

FROM SILICON VALLEY TO TASHKENT: LESSONS FROM THE UNITED STATES' TRIPLE HELIX EXPERIENCE FOR UZBEKISTAN'S INNOVATION ECOSYSTEM

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Abstract

The Triple Helix Model conceptualises innovation as the product of dynamic interaction among universities, industry, and government. While the model has become a dominant framework in innovation studies, its practical application in transition economies remains underexplored. This article examines how the United States — widely regarded as the archetype of an advanced Triple Helix system — has institutionalised university–industry–government collaboration across federal policy, corporate practice, and higher education. Drawing lessons from the US experience, the article then analyses the current state of Uzbekistan's innovation ecosystem, identifying the structural barriers that constrain Triple Helix development, including the legacy of Soviet-era institutional separation, weak university–industry linkages, limited research commercialisation, and human-capital outflow. The analysis is applied to a specific institutional case, the Tashkent Institute of Management and Economics (TIME), demonstrating how the framework can inform institutional strategy. The article concludes with a set of government-level policy recommendations designed to accelerate Uzbekistan's transition toward a balanced, interactive Triple Helix configuration.

Keywords: Triple Helix; innovation ecosystem; university–industry–government relations; higher education; transition economy; Uzbekistan; United States; technology transfer; entrepreneurial university

1. Introduction

Innovation has become the central determinant of economic competitiveness in the knowledge economy. Since the 1990s, the dominant analytical lens for understanding how innovation emerges has been the Triple Helix Model, developed by Etzkowitz and Leydesdorff (1995, 2000), which conceptualises innovation not as a

linear pipeline from laboratory to market but as the product of dynamic, overlapping interaction among three institutional spheres: universities, industry, and government. In a fully developed Triple Helix system, each sphere retains its distinct identity while assuming aspects of the others' roles — universities become entrepreneurial actors engaged in technology transfer and venture creation, firms invest in fundamental research and education, and governments adopt facilitative, venture-like roles that catalyse collaboration (Etzkowitz, 2008).

For transition economies such as Uzbekistan, the relevance of the Triple Helix Model is acute. Having inherited an institutional architecture in which knowledge production, education, and industrial application were administratively separated, these economies face the dual challenge of dismantling legacy structures while simultaneously building the integrative mechanisms that characterise effective innovation ecosystems (Ruziev and Majidov, 2022). Since 2017, Uzbekistan has launched ambitious reform initiatives — including the Digital Uzbekistan 2030 strategy, the establishment of IT Park Uzbekistan, and the creation of the Ministry of Innovative Development — that signal a strong governmental commitment to innovation-led development. Yet the translation of this commitment into institutional capability remains incomplete, particularly in the higher education sector (World Bank, 2023).

2. The Triple Helix Model: A Brief Theoretical Foundation

The Triple Helix Model emerged as a response to the limitations of earlier conceptions of innovation. The linear model, dominant through much of the twentieth century, treated innovation as a sequential process in which universities produced basic knowledge, industry conducted applied development, and government funded research and set regulatory conditions (Godin, 2006). National innovation systems theory (Lundvall, 1992; Nelson, 1993) advanced this thinking by emphasising the importance of interactions among institutions, but it still tended to treat institutional roles as relatively fixed.

Etzkowitz and Leydesdorff (2000) introduced a more dynamic conception, identifying three possible configurations of the relationship among the institutional spheres. In the *statist* configuration (Triple Helix I), the government dominates, directing universities and industry through centralised planning — a model that characterised the Soviet Union and whose legacy persists in post-Soviet states. In the *laissez-faire* configuration (Triple Helix II), the three spheres operate autonomously, interacting through arms-length market mechanisms. In the *balanced* or *interactive* configuration (Triple Helix III), regarded as the normative ideal, the spheres maintain distinct identities while developing extensive overlapping interactions, generating hybrid organisations at their intersections (Ranga and Etzkowitz, 2013).

