

INNOVATION SCIENCE AND TECHNOLOGY



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ISSUE 3

 Acceptance of papers **March, 2026**



Acceptance of papers

Published monthly



Topics

economics, technology, social sciences

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FROM OCTOBER 9, 2024.

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AN ENHANCED FINANCING MODEL FOR STARTUP PROJECTS IN HIGHER EDUCATION INSTITUTIONS OF UZBEKISTAN

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Abstract: The purpose of this article is to develop scientifically grounded proposals for improving the financing model of startup projects in higher education institutions of Uzbekistan. Within the framework of the study, regression analysis was applied to quantitatively assess the effectiveness of innovation financing in Central Asian countries during 2024–2026. Based on the empirical results, an enhanced financing model for university startup projects in Uzbekistan was developed.

The scientific novelty of the proposed model lies in substantiating the priority allocation of financial resources to university-based startup projects compared to other innovation initiatives within the national innovation system. The study provides practical recommendations aimed at increasing the efficiency of university startup financing by 2028.

The proposed model is designed to accelerate the diffusion of innovation, expand research-oriented employment, and support the gradual shift of national exports toward high-technology sectors, while ensuring more efficient utilization of research and development (R&D) expenditures.

Key words: innovation financing, startup projects, university startups, higher education innovation, innovation economy, economy of Uzbekistan.

INTRODUCTION

The financial component represents one of the key determinants of the successful implementation of Uzbekistan's innovation-driven development strategy. In the context of global technological transformation, the country seeks to accelerate technological modernization of its national economy, enhance digital competitiveness, and strengthen its position in international high-technology markets.

Effective and timely financial support plays a crucial role in the creation and implementation of advanced innovative solutions that contribute to sustainable economic growth and export expansion. In this regard, particular importance is attached to the project "Modernization of the National Innovation System of Uzbekistan," implemented with the support of international partners, including the World Bank [1]. The project aims to develop a favorable innovation ecosystem and increase the effectiveness of research and development (R&D) activities.

One of the strategic objectives is to further improve Uzbekistan's position in global innovation rankings, including the Global Innovation Index published annually by the World Intellectual Property Organization (WIPO) [5]. Since 2020, modernization initiatives have contributed to positive progress in the country's innovation performance indicators. Nevertheless, achieving long-term strategic goals requires further enhancement of innovation financing mechanisms.

As a promising policy direction, this article proposes strengthening the concentration of financial resources within the university-based research and development (R&D) environment, particularly in supporting startup projects emerging from higher education institutions. The study is devoted to the scientific and methodological substantiation of improving the financing model for university startup projects in Uzbekistan.

LITERATURE REVIEW

This study is grounded in the fundamental theoretical concept of finance as a strategic resource of the innovation economy [2]. Within this framework, financial resources are viewed as a critical driver of innovation-led development, enabling structural transformation and technological advancement of modern economic systems.

The literature highlights several expected benefits of innovation-oriented growth, including the acceleration of innovation diffusion and the broader adoption of advanced technological and industrial design solutions across business and society [7].

Another significant advantage identified in prior research is the expansion of employment in research and development (R&D)-intensive sectors, leading to an increased share of research-oriented occupations in the overall employment structure of the national economy [3]. The combined effect of accelerated innovation diffusion and the transition toward research-based employment contributes to the high-technology reorientation of national export structures and strengthens global competitiveness [10].

A review of recent academic literature [9] indicates that the current model of financing university startup projects in Uzbekistan, similar to other Central Asian countries, is generally based on proportional allocation of public budget resources across various categories of innovation projects. These include university-based R&D initiatives, non-university startups, innovation projects implemented by private firms, and state-owned enterprises.

However, a notable research gap exists regarding the comparative effectiveness of financing university startup projects relative to alternative innovation initiatives. Specifically, there is limited empirical clarity on the extent to which university startups generate greater economic and innovation-related benefits compared to other forms of innovation funding within the Central Asian context. This gap raises an important research question: how does the share of funding allocated to university startup projects within the overall structure of innovation financing in Central Asia influence innovation performance outcomes?

Building upon previous studies [4; 8], which emphasize the relatively high returns associated with venture investment in university-based startups, this article formulates the following hypothesis: the greater the proportion of financial resources allocated to university startup projects within the overall innovation financing structure of Central Asia, the higher the overall effectiveness of innovation-driven economic development. The empirical testing of this hypothesis constitutes the central objective of the present research.

