnika va iqtisodiyot fanlari bo'yicha "Muhandislik va iqtisodiyot" jurnali ro'yxatga kiritilgan.

Muassis: "Tadbirkor va ishbilarmon" MChJ

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FEATURES AND PRINCIPLES OF ECONOMETRIC MODELING OF INDUSTRIAL DEVELOPMENT

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Abstract. This article examines industrial development through econometric modeling and provides a comprehensive description of the key stages involved in the modeling process. It also analyzes the factors influencing industrial development and develops a framework illustrating their interrelationships and integration. Furthermore, the study outlines the main criteria and principles for constructing econometric models and highlights the potential of econometric modeling as an effective tool for analyzing and forecasting industrial development.

Keywords: industrial development, econometric modeling, analysis, influencing factors, economic growth, socio-economic development.

Annotatsiya. Ushbu maqolada sanoat rivojlanishini ekonometrik modellashirish asosida tadqiq etish jarayonlari ko'rib chiqilib, modellashirish jarayonining asosiy bosqichlari har tomonlama tavsiflangan. Shuningdek, sanoat rivojlanishiga ta'sir etuvchi omillar tahlil qilinib, ularning o'zaro bog'liqligi va integratsiyasini ifodalovchi tizim ishlab chiqilgan. Bundan tashqari, ekonometrik modellarni tuzishning asosiy mezon va tamoyillari yoritilgan hamda sanoat rivojlanishini tahlil qilish va prognozlashda ekonometrik modellashirishning samarali vosita sifatidagi imkoniyatlari ko'rsatib berilgan.

Kalit so'zlar: sanoat rivojlanishi, ekonometrik modellashirish, tahlil, ta'sir etuvchi omillar, iqtisodiy o'sish, ijtimoiy-iqtisodiy rivojlanish.

Аннотация. В статье рассматриваются процессы исследования промышленного развития на основе эконометрического моделирования и дается комплексная характеристика основных этапов процесса моделирования. Также анализируются факторы, влияющие на промышленное развитие, и разрабатывается система, отражающая их взаимосвязь и интеграцию. Кроме того, раскрываются основные критерии и принципы построения эконометрических моделей, а также показаны возможности эконометрического моделирования как эффективного инструмента анализа и прогнозирования промышленного развития.

Ключевые слова: промышленное развитие, эконометрическое моделирование, анализ, влияющие факторы, экономический рост, социально-экономическое развитие.

INTRODUCTION

Promoting socio-economic development, maintaining macroeconomic stability, modernizing and diversifying key sectors of the regional economy—particularly industry—and improving transport and infrastructure networks remain important areas of economic development. In this context, particular attention is given to supporting industrial growth and expanding social infrastructure through the efficient allocation and effective use of domestic resources.

Further structural transformation of the economy requires stimulating the investment activity of industrial enterprises, expanding the inflow of foreign investment—particularly foreign direct investment (FDI)—and ensuring its efficient utilization. These efforts are closely associated with industrial modernization, technical and technological upgrading, and the creation of new employment opportunities. Achieving these objectives necessitates comprehensive research into the factors influencing sustainable and dynamic economic growth, as well as the development of reliable models for socio-economic development based on rigorous analytical approaches.

In the context of globalization, considerable attention is being devoted to developing the infrastructure for high-technology industrial production, increasing exports through the manufacture of high-quality and competitive products, and evaluating the efficiency of these processes. Accordingly, extensive scientific research has focused on the in-depth analysis of industrial performance indicators, the economic, econometric, mathematical, and statistical assessment of the determinants of industrial development, the improvement of evaluation methodologies, the modeling of industrial output dynamics, the forecasting of long-term development trends, and the identification of optimal strategies for reducing production costs. These areas have emerged as key priorities in contemporary industrial economics and policy research.



It should be emphasized that the position and potential of any country in the global community are largely determined by its level of socio-economic development. Achieving sustainable development requires the formulation of country-specific socio-economic development models based on domestic capabilities and external opportunities. Such models should primarily focus on meeting the material, technical, and capital requirements of key sectors of the economy, while also ensuring effective structural transformation across industries and promoting a rational and efficient investment policy.

