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CONTEMPORARY TRENDS IN INDUSTRIAL DEVELOPMENT

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Abstract. The article examines contemporary trends in industrial development from economic, technological, institutional, and regional perspectives. It analyses the structural transformation of industrial production, the adoption of digital technologies, innovation activities, the reorganisation of production chains, and the evolving role of human capital. The specific features of industrial development in Uzbekistan are examined in comparison with international trends. Based on the research findings, the article proposes an analytical approach to assessing industrial development through the interrelationship among the scale of production, structural quality, technological modernisation, and economic performance, and identifies priority directions for further industrial development.

Keywords: industry, industrialisation, structural transformation, digitalisation, Industry 4.0, Industry 5.0, innovation, industrial cooperation, competitiveness, labour productivity.

Аннотация. В статье рассматриваются современные тенденции промышленного развития с экономической, технологической, институциональной и региональной точек зрения. Анализируются структурная трансформация промышленного производства, внедрение цифровых технологий, инновационная деятельность, реорганизация производственных цепочек и изменяющаяся роль человеческого капитала. Особенности промышленного развития Узбекистана рассматриваются в сопоставлении с международными тенденциями. На основе результатов исследования предложен аналитический подход к оценке промышленного развития через взаимосвязь масштабов производства, структурного качества, технологической модернизации и экономической результативности, а также определены приоритетные направления дальнейшего развития промышленности.

Ключевые слова: промышленность, индустриализация, структурная трансформация, цифровизация, Индустрия 4.0, Индустрия 5.0, инновации, промышленная кооперация, конкурентоспособность, производительность труда.

INTRODUCTION

The industrial sector plays an important role in shaping the productive capacity of the national economy, generating value added, accelerating technological modernisation, and developing foreign economic relations. The level of industrial development is closely related to a country's ability to utilise available resources effectively, stimulate investment activity, increase labour productivity, and strengthen its position in international competition. Therefore, the study of industrial development should encompass not only the quantitative outcomes of economic growth but also changes in the structure, efficiency, and technological quality of production.

In recent years, the nature of industrial development has undergone significant transformation. While the main characteristics of industrialisation were previously associated primarily with the expansion of production capacity, the establishment of new enterprises, and increases in output, contemporary industrial progress increasingly involves a broader set of qualitative indicators. The digitalisation of production processes, the expansion of automated management systems, growing demand for high-technology products, and the restructuring of global supply chains are encouraging industrial enterprises to adopt new economic and technological approaches.

These changes also influence the development strategies of industrial enterprises. Enterprise competitiveness is increasingly determined not only by product prices and production capacity but also by technological adaptability, product quality, order fulfilment speed, supply reliability, and the effective use of production data. These factors are becoming important sources of sustainable competitive advantage in

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modern industrial development.

In Uzbekistan, the diversification of industrial activities, the expansion of advanced processing of domestic raw materials, the development of industrial cooperation, and the increase in the share of high-value-added products are important priorities. At the same time, growth in production volume should be considered together with qualitative indicators of industrial development. For example, an increase in the value of industrial output may reflect both changes in prices and the expansion of production in particular resource-based industries. In such circumstances, it is important to assess structural and technological changes alongside quantitative growth indicators.

Accordingly, the purpose of this study is to systematise contemporary trends in industrial development, explain their economic significance, and develop scientific and practical recommendations aimed at further strengthening the competitiveness of Uzbekistan's industrial sector.

LITERATURE REVIEW

The contemporary characteristics of industrial development have been examined in the economic literature from the perspectives of the institutional foundations of industrialisation, technological modernisation, digital transformation, the regional organisation of production, and emerging industrial paradigms.

Uzbek economist E. Shavqiyev investigated the role of industry in the national economy, the main trends in industrial development, and the economic activities of small industrial enterprises and microfirms. The author examined the technological and economic factors influencing industrial development and emphasised the importance of the efficient utilisation of production potential [9].

N. B. Xolmatov examined new trends in industrialisation in Uzbekistan in the context of institutional changes. The study analysed special industrial zones, technology parks, the export potential of the electrical engineering industry, investment attractiveness, and factors influencing regional industrial development [11].

M. J. Saidova investigated the technological renewal and modernisation of industrial production under conditions of structural transformation. The study emphasised the importance of systematically assessing the technological condition of production capital, expanding the application of the Industry 4.0 concept, and evaluating the impact of modernisation on economic efficiency [8].

