

DIRECTIONS FOR DEVELOPING A REGIONAL INDUSTRIAL DEVELOPMENT STRATEGY BASED ON ECONOMETRIC MODELS IN UZBEKISTAN

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1. Abstract

The transition of the Republic of Uzbekistan toward a high-output industrial economy constitutes the bedrock of the national "Uzbekistan-2030" strategy, necessitating a paradigmatic shift from qualitative governance to advanced econometric forecasting. This research synthesizes a strategic framework for the Surkhandarya region, a pivotal southern industrial node that, despite demonstrating resilient growth, currently contributes only 1.4% to the national industrial aggregate. To address this disparity, we deploy a sophisticated methodological apparatus integrating Multiple Linear Regression for macroeconomic benchmarking, Complex Number Modeling to capture auxiliary economic dimensions, and ARIMA (1, 1, 0) for temporal forecasting. By analyzing longitudinal data from 2010 to 2024, the study identifies critical efficiency tiers—ranging from a resource-bound 21.1% to a harmonized optimal effect of 54.7%—and classifies the region's districts into specific developmental strata. The implementation of complex number modeling proves transformative, utilizing imaginary units to represent non-primary capital and management labor, thereby revealing hidden cross-sectoral dependencies. Our results indicate that while national GDP is highly responsive to investment, regional industrial output requires targeted structural interventions in "activity levels" to realize a forecasted 1.3-fold increase by 2028. This document provides actionable policy directions for establishing youth entrepreneurship zones and industrial clusters to catalyze sustainable regional optimization.

2. Keywords

Industrialization, Econometric Models, ARIMA, Complex Number Theory, Uzbekistan-2030, Strategic Clustering, Regional Development, Macroeconomic Forecasting, Structural Policy.

3. Introduction: Industrial Policy and the 'Uzbekistan-2030' Strategic Framework

The contemporary global economic order increasingly privileges states that master the intersection of technological innovation and strategic industrial placement. As an expert



econometrician and strategist, it is imperative to view industrialization not merely as a sectoral objective, but as the primary endogenous driver of comprehensive social welfare and systemic economic stability. On a global scale, the correlation between industrial volume and sovereign wealth is undeniable; for instance, the United States maintained a GDP of 25,463 billion USD in 2022, a figure underpinned by the high-velocity movement of its industrial business entities. For Uzbekistan, mirroring this success requires a shift from raw-material extraction to high-value-added processing, a goal explicitly codified in the "Uzbekistan-2030" strategy.

Global Trends

In the international arena, the fourth industrial revolution has redefined the competitive landscape. Developed nations no longer rely on labor-intensive manufacturing but on innovation-led "smart" industrial potential. China's "Made in China 2025" roadmap and Japan's focus on sustainable heavy processing industries demonstrate that modern industrial policy is synonymous with technical planning and technological structure optimization. These global benchmarks suggest that regional development must be integrated into international export markets while maintaining a rigorous monitoring of "smart" potential. The shift toward digital-industrial integration allows nations to minimize the stochastic errors often found in traditional resource-management models, providing a more stable trajectory for long-term growth.

National Strategy

Uzbekistan's domestic policy has responded to these global shifts with unprecedented institutional vigor. The "New Uzbekistan Development Strategy" (2022-2026) and the subsequent "Uzbekistan-2030" framework serve as the architectural blueprint for this transformation. Over a recent six-year horizon, the nation's population expanded by 13%, while the count of industrial enterprises surged from 45,000 to approximately 100,000 units—a 122% increase in industrial density. This expansion is governed by a robust legislative framework, including Presidential Decree PF-60, which prioritizes regional socio-economic development, and PQ-331, focusing on the decentralization of industry into neighborhood (mahalla) micro-centers. This "micro-industrialization" strategy seeks to utilize local human capital while diversifying the industrial base across 24 distinct sub-sectors, ranging from food processing and textiles to the manufacturing of complex machinery and pharmaceutical products.

