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STRATEGIC DIRECTIONS FOR ORGANIZATIONAL–INSTITUTIONAL AND FINANCIAL–ECONOMIC TRANSFORMATION OF THE NATIONAL INNOVATION SYSTEM: EVIDENCE FROM UZBEKISTAN

B. F.Azimov

Asia international university, Bukhara, Uzbekistan

Abstract

In the context of the modern global economy, the effectiveness of a national innovation system (NIS) has become a decisive factor in ensuring long-term competitiveness and sustainable economic growth. This article examines the priority strategic directions for the organizational–institutional and financial–economic transformation of Uzbekistan's national innovation system. The study integrates institutional analysis with empirical data covering the period 2015–2023 and applies forecasting tools, including linear trend models and a multifactor regression model, to assess innovation performance for 2024–2027. The results reveal a structural imbalance between the rapid quantitative expansion of innovation infrastructure and the weakening qualitative indicators related to human capital, R&D institutions, and investment intensity. While time-series trend analysis suggests potential stagnation of innovation activity, the multifactor regression model demonstrates that stabilizing key drivers—scientific institutions, human capital quality, and investment share—can generate sustained growth in innovation output. The findings highlight the critical role of coordinated institutional reforms, public–private partnerships, venture financing mechanisms, and human capital development in strengthening the national innovation ecosystem. The paper provides policy-relevant recommendations aimed at enhancing innovation efficiency and ensuring the transition from extensive to intensive innovation-driven growth in Uzbekistan.

Keywords

national innovation system; institutional transformation; innovation policy; regression forecasting; Uzbekistan; economic development.

In the contemporary global economy, innovation has become a central determinant of national competitiveness, productivity growth, and structural transformation. Countries that succeed in building effective national innovation systems (NIS) are better positioned to adapt to technological change, integrate into global value chains, and achieve sustainable economic development. As innovation processes increasingly rely on complex interactions between science, education, industry, and government, the organizational and institutional design of innovation systems has gained growing scholarly and policy attention.

For developing and transition economies, the challenge lies not only in expanding innovation infrastructure but also in ensuring its qualitative effectiveness. In this context, Uzbekistan has undertaken large-scale reforms aimed at fostering innovation-driven growth, strengthening research capacity, and modernizing institutional frameworks. However, despite visible progress in expanding innovation-related organizations and infrastructure, concerns remain regarding the efficiency, coordination, and sustainability of the national innovation system.

This article aims to identify and analyze the priority strategic directions for the organizational–institutional and financial–economic transformation of Uzbekistan's national innovation system. By combining institutional analysis with econometric forecasting, the study seeks to provide

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evidence-based insights into the strengths, weaknesses, and future trajectories of innovation development in the country.

The national innovation system is commonly defined as a network of institutions, policies, and actors whose interactions determine the creation, diffusion, and application of new knowledge and technologies. According to the OECD and UNCTAD frameworks, an effective innovation system encompasses five interrelated pillars: (i) regulatory and policy frameworks, (ii) institutional governance, (iii) entrepreneurial ecosystem and access to finance, (iv) human capital, and (v) technical and research infrastructure.

Scholars such as Nelson (1993) and Cimoli et al. (2009) emphasize that institutional coherence and policy consistency are essential for fostering innovation. Stable and predictable policy environments reduce uncertainty, encourage long-term investment in research and development, and facilitate risk-taking by firms and entrepreneurs. In this regard, public support mechanisms—such as fiscal incentives, targeted subsidies, and public–private partnerships—play a crucial role, particularly in economies where private innovation financing remains underdeveloped.

In Uzbekistan, state regulation of science and technology development includes strategic goal-setting, the establishment of specialized governance bodies, direct and indirect financial support for R&D, and the formation of innovation-supporting infrastructure such as laboratories, technology parks, and analytical centers. However, the effectiveness of these mechanisms depends on their coordination and alignment with broader economic and industrial policies.