M. M. Muxtarov examined the specific characteristics of Uzbekistan's industrial development in relation to structural changes, regional specialisation, innovation, and digitalisation. The author highlighted the importance of production potential, technology transfer, the investment environment, and personnel training in supporting industrial progress [6].

Among international researchers, A. G. Frank, L. S. Dalenogare, and N. F. Ayala empirically investigated the implementation patterns of Industry 4.0 technologies in manufacturing companies. They identified interconnected directions for applying digital technologies to production processes, products, supply chains, and work organisation [1].

J. Stentoft, O. S. Mikkelsen, and K. A. Wickstrøm examined the influence of automation, changes in supply-chain conditions, and product-origin considerations on decisions to reshore manufacturing activities. Their research demonstrates that production-location decisions are shaped by a combination of technological and organisational conditions [10].

Y. Lu and co-authors investigated the concept of human-centric manufacturing within the framework of Industry 5.0. Their research addressed the improvement of human–technology interaction, the evolving role of employees in production processes, and the adaptation of technological systems to human needs [5].

S. Grabowska, S. Saniuk, and B. Gajdzik considered Industry 5.0 as an evolution of Industry 4.0 with a stronger orientation towards human well-being and sustainability. Their study paid particular attention to the social and organisational dimensions of technological transformation [2].

N. Harikannan and S. Vinodh investigated the relationship between sustainable manufacturing and Industry 4.0, summarising the effects of modern technological adoption on production systems and sustainability performance [3].

M. I. Khan and co-authors examined opportunities for integrating Industry 4.0 technologies with sustainable manufacturing and demonstrated how digital systems and advanced technologies may contribute to improving the economic and environmental performance of industrial activities [4].

The reviewed scientific literature indicates that contemporary trends in industrial development should be understood as interconnected and mutually reinforcing processes rather than isolated changes. At the same time, examining the scale of industrial production, structural quality, technological modernisation, and economic performance within an integrated analytical framework is of considerable scientific and practical importance.

RESEARCH METHODOLOGY

The study employs systematic and comparative analysis, classification, dynamic assessment of economic indicators, structural analysis, and logical generalisation. The research is based on domestic and international scientific publications addressing contemporary trends in industrial development, as well as official statistical data from Uzbekistan. An original analytical approach is developed to assess industrial progress through the interrelationship among production scale, structural transformation, technological modernisation, and economic performance.

Artificial intelligence tools were used as an auxiliary instrument for the preliminary systematisation of research materials, the structuring of selected analytical information, and the improvement of the textual presentation related to contemporary trends in industrial development, accounting for approximately 10% of the overall research process. The selection of research methods, analysis and interpretation of economic indicators, development of the analytical approach, formulation of conclusions, and preparation of scientific and practical recommendations were carried out independently by the author.

ANALYSIS AND RESULTS

The principal characteristic of contemporary industrial development is that the expansion of production is accompanied by qualitative changes in the internal structure, technological capabilities, and economic performance of industrial systems. This process reflects a gradual transition from traditional industrial production models towards development models increasingly based on knowledge, technology, data, and innovation.

Industrial development can therefore be assessed through two interconnected dimensions. The first is quantitative expansion, reflected in increases in industrial output, production capacity, the number of enterprises, and investment volumes. The second is qualitative development, encompassing improvements in labour productivity, an increasing share of high-value-added products, technological modernisation, and more efficient use of resources.

The distinction between these two dimensions is important for assessing the actual outcomes of industrial development. For example, an enterprise may increase its output by commissioning a new production line. However, if unit production costs, labour productivity, and product quality remain unchanged, the qualitative effects of such expansion may require further development.

From this perspective, contemporary trends in industrial development can be classified into the following major directions (Table 1).

Table 1
Contemporary Trends in Industrial Development and Their Economic Significance[1]

No.	Trend	Main Manifestation	Expected Economic Outcome
1	Structural transformation	Development of high-value-added manufacturing activities	Qualitative improvement in the composition of industrial output
2	Digital transformation	Digital management, automation and data analytics	Reduction in production costs and operational losses
3	Innovation-driven development	Introduction of new products and technological processes	Improvement in product quality and competitiveness
4	Reorganization of production chains	Supplier diversification and localization of production	Greater supply chain resilience
5	Regional specialization	Industrial zones, clusters, and cooperative networks	More efficient utilization of regional production potential
6	Human-centric manufacturing	Integration of technological capabilities and workforce competencies	Higher labor productivity and production flexibility
7	Sustainable manufacturing	Resource efficiency and environmentally oriented technologies	Long-term economic and environmental sustainability

The trends presented in Table 1 may emerge simultaneously or in different sequences across industrial enterprises. Their economic effects depend on sector-specific technological characteristics, investment opportunities, workforce capabilities, and prevailing market requirements.