According to economists I. Abdullayev and B. Ruzmetov, a country's economic development is determined by several interrelated components, including industrial production, labor potential, the efficient spatial distribution of productive forces, the standard of living of the population, and the effectiveness of public administration institutions [1].

Economist R. L. Thomas argues that a system of determinants plays a crucial role in economic growth. However, the combined influence of these determinants should not be interpreted as merely the arithmetic sum of their individual effects. Rather, the system encompasses internal relationships and interactions among its structural elements, generating a "system effect" that enhances the overall impact beyond the contribution of individual factors [2].

This perspective suggests that economic processes should be examined not only from an empirical standpoint but also through a quantitative assessment of the determinants of economic growth. Such an approach provides a scientific basis for developing long-term strategies aimed at sustainable socio-economic development.

According to R. Alimov and his co-authors, economists employ economic models to simplify and analyze complex economic phenomena. In constructing these models, researchers identify the most significant variables representing the phenomenon under investigation while excluding factors that have little relevance to solving the research problem [3].

R. A. Gataullin emphasizes that sustainable industrial development and economic growth require the formulation of new regional socio-economic development models. These models should account for the development trends of production complexes, facilitate purposeful structural transformation, enhance product competitiveness, and support the identification of strategic priorities for industrial development [4].

Furthermore, improving the efficiency of resource utilization in industrial sectors requires the ability to anticipate potential risks associated with emerging challenges and to develop scientifically grounded policy measures and practical solutions. A comprehensive analysis of the conditions necessary for achieving sustainable industrial growth and strengthening international competitiveness, together with the identification of quantitative relationships among industrial sectors, plays a vital role in designing effective industrial development strategies.

Analysis indicates that the factors influencing industrial development possess distinct characteristics in terms of their interdependence and the magnitude of their impact from both logical and economic perspectives. For example, the volume of industrial output is directly affected by such factors as financial and material and technical resources, labor resources, the availability of raw materials, and other production-related determinants.

However, industrial development is a complex and long-term process influenced by numerous factors with varying degrees of direct and indirect effects. These include institutional governance, a country's geographical location, environmental conditions, innovation capacity, the availability of natural and raw material resources, the intellectual potential of the labor force, and the level of development of transport and market infrastructure, among other determinants.

In developing an optimal model of industrial development, particularly under conditions of uncertainty and risk, the application of economic-mathematical methods and econometric models provides an effective analytical framework for examining economic processes and minimizing potential adverse consequences [5].

Accordingly, research aimed at improving the efficiency of the factors affecting industrial production, together with the development and application of dynamic models that adequately reflect uncertainty and risk, has gained significance not only from a theoretical perspective but also in terms of its practical value.

This is because economic theory provides a conceptual foundation for the construction of economic models capable of generalizing statistical information related to specific sectors of the economy and representing complex economic relationships through abstract indicators. Consequently, economic-mathematical models have become widely used in the analysis of economic processes, enabling researchers to estimate the values of dependent variables on the basis of changes in explanatory variables and to reveal the quantitative relationships among key economic indicators.

It can be argued that the primary objective of econometric analysis of regional industrial sectors is to develop econometric models that support the formulation of effective and optimal managerial decisions while enabling the forecasting of industrial development trends and processes affected by economic uncertainty.

Economist E. R. Berndt also emphasized in his research that, within a market economy characterized by probabilistic relationships, econometric models play a particularly important role in the analysis of regional

industrial sectors [6].

Econometric models make it possible to identify the operational characteristics of industrial systems and to predict their future behavior under changing economic conditions. This capability improves the reliability and accuracy of forecasts, thereby providing a stronger analytical basis for strategic planning. For regional industrial sectors, the ability to anticipate future developments contributes to achieving better performance, reducing the likelihood of potential losses, and minimizing economic risks.

Accordingly, the fundamental criteria for developing econometric models can be summarized as follows:

- Clearly defining and accurately formulating the research problem;
- Reducing costs while improving operational and economic efficiency;
- Incorporating risks arising from market uncertainty into the modeling framework;
- Developing alternative scenarios and identifying the optimal solution based on quantitative evaluation.