RESEARCH METHODOLOGY

To test the proposed hypothesis, a regression analysis method is applied in order to assess the contribution of total R&D expenditures in the economy (TRD) and university innovation financing—measured through startup funding volume (USP1) and the level of business–university collaboration (USP2)—to two key innovation performance indicators: (1) the diffusion and widespread adoption of advanced industrial design solutions in business and society (IPE1), and (2) the share of employment in R&D-intensive sectors (IPE2).

In addition, the study evaluates the impact of IPE1 and IPE2 on the share of high-technology exports in total industrial exports (IPE3). This analytical framework allows for the examination of both direct and indirect relationships between innovation financing structures and broader economic outcomes.

All statistical data for the selected indicators were obtained from official sources, including reports published by UNDP Regional Bureau for Asia and the Pacific (RBAS) [6], with the exception of USP1 (startup funding volume), for which data were collected from the World Intellectual Property Organization (WIPO) [5].

The empirical analysis is based on data covering the period 2024–2026 (as of the beginning of each year) for five core Central Asian countries, including Uzbekistan (Table 1).

Table 1. Statistics on Innovation Economy Financing and University Startup Support in Central Asia (2024–2026)

Year	Central Asian Country	R&D expenditures, % of GDP	Finance for startups and scaleups, score 0-100	University-industry collaboration in R&D, score 0-100	Industrial design applications, resident, by count per million population	Employment in R&D-intensive industries, % of the total number of employed people	High-technology exports, % of manu-factured exports
		ОФИ	СПВ1	СПВ2	Пиэ1	Пиэ2	Пиэ3
2024	Kazakhstan	2,20	45,60	34,80	7,04	8,12	47,61
	Kyrgyzstan	1,50	0,00	32,30	3,01	12,65	25,68
	Tajikistan	1,50	0,00	38,30	2,25	2,25	2,25
	Turkmenistan	2,16	0,00	6,05	0,00	0,00	0,00
	Uzbekistan	2,30	65,80	56,00	6,43	3,79	3,90
2025	Kazakhstan	2,00	45,60	34,80	7,04	8,12	47,61
	Kyrgyzstan	1,20	0,00	32,30	3,01	12,65	25,68
	Tajikistan	1,32	0,00	27,41	2,25	2,25	2,25
	Turkmenistan	2,16	0,00	6,05	0,00	0,00	0,00
	Uzbekistan	2,70	65,80	56,00	6,43	3,79	3,90

2026	Kazakhstan	2,24	38,48	6,43	7,04	8,12	47,61
	Kyrgyzstan	0,81	0,00	29,73	3,01	12,65	25,68
	Tajikistan	1,32	0,00	27,41	2,25	2,25	2,25
	Turkmenistan	2,16	0,00	6,05	0,00	0,00	0,00
	Uzbekistan	1,92	88,97	37,71	6,43	3,79	3,90

Source: Compiled by the author based on data from [5; 6].

Based on regression estimates, the study assesses the potential for enhancing the performance of Uzbekistan's innovation economy through 2028 under a scenario involving the strategic reallocation of public innovation funding toward university-based startup projects.

The model evaluates how increasing the share of budgetary resources directed to university startups may influence key innovation performance indicators, including the diffusion of advanced industrial design solutions, the expansion of employment in R&D-intensive sectors, and the growth of high-technology exports.

This forward-looking assessment provides a quantitative basis for policy recommendations aimed at improving the efficiency and impact of innovation financing mechanisms in Uzbekistan.

RESULTS AND DISCUSSION

As a result of the regression analysis of the statistical data presented in Table 1, a system of multiple linear regression equations (1) was developed to quantitatively assess the returns on innovation financing in the economies of Central Asia during the period 2024–2026.

$$\begin{cases} \text{IPE}_1 = 3,2968 - 1,0004\text{TRD} + 0,0775\text{USP}_1 + 0,0164\text{USP}_2, R^2 = 0,8659, \\ \text{IPE}_2 = 14,0534 - 5,7404\text{TRD} + 0,0494\text{USP}_1 + 0,0234\text{USP}_2, R^2 = 0,5554, \\ \text{IPE}_3 = -6,3450 + 2,4823\text{IPE}_1 + 2,4123\text{IPE}_2, R^2 = 0,8069. \end{cases}$$

where:

- TRD – Total R&D expenditures (% of GDP),
- USP1 – Finance for startups and scaleups (score 0–100),
- USP2 – University–industry R&D collaboration (score 0–100),
- IPE1 – Industrial design applications (per million population),
- IPE2 – Employment in R&D-intensive industries (% of total employment),
- IPE3 – High-technology exports (% of manufactured exports).

The coefficients indicate that increased financing of university startups (USP1) and stronger university–industry collaboration (USP2) are positively associated with higher levels of industrial design activity (IPE1) and employment in R&D-intensive sectors (IPE2).