When assessing contemporary industrial development in Uzbekistan, it is important to consider not only the volume of industrial production but also its sectoral composition and real growth dynamics.

1 Developed and systematized by the author.

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According to official data from the National Statistics Committee of the Republic of Uzbekistan, industrial output amounted to UZS 885.8 trillion in 2024 and increased to UZS 1,101.1 trillion in 2025. At the same time, the industrial production volume index reached 106.8% in 2025 (Table 2).

Table 2
Main Indicators of Industrial Production in Uzbekistan[2]

No.	Indicator	2024	2025
1	Industrial output, UZS trillion	885,8	1101,1
2	Real industrial production growth rate, %	6,8	6,8
3	Nominal growth in industrial output, %	-	24,3

As shown in the table and figure, the nominal value of industrial output increased by UZS 215.3 trillion in 2025 compared with 2024, representing nominal growth of 24.3%.

At the same time, nominal growth should be interpreted separately from changes in real production volume, since nominal values are influenced by both price dynamics and production volumes. By contrast, the officially reported real growth rate of 6.8% reflects changes in the physical volume of industrial production. Therefore, distinguishing between nominal industrial output and real production growth is important for an accurate assessment of industrial development.

The structural characteristics of industrial production also deserve particular attention. At the end of 2025, manufacturing accounted for 86.0% of total industrial production in Uzbekistan. Mining and quarrying represented 7.0%, electricity, gas, and steam supply accounted for 6.4%, while water supply and waste management activities represented 0.6%.

The substantial share of manufacturing demonstrates the dominant position of processing activities in the total value of the country's industrial output. At the same time, this indicator should be considered together with additional measures reflecting the share of high-technology products and the level of industrial innovation. Such an assessment requires further analysis of technological complexity within manufacturing, value added, export competitiveness, and labour productivity.

Consequently, improving the technological and economic quality of industrial output, alongside expanding production volumes, remains an important priority for Uzbekistan's future industrial development.

Digital transformation represents one of the most significant contemporary directions of industrial development. This process extends beyond the automation of production equipment and involves the integrated processing of information related to technological operations, management decisions, logistics, product quality, and resource utilisation.

In traditional production systems, managerial decisions have often relied on periodic reports and historical performance data. In digitally transformed industrial systems, however, it becomes possible to monitor production conditions in near real time. For example, the continuous collection of information on equipment conditions can help identify potential technical issues in advance, minimise unplanned downtime, and optimise maintenance costs.

The economic outcomes of digital technology adoption depend largely on how effectively such technologies are integrated into existing production processes. The acquisition of software or the installation of sensors on machinery represents only part of the broader digital transformation process.

Digital transformation requires three interconnected changes:

– establishing reliable data on production processes;

– using these data in managerial decision-making;

– assessing the effects of resulting decisions on production performance.

Accordingly, the economic efficiency of digitalisation should be evaluated through changes in production costs, equipment utilisation rates, product quality, and labour productivity.

Innovation in contemporary industrial development contributes not only to technological modernisation but also to the emergence of new products, services, and forms of economic activity. The economic significance of innovation-driven development extends beyond the acquisition of new technologies. The development of new products, improvement of existing technological processes, modification of production organisation methods, and implementation of managerial solutions that enhance product quality may also represent important outcomes of innovative activity.

An important distinction should be made between technological modernisation and structural transformation. Technological modernisation improves the efficiency of production processes, whereas structural transformation changes the composition of industrial output and the sectoral structure of production.

2 Compiled using data from the National Statistics Committee of the Republic of Uzbekistan.

For instance, producing an existing product at a lower cost indicates an improvement in technological efficiency. By contrast, a transition towards the production of more sophisticated products with higher value added represents a qualitative structural change.

In our view, assessing the effectiveness of innovation-driven development in Uzbekistan's industrial sector requires complementing innovation expenditure indicators with an analysis of their effects on product composition, value added, and labour productivity.

Another significant trend in industrial development is the reorganisation of production and supply chains. While enterprises operating within global production systems previously tended to locate particular technological processes in regions with relatively low costs, considerations such as supply reliability, transportation costs, technological capabilities, and production security have become increasingly important.

Under these circumstances, trends towards the geographical diversification of production, cooperation with alternative suppliers, and the location of certain manufacturing activities closer to consumer markets have become more prominent.