3. The United States Experience: Triple Helix in Practice

The United States is widely regarded as the most fully developed Triple Helix system in the world. Its evolution offers instructive lessons because the American model was not the product of a single grand design but emerged through a series of deliberate policy choices, institutional innovations, and cultural shifts over more than a century. Three dimensions of the US experience are particularly relevant: federal government policy, corporate and industrial practice, and the transformation of higher education. The American government has played a far more active role in innovation than its laissez-faire reputation suggests. As Mazzucato (2013) demonstrates, many of the foundational technologies of the modern economy — from the internet to GPS to the core components of the smartphone — originated in publicly funded research programmes. The Defense Advanced Research Projects Agency (DARPA), established in 1958, pioneered a model of mission-oriented research funding that bridged universities, government laboratories, and private firms, demonstrating how the state can act as an entrepreneurial catalyst rather than a passive funder.

Two policy instruments are especially significant for the Triple Helix. The first is the Bayh–Dole Act of 1980, which permitted universities to retain ownership of patents arising from federally funded research and to license those patents to industry. Before Bayh–Dole, intellectual property generated through federal grants typically remained with the government and was rarely commercialised; afterwards, universities established technology transfer offices, patenting and licensing activity expanded dramatically, and a new pathway from academic research to commercial application was institutionalised (Mowery et al., 2004). The second is the Small Business Innovation Research (SBIR) programme, established in 1982, which requires federal agencies to allocate a portion of their research budgets to small firms, effectively functioning as a public venture-capital mechanism that de-risks early-stage innovation and strengthens the link between research and commercialisation (Lerner, 2009).

3.2 Industry and Regional Ecosystems

The second dimension of the American experience is the active engagement of industry with universities, most vividly exemplified by the emergence of regional innovation ecosystems such as Silicon Valley and the Route 128 corridor around Boston. Saxenian (1994), in her seminal comparative study, showed that Silicon Valley's success derived not merely from the presence of leading universities but from the dense, fluid networks connecting universities, firms, venture capitalists, and a highly mobile labour force. Stanford University was central to this ecosystem, not as an ivory tower but as an active participant — leasing land for an industrial park, encouraging faculty entrepreneurship, and maintaining porous boundaries with the surrounding firms.

This pattern illustrates a key Triple Helix dynamic: the most innovative regions are characterised by institutional overlap and role-blurring. Firms fund university research and recruit graduates; universities license technology and spin off companies; and informal networks circulate knowledge across organisational boundaries. The American experience demonstrates that proximity and trust — the social infrastructure of innovation — are as important as formal mechanisms.

3.3 The Entrepreneurial University

The third dimension is the transformation of American higher education into an active economic actor. The roots of this transformation lie in the land-grant university tradition established by the Morrill Act of 1862, which created public universities with an explicit mission of serving regional economic and agricultural development. Contemporary American research universities exemplify Clark's (1998) model of the entrepreneurial university: they maintain strong research cores while developing extensive “developmental peripheries” — technology transfer offices, incubators, industry liaison units, and continuing education arms — that connect them to industry and government. Institutions such as Stanford and the Massachusetts Institute of Technology have generated thousands of companies and hundreds of thousands of jobs through their entrepreneurial activities, demonstrating that academic excellence and economic engagement are complementary rather than contradictory (Etzkowitz, 2008).

Table 2. Key United States policy instruments and institutional innovations underpinning the Triple Helix¹

Instrument / institution	Year	Function	Triple Helix significance
Morrill Act	1862	Created land-grant universities mandated to serve regional economic and agricultural development	Embedded the engaged, service-oriented university in United States higher education
DARPA	1958	Mission-oriented research funding bridging universities, federal laboratories and private firms	Showed the state acting as an entrepreneurial catalyst rather than a passive funder

¹ Compiled by the author from Mazzucato (2013), Mowery et al. (2004) and Lerner (2009). The instruments are discussed in Sections 3.1 and 3.3.

