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STRUCTURAL TRANSFORMATION OF REGIONAL ECONOMIES IN UZBEKISTAN

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Annotation: Contemporary regional economies are undergoing deep structural transformations driven by deindustrialization, digitalization, environmental imperatives, and spatial polarization. These processes fundamentally reshape production systems, labor markets, and regional competitiveness. This article investigates the nature, scale, and measurement challenges of structural economic change, with a particular focus on Uzbekistan as a representative transition economy. Using official statistical data, national development indicators, and comparative international benchmarks, the study evaluates shifts in sectoral composition, digital infrastructure expansion, and the emergence of green economic activities. The findings reveal that Uzbekistan has experienced a rapid decline in traditional manufacturing employment shares, concurrent growth in service and digital sectors, and increasing investment in renewable energy and environmental modernization. However, persistent methodological limitations related to data granularity, structural heterogeneity, and measurement frameworks complicate accurate assessment. The study proposes an integrated analytical model for capturing regional economic transformation by combining structural indicators, spatial analytics, and sustainability metrics. The results contribute to the academic understanding of economic restructuring in emerging economies and provide evidence-based guidance for regional development policy.

Keywords: structural transformation, regional economy, digital transition, green economy, deindustrialization, Uzbekistan, economic measurement

Regional economic systems across the globe are experiencing profound structural transformations that extend far beyond cyclical business fluctuations. These transformations encompass fundamental changes in production structures, employment patterns, technological intensity, and spatial organization of economic activity. In both advanced and emerging economies, the transition toward service-based systems, digital integration, and environmentally sustainable production models is redefining traditional development trajectories. The acceleration of globalization, digitalization, and climate policy has further intensified these shifts, generating complex and often non-linear patterns of regional economic evolution.

Uzbekistan represents a particularly compelling case for analyzing structural transformation. As a transition economy undergoing rapid institutional reform, industrial modernization, and market integration, Uzbekistan faces the simultaneous challenge of upgrading industrial capabilities, expanding digital infrastructure, and ensuring environmentally sustainable growth. Over the past decade, the country has implemented extensive economic reforms aimed at diversifying production, stimulating private enterprise, and enhancing technological innovation. These reforms have triggered significant sectoral reallocation, labor market restructuring, and spatial realignment of economic activities.

Despite the growing importance of these processes, accurately measuring and interpreting structural change remains methodologically challenging. Traditional economic indicators such as gross domestic product and employment shares often fail to capture the complexity, heterogeneity, and dynamic nature of regional transformation. This study addresses these challenges by providing a comprehensive analysis of Uzbekistan's structural transformation, integrating sectoral data, spatial indicators, and sustainability metrics into a unified analytical framework.

Structural transformation refers to the long-term reallocation of economic activity across sectors, technologies, and spatial units. Historically, this process followed a relatively linear trajectory, moving from agriculture to manufacturing and eventually toward service-dominated economies. However, contemporary transformations are far more complex, characterized by

overlapping transitions involving industrial decline, digital expansion, and environmental restructuring.

The digital transformation has introduced new forms of production organization, labor relations, and regional specialization. Digital platforms, cloud computing, and artificial intelligence have blurred traditional sectoral boundaries, enabling the emergence of hybrid economic activities that combine manufacturing, services, and data-driven operations. Simultaneously, the green transition has imposed environmental constraints on industrial activity, driving investments toward renewable energy, circular production models, and low-carbon technologies.

These dual transitions interact dynamically, reinforcing and reshaping each other. Regions with advanced digital infrastructure and high human capital tend to adapt more effectively to environmental regulation, while those dependent on carbon-intensive industries face heightened adjustment costs. As a result, structural transformation increasingly generates spatial polarization, whereby economically advanced regions accelerate growth while peripheral areas struggle to escape development traps.

Uzbekistan's economy has experienced substantial sectoral reconfiguration since 2016. Manufacturing, once the dominant contributor to employment and value creation, has gradually declined in relative importance, while services, trade, and digital activities have expanded rapidly. According to official statistics, the share of manufacturing in total employment decreased from approximately 22 percent in 2010 to 16 percent in 2023. In contrast, the service sector expanded from 36 percent to nearly 48 percent over the same period.