These developments may create additional opportunities for Uzbekistan's industrial sector. In particular, integrating domestic enterprises into international production chains, developing component manufacturing, and expanding technological cooperation with foreign companies may contribute to strengthening the competitiveness of industrial products.

At the same time, the economic effectiveness of production localisation depends on specific production and market conditions. Where domestic production is associated with relatively higher costs, differences in product quality, or insufficient production scale, additional measures may be required to improve its economic efficiency. Therefore, the selection of localisation projects should take into account production costs, product quality, technological capabilities, production scale, and long-term market demand.

Assessing contemporary industrial development solely through production volume or growth rates provides only a partial picture of its economic significance. Growth in industrial output is most informative when considered together with technological modernisation, productivity improvements, and structural diversification.

Therefore, this study proposes evaluating contemporary industrial development trends across four interconnected dimensions (Table 3).

Table 3

An Original Approach to the Comprehensive Assessment of Contemporary Industrial Development Trends[3]

No.	Assessment Dimension	Main Indicators	Economic Significance
1	Production scale	Real production growth, industrial value added	Quantitative industrial development
2	Structural quality	Share of high and medium-high-technology manufacturing, product diversification	Improvement in the composition of industrial production
3	Technological modernization	Share of innovative products, level of digital technology adoption	Technological advancement of industry
4	Economic performance	Labor productivity, capital productivity, resource intensity	Efficiency of production factor utilization

The principal characteristic of the proposed approach is the integrated assessment of both quantitative and qualitative indicators of industrial development. Accordingly, the expansion of production scale is regarded as an important component of industrial progress, while its full evaluation also requires consideration of structural, technological, and economic quality indicators.

To summarise the development of a particular industry or region across these dimensions, the following integrated assessment model may be applied:

$$I_{SR} = \sum_{j=1}^{4} \omega_j I_j , \quad \sum_{j=1}^{4} \omega_j = 1 \qquad (1)$$

where: I_{SR} - integrated industrial development index; I_1 - production scale index; I_2 - structural quality index; I_3 - technological modernization index; I_4 - economic performance index; ω_j - weight coefficient reflecting the relative importance of the corresponding dimension.

Since the indicators are expressed in different units of measurement, normalisation is required before aggregation. For benefit-type indicators, min–max normalisation is applied as follows:

3 Developed by the author.

$$z_{ij} = \frac{x_j - x_j^{\min}}{x_j^{\max} - x_j^{\min}} \quad (2)$$

For cost-type indicators, where lower values are considered preferable, such as resource consumption per unit of output, reverse min–max normalisation is applied as follows:

$$z_{ij} = \frac{x_j^{\max} - x_j}{x_j^{\max} - x_j^{\min}} \quad (3)$$

Here, x_{ij} denotes the value of the corresponding indicator for the assessed unit, while $x_j^{\min}$ and $x_j^{\max}$ represent the minimum and maximum values within the comparison dataset.

If the minimum and maximum values are equal, the corresponding indicator shows no variation; in such cases, an appropriate alternative normalisation rule should be specified. Furthermore, when comparing regions or years, it is important to apply consistent normalisation boundaries in order to ensure comparability of the results.

Weight coefficients may be determined using expert assessment, the Analytic Hierarchy Process (AHP), or the entropy weighting method. Since the weights obtained through these approaches may have different economic interpretations, the choice of weighting method should be aligned with and justified by the objectives of the study.

The proposed model is currently conceptual and methodological in nature. Its practical application would benefit from the development of a comprehensive database of indicators across industries or regions, the substantiation of weighting coefficients, and sensitivity analysis of the resulting assessments (Figure 1).