Instrument / institution	Year	Function	Triple Helix significance
Bayh–Dole Act	1980	Allowed universities to retain and license patents arising from federally funded research	Institutionalised academic technology transfer and prompted the creation of transfer offices
SBIR programme	1982	Requires federal agencies to direct a share of research budgets to small firms	Operates as a public venture-capital mechanism that de-risks early-stage innovation

4. Uzbekistan’s Innovation Ecosystem: Current State and Challenges

Uzbekistan’s innovation ecosystem stands at a markedly different stage of development, exhibiting characteristics of the statist Triple Helix I configuration with emerging elements of transition toward a more interactive model (Ruziev and Majidov, 2022).

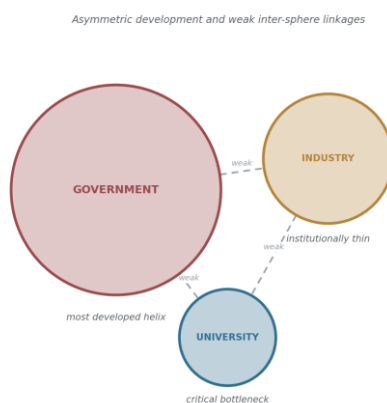


Figure 3. The asymmetric Triple Helix of Uzbekistan²

The *government helix* is by far the most developed. Since 2017, Uzbekistan has demonstrated strong political commitment to innovation through the Digital Uzbekistan 2030 strategy (MICT, 2020), the establishment of IT Park Uzbekistan — which by 2024 hosted more than 1,200 registered technology companies (UZINFOCOM, 2024) — and the creation of the Ministry of Innovative Development.

² Conceptual diagram prepared by the author, summarising the assessment of Uzbekistan’s three helices in Section 4 (Ruziev and Majidov, 2022; World Bank, 2023). Circle size denotes the relative institutional development of each helix; dashed lines denote weak inter-sphere linkages.

These initiatives have built substantial innovation infrastructure and created a favourable policy environment.

The *industry helix*, however, remains institutionally thin. Most Uzbekistani firms are small and medium-sized enterprises operating in traditional sectors with limited research and development capability, and even the rapidly growing IT sector is oriented predominantly toward outsourcing rather than proprietary technology development (Abdullaev, 2021; Stat.uz, 2023).

The *university helix* is the critical bottleneck. The World Bank (2023) found that fewer than 12 per cent of Uzbekistani universities have formal industry partnership agreements, and the Global Innovation Index 2023 ranked Uzbekistan 86th of 132 countries, below regional comparators Kazakhstan (79th) and the Russian Federation (51st) (WIPO, 2023).

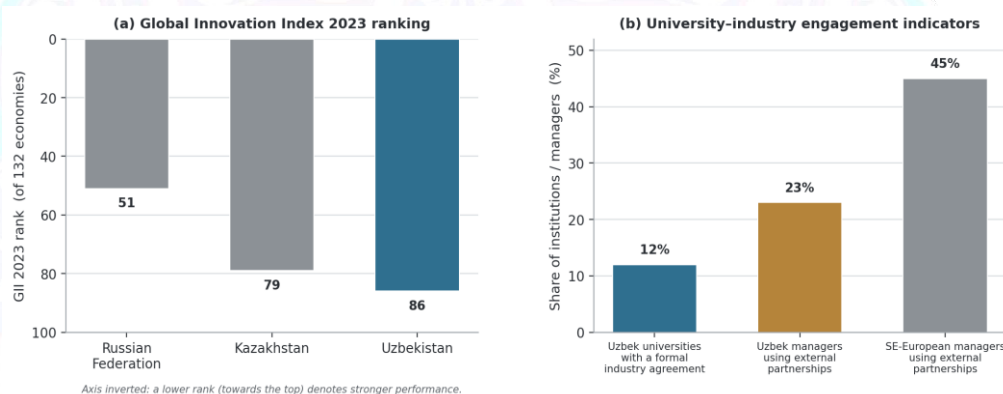


Figure 2. Selected innovation ecosystem indicators for Uzbekistan and comparators³