Theoretical Background

The modeling of regional industrial systems is an academic and practical endeavor enriched by decades of spatial economic theory. Internationally, the works of Rahatulain and Salaheddine have explored the dependencies between product development and industrial case studies, while Fujita, Krugman, and Venables established the foundations of the "Spatial Economy," highlighting how cities and regions function as nodes of

international trade. In the post-Soviet context, the regional economic diagnostics of Dmitrieva and the institutional analyses of Zubarevich have provided essential tools for understanding transitional economies. Locally, the contributions of Academician S.S. Gulomov and Professor B.T. Salimov have been instrumental in modeling the production potential of Uzbekistan's specific territories. This research extends these theoretical foundations by applying high-order econometric tools to the Surkhandarya region, moving beyond static linear assumptions to incorporate the dynamic and auxiliary variables necessitated by modern regional strategic planning.

4. Methodology: Advanced Econometric Approaches

To achieve a scientifically rigorous assessment of Surkhandarya's industrial trajectory, this framework utilizes three specialized mathematical structures. We must distinguish between national macroeconomic models and regional-specific industrial elasticity to avoid the pitfalls of aggregation bias.

Multiple Linear Regression (OLS): National Benchmarking

Before analyzing regional specifics, we establish the national context using an Ordinary Least Squares (OLS) approach. Based on the work of Karshiev (2025), the relationship between Uzbekistan's national GDP (Y) and its primary drivers—Investment (X_1) and Employment (X_2)—is expressed through the following linear model:

$$Y = 2.1X_1 + 66.003X_2 - 744823$$

In this macro-model, X_1 represents investment in fixed capital (billion soums) and X_2 represents the thousand-count of persons employed. While this provides a snapshot of national sensitivity, regional strategists must utilize logarithmic transformations to understand elasticity, which minimizes the impact of heteroscedasticity and non-normality in time-series data.

Complex Number Modeling: Capturing Auxiliary Dimensions

Standard real-number models often fail to account for the "imaginary" or auxiliary dimensions of a regional economy, such as the qualitative impact of management or non-primary capital dependencies. Using the methodology of Saatmurotov (2024), we employ a complex number model to represent the industrial system:

$$G + iC = (a_0 + ia_1)(K_0 + iK_{\nu})^{\alpha}(L_0 + iL_{\nu})^{1-\alpha}$$

Model Parameters:

- G : Gross income (the Real part of the industrial output).
- C : Total expenditures/costs (the Imaginary part, representing resource drain).
- K_0 : Fixed capital (primary assets).
- K_{ν} : Auxiliary capital (non-primary infrastructure and support funds).
- L_0 : Primary labor (main workforce engaged in production).
- L_{ν} : Non-primary labor (management, R&D staff, and auxiliary personnel).
- α : Elasticity coefficient of capital (calculated at **0.57** for Surkhandarya).

- $1-\alpha$: Elasticity coefficient of labor (calculated at **0.43**).
- i : The imaginary unit ($\sqrt{-1}$), used to differentiate auxiliary economic dimensions and secondary sectoral linkages.

The economic logic behind the imaginary unit i is profound: it allows the strategist to monitor the efficiency of the "shadow" or support structures of an industrial zone. A high imaginary component in the elasticity of labor suggests that management quality is the dominant factor in output variation, a critical insight for governors in "Low Efficiency" (21.1%) zones.

ARIMA (Autoregressive Integrated Moving Average)

For temporal forecasting, we utilize an ARIMA (1, 1, 0) model. This specific configuration indicates a first-order autoregressive process ($p=1$) applied to a once-differenced series ($d=1$) to achieve stationarity, with a zero moving-average order ($q=0$). The model for Surkhandarya's industrial output is:

$$\Delta \text{Industrial_Product}_t = 657.886 + 0.604 * \Delta \text{Industrial_Product}_{t-1} + \epsilon_t$$

Parameters:

- Δ : The differencing operator used to remove non-stationary trends.
- **657.886**: The constant representing the mean periodic growth.
- **0.604**: The autoregressive coefficient (ϕ_1), demonstrating that 60.4% of the previous period's growth momentum is sustained in the current period.
- ϵ_t : The stochastic error term or "innovation" representing unpredictable shocks.

5. Results and Analysis: Regional Dynamics and Surkhandarya Case Study

The data reveals a stark disparity between industrial leaders and emerging regions. As of late 2025, Tashkent City led with 184.4 trillion soums in industrial output, while Surkhandarya recorded 16.1 trillion soums. However, growth rate analysis shows Surkhandarya's resilience.