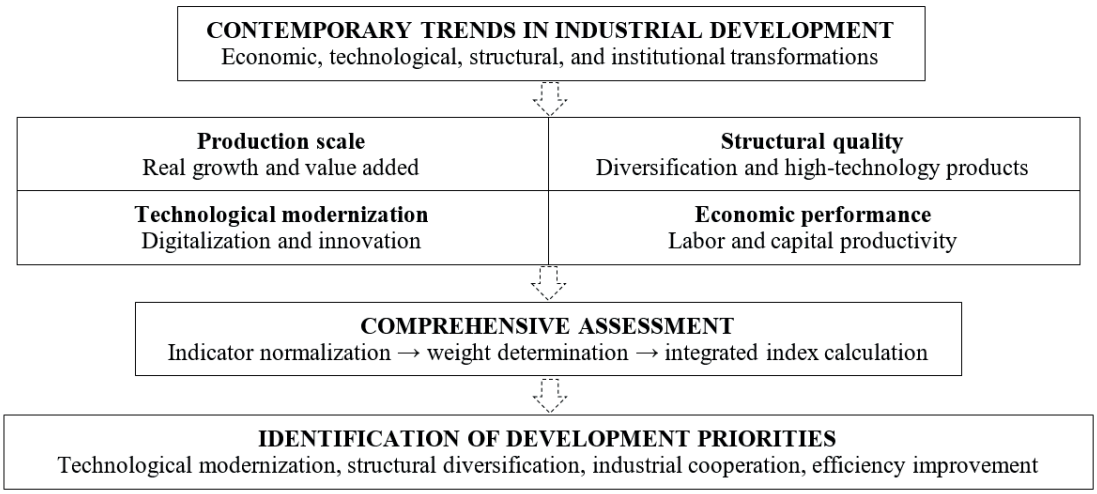


Figure 1. Conceptual model for the comprehensive assessment of contemporary industrial development trends and the identification of priority directions[4]

This model may serve not only to assess the level of industrial development but also to identify areas in which existing economic potential can be utilised more effectively.

For example, if a region with substantial industrial output demonstrates comparatively modest levels of technological modernisation, industrial policy may reasonably prioritise the upgrading of existing enterprises alongside further capacity development. Conversely, in regions with considerable technological potential but a relatively smaller production scale, attracting investment, expanding industrial cooperation, and entering new markets may become priority objectives.

To ensure that Uzbekistan's industrial sector develops in line with contemporary trends, policies aimed at expanding production volumes should be combined with measures designed to improve the technological and structural quality of industrial activities.

4 Developed by the author.

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First, modernisation priorities should be identified through a comprehensive assessment of the technological capabilities of individual industries. Such an assessment should take into account the technical condition of existing production equipment, energy and material consumption, capacity utilisation, and product quality.

Furthermore, the introduction of digital technologies into industrial enterprises should be linked to clearly identified economic objectives within production processes. The selection of digitalisation projects should primarily be based on their potential to reduce production costs, improve equipment utilisation, enhance production continuity, and increase the responsiveness of managerial decision-making.

In regional industrial development, it is important to assess available resources, production infrastructure, skilled labour, and opportunities for inter-enterprise cooperation in an integrated manner. Such an approach can contribute to providing a stronger economic justification for the territorial distribution of industrial production.

In addition, particular attention should be paid to the development of human capital within industrial enterprises. The economic benefits of modern technologies depend to a significant extent on the availability of specialists capable of using them effectively. Consequently, technological modernisation programmes should be coordinated with measures aimed at developing employees' professional competencies.

As a result, the contemporary model of industrial development may be conceptualised as an interconnected system combining the expansion of production capacity, technological modernisation, structural diversification, and human capital development.

CONCLUSION AND RECOMMENDATIONS

The study demonstrates that contemporary trends in industrial development are reflected not only in increasing production volumes but also in technological, structural, institutional, and organisational transformations. Digital transformation, innovation-driven development, the restructuring of global production chains, and human-centric manufacturing principles are becoming important determinants of the qualitative dimensions of industrial progress.

The real growth rate of industrial production in Uzbekistan reached 6.8% in 2025, while manufacturing accounted for 86.0% of total industrial output, indicating the sector's considerable importance to the national economy. At the same time, a comprehensive assessment of industrial development also requires consideration of the technological complexity, innovation potential, and efficiency of production factor utilisation within the industrial sector.

Based on the research findings, the following scientific and practical recommendations are proposed:

1. Assess industrial development by combining indicators of production volume and real growth with measures of structural quality, technological modernisation, and economic performance.

2. Select digital transformation projects in industrial enterprises according to their potential contribution to production efficiency and evaluate their economic outcomes using clearly defined performance indicators.

3. Improve the technological composition of industrial production and strengthen innovation performance in order to expand the production of high-value-added goods.

4. Develop industrial cooperation and production localisation projects with due consideration of production costs, product quality, technological capabilities, and market demand.

5. Assess regional industrial potential through the integrated consideration of production infrastructure, investment opportunities, workforce capabilities, and inter-industry linkages.

6. Empirically test the proposed integrated index for the comprehensive assessment of contemporary industrial development trends across four dimensions: production scale, structural quality, technological modernisation, and economic performance.

In conclusion, the future development of the industrial sector depends on effectively combining quantitative production expansion with qualitative modernisation. Improving economic efficiency, strengthening technological capabilities, and diversifying the structure of industrial production should therefore be regarded as key directions for enhancing the long-term competitiveness and sustainability of industry.

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