Several deep-seated challenges underlie this weakness. The first is the *legacy of Soviet-era institutional separation*. Under the Soviet system, teaching was the function of universities, research was concentrated in the institutes of the Academy of Sciences, and industrial application occurred within enterprise research units. This tripartite separation meant that the integrative, boundary-crossing activities central to the Triple Helix had no natural institutional home, and they must now be constructed essentially from scratch (Brunner and Tillett, 2007; Ruziev and Majidov, 2022).

The second challenge is *weak institutional capacity for external engagement*. Ismoilov and Kholmatova (2023) identify a persistent absence of incentive systems rewarding faculty engagement with industry, a shortage of dedicated units for partnership management, and administrative structures that prioritise teaching volume over research quality and external collaboration.

The third challenge is *human-capital outflow*, commonly described as brain drain. Talented researchers and graduates frequently pursue opportunities abroad,

³ Prepared by the author. Panel (a): Global Innovation Index 2023 ranks from WIPO (2023). Panel (b): the 12 per cent figure from World Bank (2023); the 23 and 45 per cent figures from EBRD (2023). Discussed in Section 4.

depriving the domestic innovation system of precisely the human capital required to build the university helix and to staff the entrepreneurial activities that the Triple Helix model prescribes.

6. Policy Recommendations for Uzbekistan

While individual institutions such as TIME can take meaningful action within their own constraints, the structural barriers identified in this analysis cannot be fully addressed without government-level intervention. The American experience offers a clear lesson: the state's most effective role is facilitative — creating the legal frameworks, funding mechanisms, and incentive structures that enable universities and firms to collaborate. First, the government should *introduce university–industry collaboration as a formal criterion in institutional accreditation*. The finding that fewer than 12 per cent of Uzbekistani universities have formal industry partnerships indicates that voluntary adoption has not produced the levels of engagement required for innovation-led development (World Bank, 2023).

Second, Uzbekistan should *establish a national equivalent of the Bayh–Dole framework and the SBIR programme*. A clear legal framework governing the ownership and commercialisation of publicly funded research, combined with a competitive fund providing matched co-financing for university–industry collaborative projects, would simultaneously stimulate industry demand for university knowledge and build university capacity for applied research and commercialisation.

Third, the government should *invest in a national higher education performance data infrastructure* that enables transparent benchmarking of institutions' innovation performance, graduate employment outcomes, research output, and partnership activity.