The relatively high R^2 values for the first (0.8659) and third (0.8069) equations suggest strong explanatory power of the models, particularly in capturing the relationship between innovation financing structure and high-technology export performance.

These results support the hypothesis that prioritizing university-based startup financing contributes to strengthening innovation diffusion mechanisms and enhancing the high-technology orientation of exports in Central Asian economies.

Model (1) indicates that a 1 percentage point increase in total R&D expenditures as a share of GDP is associated with a decrease of 1.0004 industrial design applications per million population (IPE1) and a reduction of 5.7404 percentage points in the share of employment in R&D-intensive industries (IPE2).

In contrast, a one-point increase in startup financing activity (USP1) is associated with an increase of 0.0775 industrial design applications per million population and a rise of 0.0494 percentage points in employment within R&D-intensive industries.

Similarly, a one-point increase in university–industry collaboration intensity (USP2) is associated with an increase of 0.0164 industrial design applications per million population and a 0.0234 percentage point increase in the share of R&D-intensive employment.

Furthermore, the model demonstrates that an increase of one industrial design application per million population leads to a 2.4823 percentage point rise in the share of high-technology exports in total manufactured exports (IPE3). Likewise, a one percentage point increase in employment in R&D-intensive industries results in a 2.4123 percentage point increase in the share of high-technology exports.

Overall, financial factors explain 86.59% of the variation in industrial design diffusion and 55.54% of the variation in R&D-intensive employment, which together account for 80.69% of the variation in high-technology

export share. These results highlight the structural importance of innovation financing composition for export modernization and technological upgrading.

Trend analysis of the data presented in Table 1 shows that in Uzbekistan, over the last two years (2026 compared to 2024), total R&D expenditures declined by a factor of 0.83, startup financing activity increased by 1.35 times, and university–industry collaboration activity decreased by 0.67 times.

If these trends continue over the next two years, by 2028 total R&D expenditures in Uzbekistan are projected to decline to 1.60% of GDP, startup financing activity may reach the maximum benchmark level of 100 points, while university–industry collaboration could decrease to 25.39 points.

Under this scenario, the model predicts:

- a 10.02% increase in industrial design diffusion, reaching 7.07 applications per million population;
- a 31.26% increase in employment in R&D-intensive industries, reaching 4.97%;
- a 31.32% increase in the share of high-technology exports, reaching 5.12% of manufactured exports.

The comparative projections of Uzbekistan’s innovation development through 2028 under alternative university startup financing models are illustrated in Figure 1.

