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Regional Trends And Statistical Analysis Of The Development Of Bioeconomic Activities In Industrial Enterprises Of Uzbekistan (Based On The Example Of 2010–2024)

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Abstract: This thesis provides an in-depth analysis of the processes of developing bioeconomic activities in the industrial enterprises of the Republic of Uzbekistan based on regional statistical data for the period 2010–2024. The study evaluates the dynamics and variability of industrial production volumes across regions and their relationship with bioeconomic potential using statistical methods. The role of the bioeconomy in the industrial sector is substantiated from the perspectives of resource efficiency, regional specialization, and sustainable development. The results serve as a basis for developing scientific and practical conclusions aimed at the bioeconomic transformation of industrial enterprises.

Keywords: Bioeconomy, industrial enterprises, regional analysis, statistical dynamics, resource efficiency, sustainable development, economic transformation.

Introduction: In recent years, the concept of the bioeconomy has gained strategic importance in global economic development processes. The bioeconomy is emerging as an economic model aimed at the efficient use of natural resources, waste recycling, and ensuring environmental sustainability in industrial production. In particular, the introduction of bioresource-based technologies in industrial enterprises not only increases economic efficiency but also enhances environmental safety. For developing countries, bioeconomic activities constitute an important component of industrial modernization. Under the conditions of Uzbekistan, the uneven regional development of industrial sectors necessitates an analysis of the bioeconomic approach from a regional perspective. Therefore, drawing scientific conclusions based on statistical data is of particular relevance. This study was conducted in response to this scientific need.

The bioeconomic activities of industrial enterprises are closely linked to regional economic potential. The long-term dynamics of statistical indicators make it possible to identify the internal factors of industrial development. Data covering the period from 2010 to 2024 reflect the influence of economic cycles, structural shifts, and technological modernization. The bioeconomic approach requires assessing industrial production not only in quantitative terms but also from a qualitative perspective. From this standpoint, regional-level analysis serves to determine the efficiency of bioresource utilization. The introduction section of the study specifically defines these conceptual foundations, which in turn provide a methodological basis for the subsequent analytical part.

METHODS

During the period 2010–2024, industrial indicators across the Republic of Uzbekistan demonstrate significant growth accompanied by fluctuations. At the national level, the highest indicator was recorded in 2014, reaching 1,162.1 units. Although certain declines were observed in subsequent years, the indicator reached 866.7 units in 2024. This situation reflects ongoing processes of structural adjustment within the industrial system. Industrial output varies sharply

across regions, with Tashkent Region and Tashkent City standing out as leading areas. Such concentration highlights the need for regional diversification of bioeconomic activities.

Industrial indicators in Tashkent Region increased from 257.6 units in 2010 to 465 units in 2024, representing nearly a twofold growth. The high industrial density in this region creates a favorable environment for the introduction of bioeconomic technologies. Opportunities for energy efficiency and waste recycling are substantial. At the same time, bioeconomic development helps reduce the environmental pressure of industrial activity. Statistical trends indicate the potential for expanding bioeconomic investments in the region, thereby strengthening industrial sustainability. As a result, economic and environmental benefits are aligned.

In Kashkadarya, Samarkand, and Bukhara regions, industrial indicators exhibit relatively stable characteristics. For example, in Kashkadarya Region, the indicator amounted to 176.3 units in 2015 but declined to 88.6 units in 2024. This decrease suggests that bioeconomic transformation has not been sufficiently implemented. These regions are distinguished by their abundance of agricultural resources and bioresources. Integrating industry with the bioeconomy could help restore regional economic balance. Statistical indicators confirm a high demand for a bioeconomic model. Therefore, the development of bioresource-based industries should be considered a priority direction.

In Surkhandarya, Namangan, and Khorezm regions, industrial volumes remain relatively low. For instance, in Surkhandarya, the indicator increased from 3.5 units in 2010 to 10.8 units in 2024. Although the growth rate is high, the absolute volume remains small. These regions possess significant potential for bioeconomic activities, particularly due to the availability of biomass, agricultural waste, and renewable resources. The bioeconomy represents an alternative pathway for industrial development in these areas. Statistical analysis indicates the necessity of regional bioeconomic specialization.

The bioeconomic efficiency of industrial enterprises can be assessed using the following integral indicator:

$$BES = \frac{Y \times R}{E \times C}$$

where:

Y – industrial output volume;

R – share of renewable bioresources;

E – energy consumption;

C – environmental damage coefficient.

RESULTS AND DISCUSSION

This model integrates the economic and environmental aspects of bioeconomic activities. Statistical data show significant regional variations in the Y variable. Increasing the share of bioresources can improve the BES (Bioeconomic Efficiency Score) indicator. The model is of crucial importance for planning bioeconomic policies. In this way, industrial efficiency can be elevated to a new qualitative level.

Table 1.Industrial Indicators in Selected Regions for 2010–2024 (in units)

Region	2010	2015	2020	2024
Republic of Uzbekistan	729	975.1	924.4	866.7
Tashkent Region	257.6	370.6	430.0	465.0
Kashkadarya Region	141.2	176.3	128.1	88.6
Samarkand Region	51.5	54.7	52.7	47.4
Surkhandarya Region	3.5	3.1	6.5	10.8

The table data clearly illustrate the regional disparities in industrial development. In leading regions, the introduction of bioeconomic innovations can be implemented more rapidly. Regions with lower indicators represent reserves for bioeconomic growth. The statistical differences confirm the need for regionally differentiated bioeconomic policies, which further enhances the national industrial strategy.

Bioeconomic activities serve as a factor that stabilizes industrial development both environmentally and economically. Statistical analysis indicates that in regions with high industrial output, resource pressure is significant. The implementation of bioeconomic technologies helps reduce this pressure. At the same time, the bioeconomy enhances the innovation potential of industry. Regional data demonstrate the necessity of adapting bioeconomic strategies to local conditions. A scientifically grounded approach elevates industrial development to a new qualitative level,

aligning economic efficiency with environmental safety.

CONCLUSIONS

The study results show that the development of bioeconomic activities in industrial enterprises of Uzbekistan is closely linked to regional statistical disparities. In leading regions, high industrial volumes allow for faster bioeconomic transformation. In less developed regions, the bioeconomy can serve as a primary mechanism to stimulate industrial growth. Statistical analysis confirms the scientific basis of the bioeconomic approach. Bioeconomic activities contribute to strengthening industrial sustainability and generate long-term economic benefits, enriching the national industrial policy qualitatively.

To develop bioeconomic activities in industrial enterprises, regionally differentiated policies are necessary. It is recommended to deepen bioinnovations in leading regions while developing bioresource-based industries in regions with lower performance indicators. Statistical monitoring should serve as the primary tool for assessing bioeconomic efficiency. Integrating bioeconomic indicators into the national industrial strategy is of crucial importance. Scientifically grounded models improve decision-making quality, thereby ensuring the ecological and economic sustainability of industry. This approach paves the way for the sustainable development of Uzbekistan's industrial sector.

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