In our view, clearly defining the research objectives is a prerequisite for selecting the most appropriate analytical alternatives. Likewise, identifying the optimal solution requires careful consideration of the methods available for achieving the stated objectives and evaluating their respective advantages. Continuous comparison of alternative options in terms of costs and efficiency constitutes one of the fundamental criteria of econometric modeling. Econometric models enable researchers to assess the expected outcomes and consequences of each alternative, while simultaneously providing a basis for reducing costs, improving efficiency, and evaluating the degree to which the established objectives can be achieved.

Furthermore, econometric models should be continuously refined through repeated evaluation and revision of their underlying assumptions and criteria. Such an iterative process helps prevent the selection of inappropriate objectives and enhances the reliability of analytical results. In addition, accounting for uncertainty and assessing its potential impact on industrial performance should be conducted in accordance with established economic principles and appropriate methods for uncertainty analysis.

The process of econometric research, modeling, and analysis of regional industrial sectors is inherently complex and may be divided into several consecutive stages, as follows.

1. Problem Formulation (Defining the Research Objective).

At this stage, the research objectives are clearly specified. These may include analyzing the performance of regional industrial sectors, forecasting key industrial indicators, and assessing the effects of changes in exogenous and endogenous variables on industrial development, including the identification of potential risks and future constraints.

2. Model Specification.

Model specification refers to the mathematical representation of the relationships identified through a preliminary analysis of the economic process or object under investigation. In other words, it defines the functional form of the econometric model and the variables included in the analysis.

$$y = f(x)$$

where:

y – the dependent (result) variable;

x – the explanatory (independent) variable representing the influencing factor.

In other words, model specification can be understood as the process of selecting an appropriate functional form to describe the relationship between variables. For example, in regression analysis, once the dependent and independent variables have been identified, the researcher selects the regression function that best represents their relationship, such as a linear, quadratic, logarithmic, or other suitable functional form.

3. Model Identification (Statistical Estimation of Unknown Model Parameters).

The objective of this stage is to determine the most appropriate functional form of ($y = f(x)$) from a set of candidate models and to estimate its unknown parameters. In addition, this stage explains the relationship between the observed values of the dependent variable (y) and the corresponding values of the explanatory variables ($x_1, x_2, \dots, x_n$).

The unknown model parameters are estimated using statistical estimation techniques. Among the most widely applied methods is the Ordinary Least Squares (OLS) method, although other estimation procedures may also be employed depending on the characteristics of the model and the available data.

4. Model Validation (Quality Assessment).

The final stage involves validating the econometric model to ensure its reliability and predictive capability. Model validation is based on statistical hypothesis testing and the evaluation of the statistical properties of parameter estimates. This stage includes comparing model predictions with observed data, assessing the goodness of fit of the model, evaluating estimation accuracy, and examining its forecasting performance. These procedures ensure that the model adequately represents the underlying economic relationships and can be applied with an appropriate level of confidence for analytical and forecasting purposes.



In general, modeling represents an important scientific tool for studying economic phenomena and processes. Its primary objective is to construct an experimental model that captures the essential characteristics of a complex economic phenomenon, process, or object under investigation. Such a model provides a sound analytical basis for effective decision-making, enables the evaluation of alternative management strategies, and facilitates a deeper understanding of the behavior and development of the economic system [7].

Econometric models are developed in accordance with a set of fundamental principles that ensure their theoretical validity, empirical reliability, and practical applicability. These principles can be summarized as follows (Figure 1).