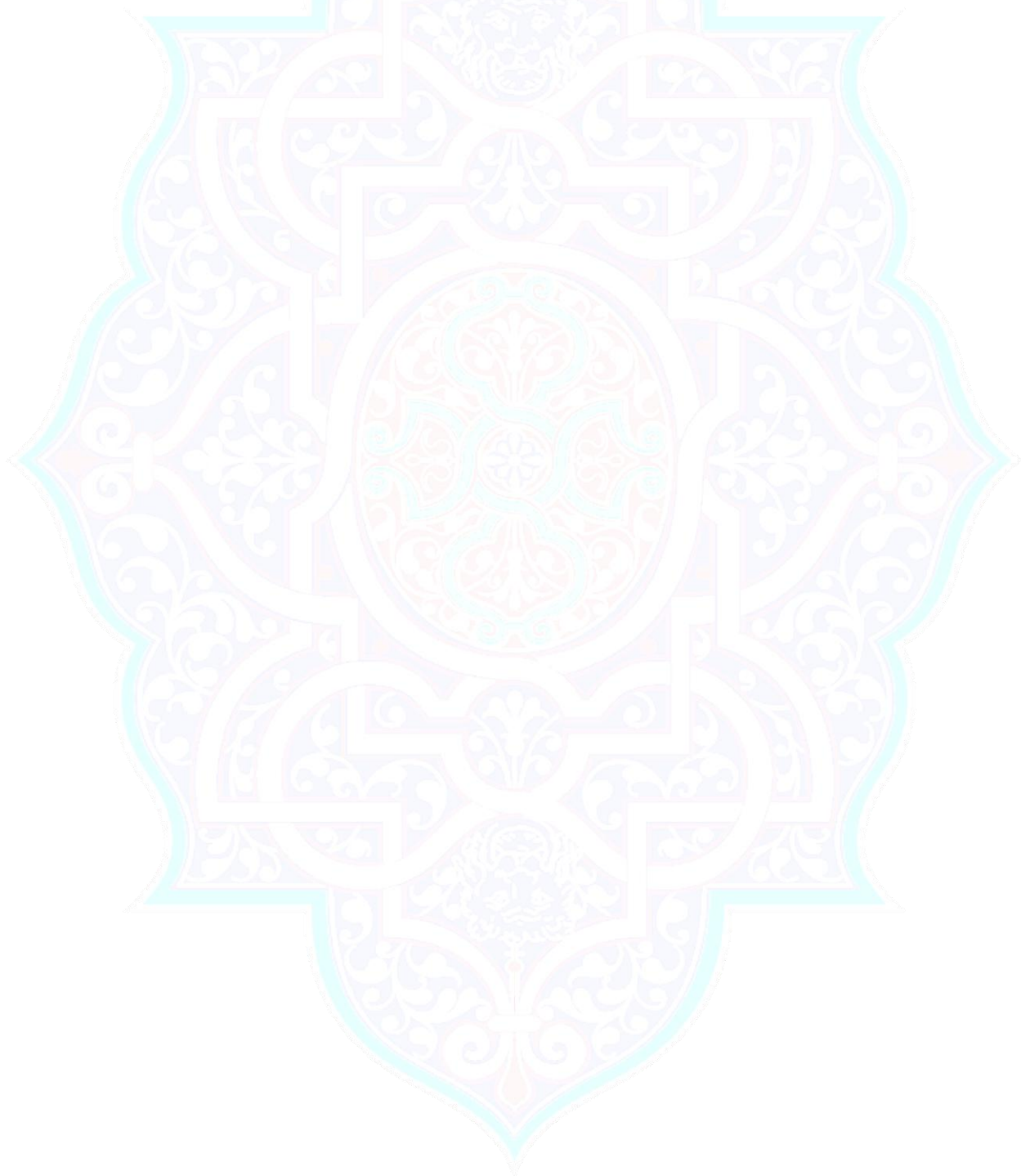
Fourth, Uzbekistan should *address human-capital outflow through targeted retention and diaspora-engagement programmes*. Drawing on international experience, such programmes might include competitive research grants for early-career scholars, structured collaboration with the Uzbekistani academic diaspora, and improved career pathways within domestic institutions.

7. Conclusion

The Triple Helix Model offers a powerful framework for understanding how innovation emerges from the dynamic interaction of universities, industry, and government. The United States, through more than a century of deliberate policy choices and institutional innovations, has constructed perhaps the world's most developed Triple Helix system — one characterised by a facilitative state, deeply engaged industry, and entrepreneurial universities embedded in dense regional networks. The American experience demonstrates that the most effective government

role is to create enabling frameworks rather than to direct outcomes, and that academic excellence and economic engagement are complementary rather than contradictory.

The central argument of this article is that Uzbekistan's path toward a balanced, interactive Triple Helix configuration requires coordinated action across institutional and policy levels. The American experience offers not a template to be copied but a set of transferable principles: that the state should facilitate rather than direct, that universities must be empowered to engage, and that the social and institutional infrastructure of collaboration is as important as financial investment.



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