Regional Industrial Growth Rates (2012–2022)

Region	2012	2014	2016	2018	2020	2022
Uzbekistan (Total)	105.7%	104.5%	105.4%	110.8%	100.9%	105.3%
Tashkent City	112.3%	115.5%	111.5%	110.2%	100.2%	106.3%
Navoiy Region	101.3%	102.9%	101.2%	101.8%	109.1%	106.1%
Surkhandarya Region	106.1%	111.0%	106.5%	106.0%	106.7%	104.2%

Surkhandarya District Classification and Vitality Analysis

To optimize policy, we must segment the region based on the Industrial Development Index and the **Vitality Coefficient (YA)**.

Development Tier	Districts	Statistical Highlights
Stable Development	Termiz city, Jarqo'rg'on, Sho'rchi, Sariosiyo	Jarqo'rg'on: 14.2% share of regional output.
Low Development	Qumqo'rg'on, Sherobod, Denov, Uzun, Muzrabod	Termiz District: High YA but low output growth.
Needing Development	Qiziriq, Oltinsoy, Angor, Bandixon, Boysun	Oltinsoy: Growth rate fell to 88.7% in 2022.

Our econometric analysis confirms that in Surkhandarya, a 1% increase in investment (X_1) results in a 0.58% increase in output, whereas a 1% increase in the Activity Level (FA) of enterprises leads to a significant 3.6% increase in the real value of industrial output. This suggests that the region's bottleneck is not a lack of capital, but the operational "activity" and "survival" (yashovchanlik) of its business entities.

6. Discussion: Optimizing SEZs and Industrial Clustering

The disparity between a region's potential and its output is often found in the "organizational-economic mechanism." To move from the current state to the Uzbekistan-2030 targets, we must navigate the efficiency tiers identified in the research.

Efficiency Tiers and Imaginary Parameters

- **Low Efficiency (21.1%):** Dominant in districts like Oltinsoy and Qiziriq. Characterized by raw resource export and a negligible L_{ν} (imaginary labor/management) contribution.
- **Medium Efficiency (38.9%):** Found in districts with external capital influx (Sherobod, Denov). Efficiency is hindered by lack of "strategic partnership" depth.
- **High/Harmonized Efficiency (54.7%):** The goal for the "Uzbekistan-2030" framework. This tier requires the a_0+ia_1 parameters of our complex model to reach a synergistic balance, where costs (C) are minimized through auxiliary capital (K_{ν}) optimization.

Strategic Recommendations for Regional Governors

- **The "Value Chain" (Qoshimcha Qiymat Zanjiri) Integration:** The textile sector in Surkhandarya saw its share grow from 33% to 43% between 2010 and 2023. Strategic focus must shift toward full-cycle textile clusters, moving from fiber to finished apparel within the region.
- **Youth Entrepreneurship and Industrial Zones:** Implementation of Decree VI-38-116-8-0-K/21 is critical. These zones must act as incubators for the 24 industrial types, specifically targeting districts in the "Needing Development" tier.
- **Cross-Regional Synergy:** Strategists should facilitate projects where Surkhandarya's resource potential (agriculture/minerals) is processed using the technological infrastructure of industrial leaders like Tashkent or Navoiy.

- **Optimization of the Vitality Coefficient:** Since enterprise activity correlates so strongly with real output (3.6:1 ratio), policy must prioritize the survival rate of new SMEs through tax holidays and infrastructure subsidies in industrial micro-centers.

7. Conclusion

The industrial modernization of Surkhandarya is a complex multi-factor process that requires the rigorous application of econometric modeling. Our analysis confirms that the region possesses significant untapped potential, currently localized in the textile and food processing sectors.

The final forecast, derived from the ARIMA (1, 1, 0) model, indicates that the industrial output in Surkhandarya is expected to increase 1.3 times by 2028 compared to 2023 levels. This growth is contingent upon the successful transition of the regional economy from a "Low" efficiency tier of 21.1% toward a harmonized optimal effect of 54.7%. A critical finding of this study is that the "Activity Level" of enterprises is a more potent driver of growth (3.6% impact) than fixed capital investment alone (0.58% impact). Therefore, regional management must prioritize the qualitative dimensions of industry—management labor (L_{ν}) and auxiliary capital (K_{ν})—as revealed by our complex number modeling. By implementing the value chain approach and optimizing industrial zones, Surkhandarya can successfully contribute to the overarching national goals of the "Uzbekistan-2030" strategy.

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