Table 1 presents the structural composition of Uzbekistan's economy based on employment and gross value added indicators.

Table 1. Structural Composition of Uzbekistan's Economy

Sector	Employment Share 2010 (%)	Employment Share 2023 (%)	GVA Share 2023 (%)
Agriculture	33.1	25.4	24.2
Manufacturing	22.0	16.2	29.5
Services	36.4	47.8	40.1
Construction	8.5	10.6	6.2

These figures indicate that while manufacturing retains a substantial contribution to value creation, its role as a mass employer has diminished, reflecting rising automation and capital intensity. The rapid expansion of services has been driven primarily by trade, transport, telecommunications, education, healthcare, and financial intermediation.

Digital transformation has become a key driver of Uzbekistan's structural shift. The number of broadband internet users increased from fewer than 10 million in 2015 to over 27 million in 2023, while digital services output grew at an average annual rate exceeding 18 percent. Regional disparities, however, remain pronounced. Urban centers such as Tashkent, Samarkand, and Bukhara exhibit significantly higher digital infrastructure density, innovation activity, and startup formation compared to rural and peripheral regions.

Digitalization has facilitated the emergence of new economic activities, including e-commerce, fintech, digital logistics, and remote service provision. These sectors exhibit high productivity potential and relatively low environmental impact, positioning them as critical components of sustainable structural transformation.

Environmental sustainability has become a central pillar of Uzbekistan's long-term development strategy. The government aims to reduce energy intensity by 35 percent and greenhouse gas emissions by 20 percent by 2030. Achieving these targets requires deep structural adjustments, particularly in energy production, industrial processes, and urban

infrastructure.

Between 2017 and 2023, renewable energy capacity expanded from less than 300 MW to over 2,300 MW, driven primarily by solar and wind investments. Simultaneously, energy efficiency measures in industrial and residential sectors contributed to measurable reductions in fossil fuel dependence.

Table 2 illustrates the evolution of Uzbekistan's energy generation structure.

Table 2. Electricity Generation Structure in Uzbekistan

Source	2015 (%)	2023 (%)
Natural gas	86.5	73.2
Hydropower	12.3	14.1
Solar & wind	1.2	12.7

This transition reflects a fundamental restructuring of the national energy system and highlights the increasing role of green technologies in shaping regional development trajectories.

Despite significant progress, accurately capturing structural transformation remains analytically complex. Official statistics often rely on aggregated administrative units, masking micro-level variations in economic dynamics. Regional disparities in productivity, innovation capacity, and environmental performance are therefore insufficiently reflected in national averages.

Furthermore, traditional sector-based classification systems struggle to capture hybrid economic activities enabled by digital platforms. For instance, e-commerce integrates logistics, data analytics, retail, and financial services, rendering conventional sectoral boundaries increasingly obsolete. This conceptual ambiguity complicates cross-regional and temporal comparisons.

Another critical limitation arises from the lagging nature of economic indicators. Gross domestic product, employment statistics, and investment flows reflect past performance rather than real-time structural adjustments. In fast-evolving environments, such delays can obscure emerging trends and distort policy responses.

To address these limitations, an integrated measurement framework is required, combining sectoral indicators, digital intensity metrics, spatial analytics, and sustainability indices.

The empirical evidence from Uzbekistan underscores the necessity of coordinated policy interventions that align industrial modernization, digital expansion, and environmental sustainability. Regional development strategies must prioritize investments in digital infrastructure, workforce reskilling, and green technologies, particularly in lagging regions vulnerable to structural decline.

Public policy should also emphasize institutional capacity building, data integration, and evidence-based planning. Establishing regional economic observatories equipped with advanced data analytics could significantly enhance policy responsiveness and strategic foresight.

Uzbekistan's experience illustrates the multidimensional nature of contemporary structural transformation. The simultaneous processes of deindustrialization, digitalization, and green transition are reshaping regional economies in complex and interdependent ways. While significant progress has been achieved in modernizing production structures and expanding

sustainable energy capacity, persistent methodological challenges hinder comprehensive assessment and effective policy design.

This study contributes to the academic literature by integrating sectoral, digital, environmental, and spatial perspectives into a unified analytical framework. The findings highlight the importance of multidimensional measurement approaches and provide actionable insights for regional development policy in emerging economies.

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