Innovation potential is a multidimensional concept that reflects the capacity of an economy to generate and implement innovations. It consists of several interdependent components: human capital potential, financial–economic potential, scientific–technical potential, organizational–managerial capacity, and production–technological capability.

Human capital is a decisive factor in innovation performance, as highly skilled researchers, engineers, and managers drive knowledge creation and commercialization. In Uzbekistan, the share of employees with higher education in R&D activities has remained relatively stable at around 33%, indicating a certain level of human capital resilience. Nevertheless, the lack of continuous growth in this indicator suggests limitations in advanced skills development and retention.

Financial–economic potential reflects the availability of resources for innovation financing. Empirical evidence indicates that the share of investment directed toward scientific, professional, and technical activities remains below 2% of total fixed capital investment, signaling insufficient financial commitment to innovation-intensive sectors.

Scientific–technical potential, measured by the number of R&D-performing organizations and research outputs, shows volatility over time. This instability points to institutional fragility and insufficient incentives for sustained research activity. Organizational–managerial capacity and production–technological potential further influence the ability to transform innovative ideas into commercially viable products.

Table 4.2 presents the dynamics of innovation activity in Uzbekistan between 2015 and 2023. During this period, the number of innovation infrastructure enterprises increased nearly sixfold, from 1,025 to 6,235 units. This rapid expansion reflects an extensive growth strategy focused on increasing institutional coverage.

However, the indicator of net innovation activity peaked in 2021 and declined sharply thereafter, suggesting diminishing returns from purely quantitative expansion. The number of R&D organizations and the share of innovation-related investment exhibited instability, highlighting structural weaknesses in the financial and institutional foundations of the innovation system.

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These trends indicate a growing imbalance between infrastructure growth and qualitative performance, raising concerns about the long-term sustainability of innovation development under existing policy approaches.

To assess future innovation dynamics, two forecasting approaches were applied: a linear time-series trend model and a multifactor regression model incorporating key drivers of innovation performance.

The linear trend model projects a gradual decline in net innovation activity from 2024 to 2027, despite continued growth in the number of innovation infrastructure enterprises. This outcome reflects the model's reliance on historical patterns without accounting for structural interactions between variables.

In contrast, the multifactor regression model demonstrates that stabilizing critical determinants—namely, the number of R&D organizations, the quality of human capital, and the share of innovation investment—can generate sustained growth in innovation output. Under this scenario, net innovation activity is projected to increase from 6,414.8 units in 2024 to 7,403.4 units in 2027.

The comparison confirms the superiority of the regression approach for policy analysis, as it captures the synergistic effects of multiple innovation drivers and provides more realistic guidance for strategic decision-making.

Based on the empirical findings, several priority strategic directions emerge for the organizational–institutional and financial–economic transformation of Uzbekistan's national innovation system:

1. **Strengthening institutional coordination** between government, research institutions, universities, and industry to enhance knowledge transfer and commercialization.
2. **Expanding public–private partnerships** and developing venture capital markets to diversify innovation financing sources.
3. **Stabilizing innovation investment levels** by maintaining a consistent share of funding for scientific and technical activities within total capital investment.
4. **Enhancing human capital development** through targeted STEM education, research training programs, and international collaboration.
5. **Improving innovation governance and evaluation mechanisms** to shift the focus from quantitative expansion toward qualitative efficiency and impact.

The study demonstrates that the transformation of the national innovation system is a critical prerequisite for sustainable economic growth and technological advancement in Uzbekistan. While recent reforms have succeeded in expanding innovation infrastructure, structural imbalances persist due to insufficient financial depth, institutional instability, and limited qualitative improvements.

Econometric forecasting confirms that without coordinated reforms, innovation activity may stagnate despite continued infrastructure growth. However, a strategic focus on stabilizing key innovation drivers can unlock significant growth potential. The findings underscore the importance of integrated institutional reforms, targeted investment policies, and human capital development in transitioning from extensive to intensive innovation-led development.

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