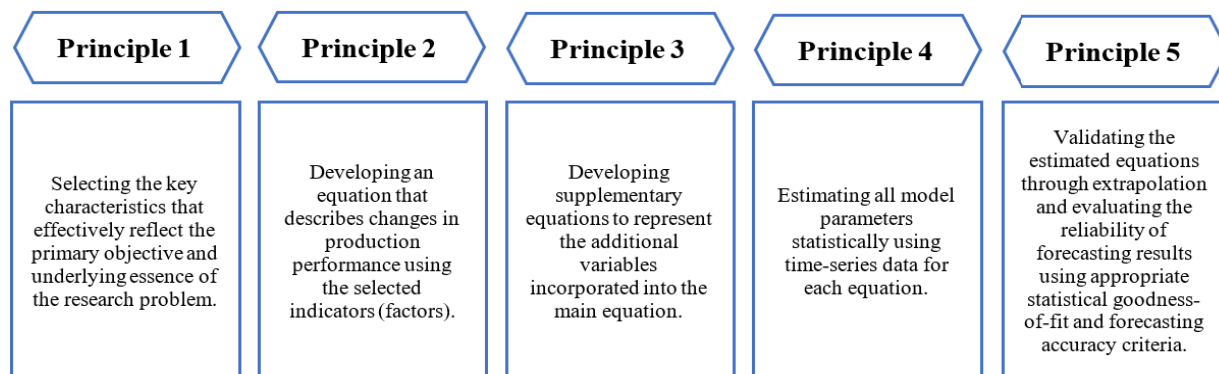


Figure 1. Principles of Econometric Modeling¹

According to T. Sh. Shodiyev and co-authors [8], economic-mathematical modeling methods, particularly econometric techniques, provide an effective means of improving the utilization of material, labor, time, and financial resources. These methods facilitate an in-depth analysis of economic phenomena and processes, reveal previously unexplored economic relationships, enable scientifically grounded forecasting of future economic development—including the development of regional industrial sectors—reduce the complexity of analytical work, and enhance the quality of managerial decision-making.

In particular, the econometric modeling of regional industrial sectors is characterized by the following features:

First, it identifies and represents the most significant relationships among economic objects and indicators of regional industrial sectors in the form of mathematical models. Since industrial systems are inherently complex, their analysis requires a high level of abstraction and simplification.

Second, given well-structured initial data and the application of deductive reasoning, econometric modeling enables researchers to derive logically consistent conclusions regarding the economic object under investigation.

Third, mathematical and statistical methods facilitate the generation of new knowledge through inductive reasoning. They make it possible to estimate both the strength and the functional form of relationships among variables based on observed empirical data, thereby improving the understanding of industrial development processes.

Fourth, the application of mathematical methods allows the principles of economic theory to be expressed more precisely and rigorously, contributing to clearer conceptualization and more accurate interpretation of theoretical propositions and empirical findings.

In our view, the most critical aspect of constructing econometric models is the appropriate selection of explanatory variables. In other words, the reliability and predictive performance of an econometric model largely depend on identifying the factors (x) that significantly influence industrial development or production output (y) and selecting those variables that have the greatest explanatory power.

CONCLUSION AND SUGGESTIONS

In conclusion, the application of econometric modeling to the analysis of industrial development provides a sound analytical basis for identifying optimal development alternatives and supporting effective decision-making. The main advantages and practical opportunities offered by econometric modeling include the following:

It ensures a comprehensive and systematic assessment of industrial performance by integrating the quantitative measurement of economic indicators with their qualitative interpretation.

It enables the validation of forecasting results by assessing their economic and statistical consistency, reliability, and practical feasibility.

¹ Compiled by the author.



It facilitates the identification and formulation of optimal industrial development strategies through the application of advanced econometric methods in the analysis of industrial sector performance.

It reveals the interrelationships among the factors influencing industrial development, allowing researchers to account for both the independent contribution of explanatory variables within a model and their interactions with other economic determinants, thereby improving the explanatory and predictive power of econometric models.

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muhandislik **& iqtisodiyot**

ijtimoiy-iqtisodiy, innovatsion texnik,
fan va ta'limga oid ilmiy-amaliy jurnal

Ingliz tili muharriri: Feruz Hakimov

Musahhih: Zokir Alibekov

Sahifalovchi va dizayner: Iskandar Islomov

2026

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"Muhandislik va iqtisodiyot" jurnali 26.06.2023-yildan
O'zbekiston Respublikasi Prezidenti Adminstratsiyasi huzuridagi
Axborot va ommaviy kommunikatsiyalar agentligi tomonidan
№S-5669245 reyestr raqami tartibi bo'yicha ro'yxatdan o'tkazilgan.
Litsenziya raqami: №095310.

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