■ Projected values for 2028 under the new financing model

■ Projected values for 2028 under the current financing model

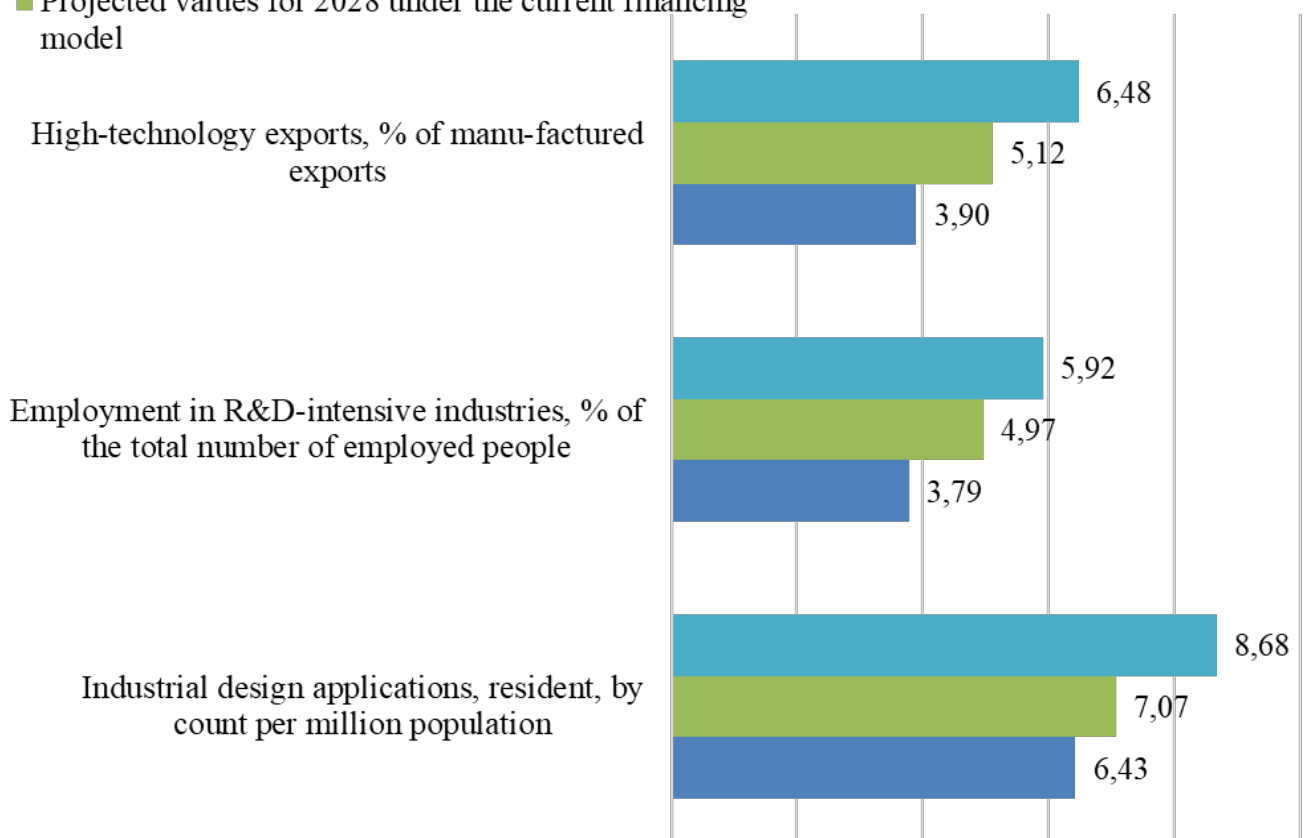


Figure 1. Comparative Forecast of Uzbekistan’s Innovation-Driven Economic Development Through 2028 Depending on the Selected University Startup Financing Model

Source: Calculated and compiled by the author.

To improve the financing model of university startup projects in Uzbekistan, this study proposes a strategic reallocation of public innovation funding in favor of university-based startup initiatives. In particular, it is recommended to reverse the previous downward trend in university–industry collaboration and to move toward strengthening this interaction, with the objective of approaching the maximum benchmark level (100 points).

According to the model-based projections, such a policy adjustment would lead to a more substantial increase in the diffusion of advanced industrial design applications—by 35.00%, reaching 8.68 applications per million population. In addition, the share of employment in R&D-intensive industries would increase by 56.14%, reaching 5.92%. These structural improvements would, in turn, contribute to a significant expansion of the share of high-technology exports in total manufactured exports—by 66.19%, reaching 6.48%.

The results obtained in this study contribute to the existing literature [2; 3; 7] by further developing the theoretical concept of finance as a strategic resource of the innovation economy. Specifically, the analysis identifies previously underexplored differences in the relative effectiveness of financing university startup projects compared to alternative innovation initiatives, in terms of their impact on innovation-driven development in Central Asia.

In contrast to earlier studies [9; 10], which implicitly assume that proportional allocation of public innovation funding across various types of projects ensures balanced development, the findings suggest that a uniform distribution of financial resources does not necessarily maximize innovation diffusion, promote research-oriented employment, or accelerate the high-technology reorientation of exports.

The empirical evidence indicates that increasing the share of funding directed toward university startup projects within the overall structure of innovation financing is associated with higher innovation performance outcomes. These findings support the research hypothesis and are consistent with previous studies highlighting the high return potential of venture investment in university-based startups [4; 8].

Overall, the results underscore the strategic importance of targeted financing mechanisms in strengthening the innovation capacity and export competitiveness of Central Asian economies.

CONCLUSION AND RECOMMENDATIONS

In conclusion, the primary outcome of this study is the development of an enhanced financing model for university startup projects in Uzbekistan. The distinguishing feature of the proposed model lies in the strategic prioritization of university-based startup initiatives within the broader structure of innovation financing. This approach emphasizes a more targeted and performance-oriented allocation of financial resources compared to alternative innovation projects.

The proposed adjustment in the financing structure is projected to generate measurable advantages, including accelerated innovation diffusion, expansion of research-oriented employment, and a gradual shift toward a higher share of high-technology exports. Importantly, these improvements may be achieved through a more efficient allocation of R&D-related financial resources rather than through a simple increase in total expenditure.

The author's model and the associated policy recommendations for enhancing the effectiveness of university startup financing through 2028 may serve as a practical analytical tool in the implementation of the national initiative aimed at modernizing Uzbekistan's innovation system [1]. By strengthening university-centered innovation ecosystems and improving university–industry collaboration mechanisms, the proposed framework contributes to long-term innovation capacity building and sustainable economic transformation.

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Proofreader: Zokir ALIBEKOV

Layout and Designer: Oloviddin Sobir ugli

2026. № 3

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